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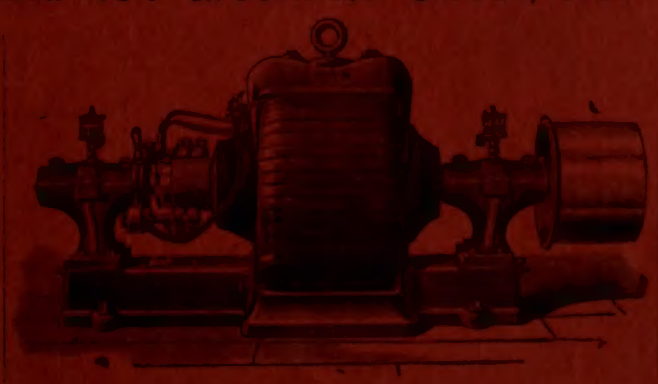
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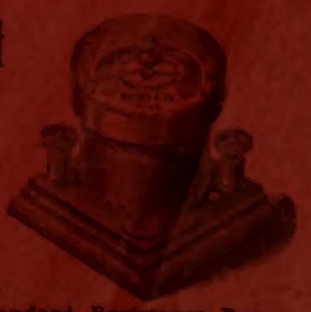
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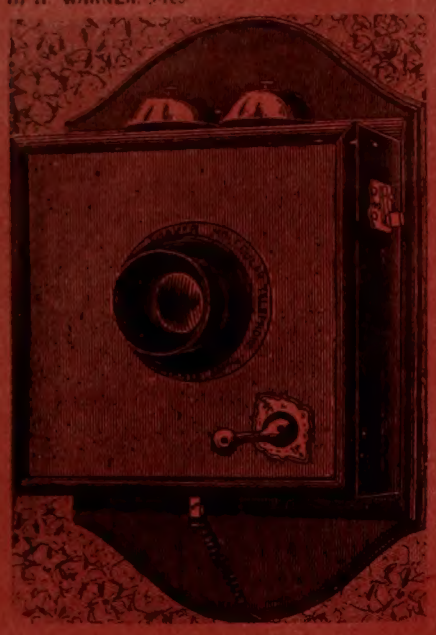
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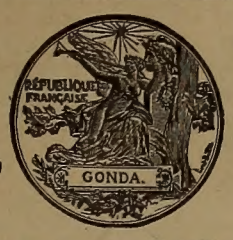
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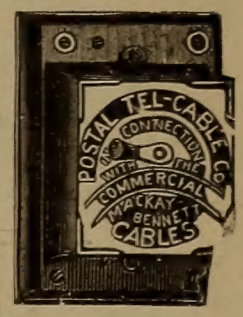
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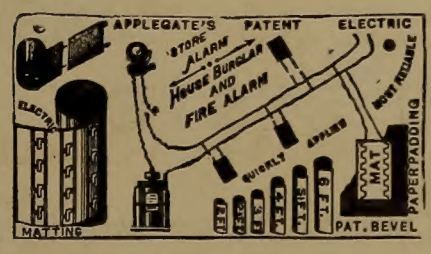
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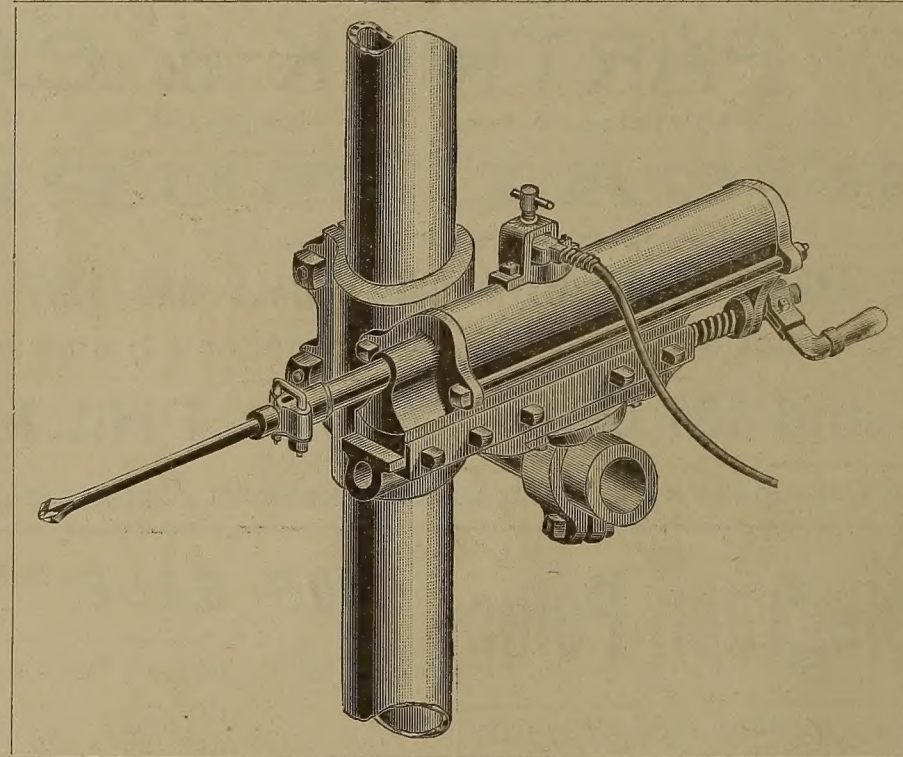
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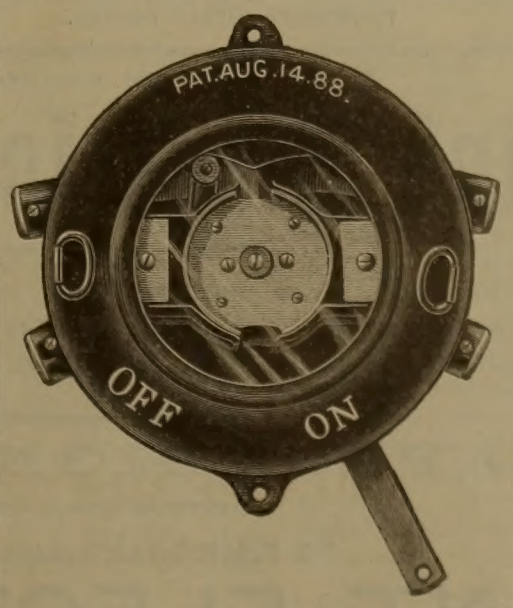
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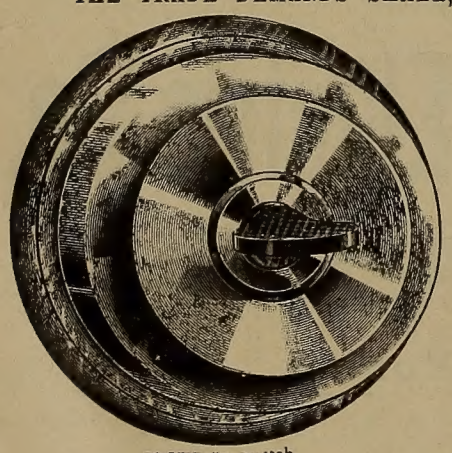
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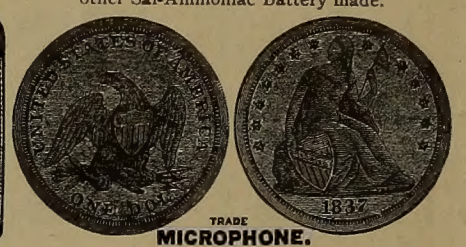
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NEW YORK, JANUARY 3, 1891.

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THE NEW YEAR.

As the New Year begins every business man naturally asks the question "I wonder what the new year has in store for me?" The transition from an old year to a new one begets thoughts of the past and the future, and plans for the future are laid down on the experiences of the past. The year 1891, to all persons engaged in electric work, will be of exceeding interest and importance. The one just closed has been the most active in the history of electrical development, and there is every prospect that the new year will witness greater activity.

There is one fact in connection with the electrical business that is evident to a casual observer, and that is, that all electrical industries are settling down to a firm and solid commercial basis. The "just" and the "unjust" have, in a great measure, been divided, and the "just" are receiving their reward. Responsible and experienced concerns are now untrammeled in the pursuit of their legitimate trade, and the result is a better general appreciation of the service of electricity to man.

As to the business outlook, we have made some inquiries in different electrical trades and learned that a very hopeful feeling exists. The most conservative persons in the trade expressed themselves as having no reason to believe that business would be any less prosperous during the new year than it was in 1890.

Of course the more enthusiastic ones foresaw great activity and predicted that the year 1891 would be one of unexampled prosperity. We earnestly trust that their expectations may be realized, and to these we will say that they may rest assured that the ELECTRIC AGE will do all in its power to bring about such a condition of things.

The prosperity of any business, whether it be electrical or otherwise, depends, to a very great extent, on the publicity given it in public prints. The truth of this is generally aeknowledged. We mention this fact here to remind our friends that if they would have a prosperous business they must enlarge their business, and to enlarge their business they must advertise it.

There can be no question that under natural conditions electrical industries will experience greater activity during the year just begun than ever before. It is in the nature of things that it should. Improvements are constantly being made in one direction or another, and these are usually in the direction of simplicity and cheapness. Simplicity and cheapness mean greater demand and consumption, hence greater activity in production.

After looking over the ground carefully and weighing opinions, we are happy to say that there is every indication that the year 1891 will be one of prosperity in the electrical trades, and we trust that the indications may prove to have been well founded.

OUR NEW SUIT.

The beginning of a new year has been, from time immemorial, considered the most appropriate time of all the year to introduce changes. The old things are then put away and the new taken up. These may be new purposes or they may be things perceptible to our senses. The central idea, however, always is to improve the old, whatever it may be. The ELECTRIC AGE begins the year 1891 with new purposes and aims and a new suit. It has done untold good in the past, and in the future it proposes to be of greater benefit than ever to all interested in electricity. Its aim will be to present to its readers the best obtainable in its line. It will be on the alert more than ever, and nothing will be left undone that may be done in the interest of its readers and patrons.

Journals, like individuals, indulge in new clothes once in a while. The ELECTRIC AGE has discarded its old suit and now appears in a new one, which is more brilliant and attractive than the old.

It also appears with a new heading of more artistic design than the old one. The new heading is emblematic of the scope of the paper. It will be noticed that the telegraph, the telephone, the electric light, and the electric railway, are appropriately represented. These embrace everything of importance, in which electricity is concerned. A little study of the heading will reveal the harmony of the parts with the object in view. It tells its own story. In one corner is represented static or natural electricity emerging from its birthplace, the clouds; at the other end the dynamo is represented, originating the life-giving force on which all of the other apparatus is dependent.

With this introduction the ELECTRIC AGE, in its new suit, makes its bow, and hopes that all of its friends may experience abundant happiness and prosperity during the year 1891.

QUANTITY OF LIGHT.—It is interesting to note what Mr. S. Alfred Varley, the noted English electrician, has to say concerning the comparative merits of illumination by burning coal and the electric light or other methods. In our last issue we published an article by this gentleman, headed "Illumination by Artificial Lights," in which he made some interesting observations concerning the penetrative power of quantity, as distinguished from the quality of light. It is well-known that the electric arc light, the most intense of all artificial lights, has not much more power of penetration in thick weather than ordinary lights of oil or gas. The quality of intensity as compared with quantity in reference to light is exemplified in the electric light as against the old time coal fires burning in iron baskets. Mr. Varley says he would like to see systematic experiments carried out to ascertain the respective penetrating powers of coal fires, gas lights and the electric light through hazy atmospheres, and he would not be surprised if the results obtained from such experiments went to show that, under special conditions, it would be more economical for the purpose of illuminating distant objects, for a given amount of coal to be burned in an open grate fire, than to burn a similar quantity in a steam engine, and from the energy developed, produce an electric light. The determination of this question would be extremely interesting.

LIGHTING NEW YORK.—Forty cents per lamp, per night, is the figure agreed upon for the lighting of New York's streets by electricity during the year 1891. Now if something would be done to improve the appearance of the electric light lines along portions of Broadway and other thoroughfares—if these lines must exist for the present above ground—New Yorkers would feel thankful. The condition of these lines at the present time is enough to make any one ashamed to acknowledge that he is a New Yorker. Certainly in no other place would such unsightly lines be tolerated. They are not only unsightly but they have the appearance of being very dangerous. They look as though they were the property of some bankrupt concern. A New Yorker going to Chicago cannot help but notice the difference in the appearance of the streets of the two cities. In Chicago hardly a pole can be found in the business streets. When shall we be able to say the same of the metropolis which should lead in all things pertaining to the welfare of its citizens?

SUBWAY RENTALS.—The Board of Electrical Control has fixed the amount of rental that must be paid for the use of the subway conduits at $900 a mile. This figure is $100 less than that claimed by the subway company, and is $600 more than the figures the electric light companies declared to be reasonable. The Subway Company has asked the privilege of amending its answer in the pending injunction suits in order to make it agree with the ruling of the Board. This action of the Board of Electrical Control virtually places a valuation on the subways of $9,000 per mile, which is probably considerable more than they cost.

ELECTRIC LIGHT ON LIGHTSHIPS.—The Lighthouse Board is considering the advisability of using electric light on the new lightships now being built for the Atlantic coast service. It is thought that the electric light would give more satisfactory results on board these craft than the usual illuminant, oil. A series of experiments will be conducted at the lighthouse station on Staten Island with a view to ascertaining whether the advantages of electric light over oil light will justify the additional expense of equipment.

PATENTS.—Elsewhere in this paper will be found an article on the subject of withdrawing patents from issue. It will be particularly interesting to electrical inventors. The petitioner requested that his application for three patents be withdrawn from issue for a period of thirty days in order to preserve rights to patents in all foreign countries in favor of the purchasers. The Commissioner of Patents denied the application for the reasons set forth in his decision as printed.

EARLY TELEPHONE TRANSMITTERS.—We recently read of the exhibition in Lowell, Mass., of the first telephone transmitter used in that city. It is a Blake transmitter, and its number is 277. It was first used on January 1st, 1879. It would be interesting to know if transmitter No. 1 is in existence. The original Bell telephone instruments have a great historical value and no doubt are very jealously guarded somewhere.

THE FIRST FIRE ALARM SYSTEM.—The fire alarm system of Boston was put into operation April 28, 1852, and is the first electric fire alarm system established in the world.

ELECTRIC LIGHTING FOR BEGINNERS.*

BY THE EDITOR.

Part XIX.—Incandescent Lamps—Concluded.

355—Is there any actual deterioration of incandescent lamp filaments while in the state of incandescence?

Yes, there is some slight wastage.

356—What is the theory advanced for this action?

It is supposed that infinitesimal particles of carbon are given off, probably in the form of vapor, during the intense molecular action while the filaments are incandescent.

357—What is the cause of rupture of the filament?

The filament may be ruptured from several causes. The natural cause, however, is probably due to reduction of structural tenacity through the alternate heating and cooling, and probably also to a certain species of electrolysis.

358—Give an example of the current necessary to maintain a light of given candle power?

Sixteen-candle power lamps require on an average an E. M. F. of 91.91 volts and a current of .71 of an ampere.

359—What are flashed filaments?

Flashed filaments are those which are rendered incandescent during the process of exhausting the air from the bulb.

360—What is the object of flashing filaments?

Flashing renders the filament of more regular structure and increases its durability.

361—Does flashing the filaments affect the light any?

Yes; on an average flashed filaments give one-third more light than those not so treated.

362—What is meant by the efficiency of an incandescent lamp?

Efficiency means the amount of light it will give for a given electrical power.

363—What is considered a good efficiency?

If a lamp will give a light of one candle power in return for 3.5 watts of energy, it is considered of good efficiency.

364—Is the efficiency of incandescent lamps uniform?

No; the efficiency varies with the candle power of the lamp.

365—What is a "watt?"

The watt is the unit of electrical energy, or power.

366—What constitutes a watt?

A watt is the product of 1 volt and 1 ampere. The electrical energy of a given machine is found by multiplying the electromotive force, or pressure, by the current in amperes: E. M. F. × amperes = watts.

(To be continued.)

NEW TYPE OF BATTERY CELL.

Mr. James H. Mason, the manufacturing electrician, of Brooklyn, has just brought out a new type of cell which promises to find a large field of usefulness in certain classes of work. The cell is cylindrical in shape, seven inches high by two in diameter, and has a capacity of 10 ampere hours. Two cells were recently tested and they ran a 1-candle-power lamp for five hours and 20 minutes before the light began to perceptibly diminish. It takes one-third of a pint of Mason's diluted solution to charge a cell, the cost per charge being one cent. Each cell has an E. M. F. of 2.1 volts, and delivers a current of 6 amperes.

This new cell is of the single fluid type, the cell jar itself constituting the carbon element. These new cells are especially adapted for magic lantern work, and the adaptation of the electric light to lanterns will be greatly appreciated by those who handle such apparatus. The name of the new cell is the "Little Giant." We understand that Mr. Mason is now conducting experiments in this direction, and that there is every promise of success.

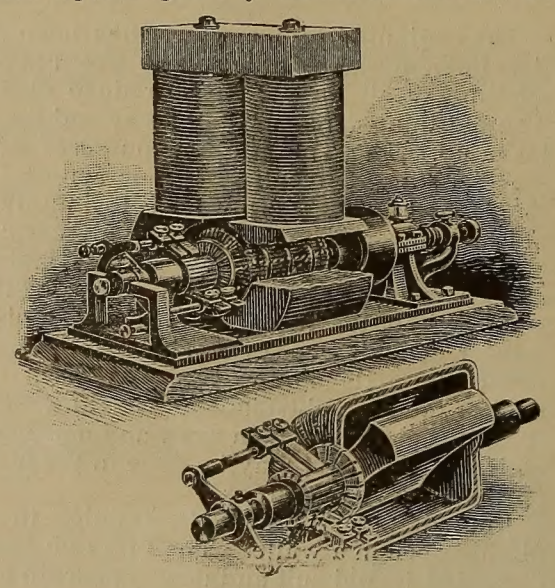
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BRUSH REGULATOR.

Mr. Fremont J. Cleaver and George Fassold, of Pittsburg, Pa., have recently obtained a patent on a regulator for dynamos and motors, the object of which is to maintain the brushes at the point of least sparking. The armature core is designed to shift automatically according to the drag or lead of the armature and always takes position with its poles in the strongest part of the field.

The following facts concerning this improvement, and the accompanying illustration, are taken from the *Scientific American*:

The armature has circular end pieces mounted on tubular shafts, and to these end pieces is secured a hollow cylinder of non-magnetic material, wound with the material in the usual way, as shown in the broken-away portion of the main view in our illustration, the terminals of the coil being connected with the commutator cylinder. Upon the central shaft, and loosely fitting the hollow of a cylinder of iron having concave sides, as shown in the small view. The central shaft is prolonged beyond the tubular armature



BRUSH REGULATOR.

shafts, the ends of the central shaft being supported on pointed screws in yokes attached to the supports of the journal boxes of the tubular shafts. To the central shaft at its commutator end is secured a cross arm of insulating material in which are held rods carrying the commutator brushes. The cross arm also carries metallic contact plates electrically connected with the rods, and which touch curved bars having binding posts for receiving the conducting wires leading from the dynamo. On the end of the central shaft opposite that carrying the cross arm is attached one end of a spiral spring attached by its other end to the yoke, to oppose the pull of the armature on the segmental core, and to return the core and the brushes to their original position when the machine is idle, so that the brushes will always occupy the same position relative to the segmental core.

ANSWERS TO INQUIRIES.

A correspondent asks: "In transmitting time from the observatory at Washington, to a clock in the Western Union office, at Galveston, through five sets of repeaters, how much time would be lost?" A claims the Galveston clock would be 5 seconds slower than Washington, while B claims the variation would not exceed 1 second.

Answer—B is nearer right. The error is variable, depending upon the adjustment of the five repeaters. The minimum error probably would be about five-tenths of a second.

ELECTRIC LIGHT UNDER WATER.—It is a curious fact that if the two carbons of an electric arc light are immersed in water, the light will burn quite as well as it does in open air. Water cannot quench an electric arc light.

REVOLVING DISPLAY FIXTURES.

Every business man knows and appreciates the value of making as effective a display as possible of his goods. There are many ways of accomplishing this object, but the idea always is to make the display as conspicuous and attractive as possible. One of the most effective ways of making displays of goods is by means of what are known as revolving display fixtures. These usually consist of turn-tables of various forms revolved by an electric motor. Such an apparatus is shown in the accompanying illustration, figure 2.

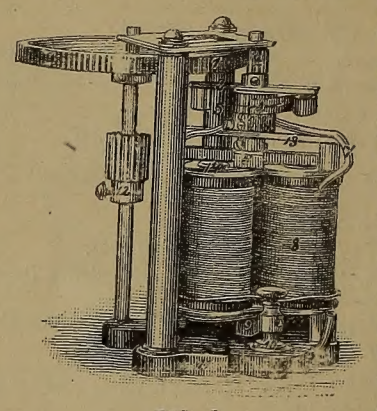


FIG. 1.

For show windows these turn-tables are admirably adapted. They practically show the goods on all sides and in many positions, which, of course, is a great advantage.

Fig. 1 is an illustration of the motor used to revolve the display tables. The motor has two armatures, one above and one below the electro magnets of which there are three. There is no dead centre, consequently the machine is self starting. The motion is transmitted from the motor to the display fixture by means of gearing as shown in the cut.



FIG. 2.

Fig. 2 shows one of the many forms of display fixtures, and gives a general idea of the utility of the apparatus.

The proprietors of this valuable device are the Bush Revolving Store Fixture Company, 24 Park Place, and at their place can be seen in operation seven fixtures of different kinds run by 4 motors, the current being supplied by two of Mason's No. 9 cells. One cell of this size is ample to run as many as four motors and tables for 65 hours, at a cost of six cents. The Bush Company are using Mason's battery exclusively for the operation of their motors, and are well satisfied with the results.

ELECTRIC ENERGY.—All electric action is an exhibition of energy, whether it be in the movement of a pith ball, in the flash of the electric spark, in the brilliancy of the arc light or the softer radiance of the incandescent, in the deposition of metal by electrolysis, the click of the telegraph, the speech-producing movement in the telephone, the propelling of cars on a railway, or in the lightning's flash rending the oak. It produces chemical decomposition, mechanical motion, light and heat. It inflicts pain, destroys life, soothes suffering, heals disease. All these varied phenomena are different manifestations of energy.

STORAGE BATTERY PLATES.—It is now the practice to use a paste of litharge (PbO) and acid for the plate connected to the negative pole of a storage battery, although makers vary the paste considerably. In some cases minium only is employed. In others a mixture of litharge and lead sulphate; and in others, again, all three substances, viz, minium, litharge and lead sulphate enter into the constitution of the paste. In all cases, however, the ultimate result of the initial charging current is the same, viz., the conversion of the paste on the positive plate into peroxide and of the paste on the negative plate into spongy lead.

WITHDRAWING PATENTS FROM ISSUE.

The Commissioners of Patents recently ruled in a case that has much general interest to patentees. "This is a petition," says the Commissioner, "to withdaw from issue for a period of thirty days three applications which have been allowed and await the payment of the final fee. The six months within which the final fee becomes due by statute will expire in each case before the expiration of the thirty days. The effect of the petition if granted is intended to be and will be to permit the final fee to be paid more than six months after the original allowance of the application.

The petitioner states that he is negotiating for the sale of his inventions, and that for that reason he requests that the applications be withdrawn from issue for a period of thirty days in order to preserve rights to patents in all foreign countries in favor of the purchasers.

The section of the statute regulating the payment of final fees is as follows:

SEC. 4885. Every patent shall bear date as of a day not later than six months from the time at which it was passed and allowed, and notice thereof was sent to the applicant or his agent, and if the final fee is not paid within that period the patent shall be withheld.

It will be seen that this statute expressly provides that if the final fee is not paid within the period of six months from the time at which the application was passed and allowed the patent shall be withheld, and in view of the language thus employed I cannot doubt that a patent issued in disregard of the express prohibition of the statute would be void.

It is, however, a part of the experience of the Patent Office that applications are sometimes allowed prematurely, so as to necessitate a withdrawal from issue for further examination to determine whether an application is entitled to a patent under the law. In other cases the filing of an application for the same invention which has already been allowed to another party necessitates a withdrawal of the allowed application from the issue for the purposes of an interference. Again, where the final fee is paid at a time so near the expiration of the six months allowed by law that a new allowance is necessary to enable the patent, which cannot be immediately prepared for signature, to bear date within six months of the allowance, withdrawal from issue becomes necessary; and if other cases exist where withdrawal from issue is permitted by the rules, it is believed that no case is recognized which does not require further action or investigation on the part of the Patent Office.

The applicant relies upon the portion of Rule 165 which provides that after the final fee has been paid and the application has received its date and number the latter will not be withdrawn or suspended for the purpose of enabling the inventor to procure a foreign patent, and he infers that the application may be withdrawn for that purpose before the payment of the final fee. Rule 165 provides that—

after notice of the allowance of an application is given, the case will not be withdrawn from issue except by approval of the Commissioner, and if withdrawn for further action on the part of the Office a new notice of allowance will be given.

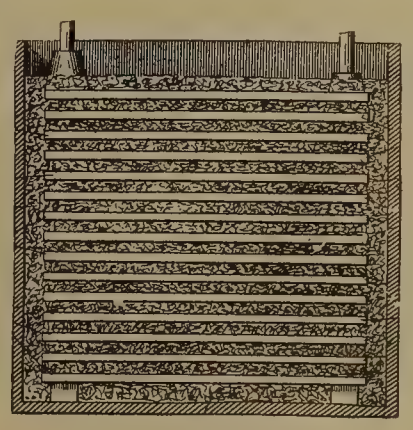
Construing the rule as a whole, it does not alter the situation or in any way authorize the granting of the request of petitioner. If the applications are withdrawn from issue, as prayed, a new allowance and notice thereof will certainly be necessary, because the final fee must be paid within six months after allowance in order to prevent forfeiture. But Rule 165 only provides for a new notice of allowance when applications are "withdrawn for further action on the part of the Office," and therefore no provision exists in the rule for a new notice in case the present petition be granted. I am very clear that the petition should be denied.

I do not intend to decide that no case can arise in which withdrawal from issue may be legal and proper which does not contemplate further action on the part of the Office. The facts in the present case do not call for a decision of such a sweeping character. At present it is enough for me to say that in my judgment the Commissioner of Patents has no authority to directly or indirectly extend the time for paying the final fee to a period later than six months from *that* allowance of the application which results from proceedings according to law in this office. In the present case, as I have already said, the petition if granted would have that effect. If the applications should be reallowed, after being withdrawn for the purpose stated in the petition, a proceeding for which no warrant is to be found in Rule 165, such reallowance would not be because proceedings had been resumed, but would be for the sole purpose, so far as the Patent Office is concerned, of permitting the final fee to be paid more than six months after the only allowance of the applications made after due proceedings had.

The petition is denied."

IMPROVED ACCUMULATOR.

The accompaying illustration shows the method employed by Mr. J. K. Pumpelly, of Chicago, of avoiding the troubles due to the dislodgement of paste or plugs from the plates of accumulators. Mr. Pumpelly places between the plates a layer of cellulose or wood pulp which by pressing



IMPROVED ACCUMULATOR.

against the plates prevents the paste from falling away. The cellulose or pulp is unacted upon by the acids and it offers an insignificant resistance, if any, to the current. It will be readily understood that this feature is a valuable one, particularly if the cells are subject to rough handling, as in street car work, etc.

ELECTRIC RAILWAY IN HUNGARY.

The following particulars of the electric tramway now in operation in Buda Pesth, Hungary, will be of interest:

The channel has a uniform breadth of 11.2 in. The slot giving access to the conductors is placed in the groove of one of the running rails, so that there is no more metal exposed in the roadway than is the case with horse tramway lines. At intervals of 4ft. along the channel, iron chairs 7.2 in. broad serve to support the running rail, and also to carry insulators, to which the conductors are attached. The bottom of the channel, which is formed of concrete, is at a depth of 28·8in. below the surface of the roadway, and the slot between the rails which form its roof is 1.3in. wide. The conductors, of which there are two (positive and negative), consist of angle iron, and are placed at the sides of the channel so as to be out of sight and out of reach. The cars carry a single motor, geared to one of the axles, and four groups of resistance frames for regulating the speed. The current is supplied at a pressure of 300 volts.

Three lines with an aggregate mileage of five and a-half miles are at present in operation on the above system. A fourth line is at present building, but on this an overhead conductor is to be used. At the central station there are at present three 100-horse power compound engines, each driving a dynamo by means of rope belts. A speed of 9⅓ miles per hour is allowed, and at certain parts this may be increased to over 11, while at others it has to be reduced to 6 and to 3¾. The day's work ranges from 75 to 95 miles per day per car.

FOREIGN ELECTRIC RAILWAY NOTES.

A despatch from Vienna, on December 22, says it is announced there that a company is about to be organized in that city with a capital of 38,000,000 florins, for the construction of an electric railway between Vienna and Buda-Pesth, a distance of 250 kilometres. It has hitherto taken four hours and a half to make the journey, but it is expected that travellers by the proposed road will do it in two and a half.

The General Electric Power and Traction Co., Limited, of London, is now offering to tramway companies to supply cars and the electrical equipment, and to *maintain* the motors, switches, gearing, and accumulators at a mileage rate, the tramway company operating the road at their own expense.

FAULTS IN SUB-MARINE CABLES.*

BY J. PARRY LAWS.

Some time ago I had my attention directed first by Mr. Saunders, of the Eastern Telegraph Company, and subsequently by Mr. Herbert Taylor, of Messrs. Clarke, Forde and Taylor, to a particular class of faults occurring in sub-marine cables. The distribution of these faults is decidedly limited, occurring, as they do, only in water having a moderately high mean temperature, and in positions where it is not very deep. When the core is examined, it presents, strictly speaking, an appearance of simple decay, the gutta percha having undergone some chemical change, which renders it extremely brittle, and causes it to shrink in volume. I say chemical change advisedly, as there are no signs whatever of mechanical erosion; indeed, many of these faults are taken, I am informed, from parts of the cable where the outer covering of wire remained intact; the hemp, however, at the particular spot was entirely destroyed. These faults have therefore caused considerable speculation as to their origin, and the explanation I am about to suggest seems to me, on due consideration, to be at least feasible.

Taking into consideration the high temperature of the water, and the very limited position of these faults, I have come to the conclusion that they may probably be produced by the action of putrefying organic material either in actual contact with the cable or in close proximity to it. Guided by this hypothesis, I made some experiments on a laboratory scale to determine whether organisms, such as occur in putrefying fluids, or the products of their life, would have any effect on the core of submarine cables. The few experiments I have made show conclusively that putrefaction does exert a very marked effect upon gutta percha, some classes of putrefaction producing more effect than others. The few experiments I have been able to carry out are certainly confirmatory of the above suggestion, the gutta percha being considerably eroded and pitted after remaining in a putrid fluid for some time.

I hope to make experiments in greater detail, and publish the above as a mere suggestion, in the hope that others may collect facts tending to establish or disprove it.

SUSTAINING THE ARC.—The fact that it is difficult to sustain an arc, or rather that it is easy to select conditions which will prevent arcs forming with the alternating current system, as compared with continuons current system of much less potential is greatly in favor of the former.

*London *Electrical Review*.

RETURN CIRCUIT FOR ELECTRIC RAILWAYS.

The usual methods of supplying means for the return of the current used in operating electric cars are frequently inefficient or expensive, or both, and there are more or less unsatisfactory results in the practical operation of the system.

It is a well-known fact that the earth a very few feet beneath its surface offers no perceptible resistance to the flow of the electric current, and for that reason it forms the best and cheapest known conductor that can be used for the purpose of conducting electric currents.

Mr. Frank W. Sabold, of Albany, N. Y., has on the basis of this fact succeeded in devising a way of successfully overcoming the objections above alluded to.

The principal feature of his invention consists of a series of metallic bars connected electrically with the rails, and inserted into the ground adjacent to and in line with the railway tracks at distances apart that will not exceed the length of an ordinary track rail, so that a car equipped with the usual motor and conducting wires will

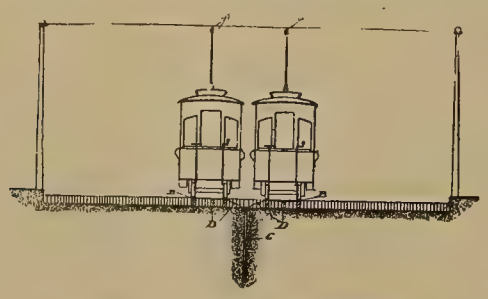


FIG. I.—EARTH RETURN.

in its transit over said track effect a constant variation in the length of the electric circuit, making the latter longer or shorter, according to the direction in which the car is moving in respect to the generator, the course pursued by the current from the dynamo or generator being through the overhead or trolley wire, downward through the conducting wires of the car to the track rails, thence to the metallic bars through the wires connecting said bars to the track rails, then from said bars through the earth back to the generator, the earth alone being used to complete the circuit from the metallic bar nearest the point on the track where the car is at the time located to the dynamo or generator, regardless of the fact whether at that time the car is in motion or stationary.

Reference to the accompanying illustrations will give a very clear idea of Mr. Sabold's method. Fig. 1 is an end or sectional view of the railway, and fig. 2 is a transverse section of the tracks showing the mode of forming electrical connections between the tracks and the earth through the metallic rods.



FIG. 2. TRACK CONNECTIONS WITH EARTH.

A indicates the overhead or trolley wires of an electric railway.

C is a series of bars or other forms of metal or other material which possesses suitable electric conductivity, driven into the ground in proximity to and substantially in line with the tracks B. Said bars are connected by means of wires or other electrical conductors D to the track-rails B, and said connections should be in electric contact to insure a proper operation of the circuits. The electric current from the dynamo or generator is conducted to the motor in the car by means of the overhead wire in the usual manner, and from the motor the current passes through the car wheels into the track rails. From the track rails the current is conducted through the nearest conductor D and bar C into the earth, which conducts the current back to the generator, and thereby the circuit is completed.

Experiments in Troy, N. Y., where there was at one time so much litigation over the interference of electric railway currents with the telephone circuits, shows that by Mr. Sabold's method all earth leakage is positively removed, and with the disappearace of that the telephones are practically free from the trouble complained of.

Mr. Sabold's system is in operation in Troy and Albany and a circuit of much lower resistance is the result. The comparative expense, moreover, is much in favor of Mr. Sabold's plan, while the practical results are superior to those obtained by the elaborate system of return wires which is so expensive.

On the electric road running between Troy and Albany Mr. Sabold's rods will be used, it having been demonstrated to the satisfaction of the company that the use of this improvement does away entirely with all interference with the telephone, and is much cheaper and efficient in its results in the operation of the plant.

THE STORAGE OF ELECTRICITY.*

The problem how to save and store up the enormous amount of natural energy which is daily dissipated in producing natural phenomena has long occupied the attention of scientists. During the last fifteen years this attention has been specially directed toward electricity as an agent. This is, perhaps, because the majority of the really active investigators have been occupied in this department of science, or perhaps the popular superstitious credulity that electricity can be made to do anything, has, to a certain extent, taken possession of the scientific mind. At any rate, the result of experiments has been the development of the electrical storage batteries, or accumulators, as they are sometimes called.

The employment of these names for the apparatus is very unfortunate. They are the cause of the popular idea that electricity, which is considered as a subtle, indefinite, and intangible something, is stored up in them; as valuables are stored in a vault. The commercial current electricity can not, in large quantities, be stored and still preserve its character. It has but a flitting existence, and is no sooner produced than it dissipates itself and is converted into some other form of energy. It was because of this momentary existence that science had to wait so long for an accident to reveal to Galvani that such a thing could exist.

The energy which a current may at any instant be said to possess, is immediately transformed into heat in the circuit, which will under certain conditions produce light; into chemical energy; into motion; which may or may not produce sound; or into magnetic and electro-tonic conditions. The last may either be permanent or have the same evanescent existence as the original current.

When electricity is employed to charge a storage battery, only that part which is transformed into chemical energy is used. The rest is dissipated. The battery, then, instead of being a place where electricity is laid away, is a place where chemicals are left by the current, with the expectation that they will in turn produce a current, when called upon. This may seem a fine distinction, but it is only apparently so. For instance, the current might be produced by a dynamo turned by Niagara water-power. The chemical left by it might be zinc deposited from a solution of zinc sulphate. This might be transported, preserved bought and sold, and finally be employed by some physicist to produce another current. Were the electricity itself stored in its original form, then the imaginative reader can best tell what would become of it and how it must be handled.

To understand this transformation more clearly, and to obtain a clear idea of what goes on in a storage battery, one must first become acquainted with that part of electricity which treats of the phenomena resulting when a current of electricity passes through a liquid. This is called electrolysis and the liquid through which a current can be made to pass is called an electrolyte.

If a current of electricity flows into a liquid solution of any metallic salt by means of a wire and if, after traversing it, flows out through another wire, then it will, by its passage separate the salt into two parts and deposit the metal upon the latter wire.

If, for instance, the solution be one of silver cyanide, then silver will be deposited on the second wire. If a brass fork be connected with this wire and dipped into the solution, then it will receive a coating of silver by the process and will be silver plated. Substitute a solution of nickle nitrate and the article will become nickle-plated. By using copper sulphate we are enabled to cover the faces of types and cuts with a coating of copper, which increases their hardness and consequently their endurance.

This electrolytic action can be watched if a solution of tin chloride be used. Tin, instead of being deposited. like most other metals in fine particles, comes out of the solution in quite large crystals. If the current of electricity be made to enter the solution through two wires, placed symmetrically on opposite sides of the wire through which it makes its exit, and the whole is performed in a vessel with glass sides, then, as the current passes, the crystals will appear, as if by magic growing out around the central wire. This is but a modification of the "lead tree" which appears in many text books on physics. The tin crystals, however, are much larger and more beautiful than those of lead.

The simplest storage battery, then, would seem to be one constructed of two copper plates suspended in a solution of some zinc salt. A current of electricity passed into this would deposit zinc upon one of the plates. After disconnecting the charging current, the battery of itself would give off a current until the zinc was re-dissolved. In fact, a modification of this form of storage battery has recently been placed upon the market. The question arises, however, whether it is cheaper to buy zinc sulphate and transform it by expensive horse power into metallic zinc, or to buy metallic zinc directly. In neither case is the zinc lost. It can be recovered by chemical means from the solution. If solutions of zinc were abundant in nature and hence inexpensive, this style of storage battery would, for economical reasons, prevail. Or, still further, if metallic zinc were inexpensive we would have no need of storage batteries at all, but could use primary batteries directly.

A more perfect system of storage batteries is much to be desired. Already electricity is a staple article, and has a market price of so many cents per ampere hour. But its sale is of necessity confined to limited areas. As soon as these can be extended, by means of storage, an improvement in our commercial welfare will become apparent, and the fear arising from the predicted loss of our coal supplies, will not trouble the minds of our immediate posterity.

*Samuel Sheldon, Ph. D., in *Popular Science Monthly*, for December.

THE NEW WESTINGHOUSE MANAGEMENT.—It is reported that Mr. A. M. Byers has been appointed General Manager of the Westinghouse Electric Company, to take the place of Mr. Byllesby, who retired under the new order of things. Assistant Treasurer McCullough will also retire, his successor yet to be named. The banks interested in the reorganization of the company have decided to advance the money needed, and the concern will again be placed on a firm financial footing.

ADVANCE OF ELECTRIC TRACTION.

Mr. Frank Kitton read a paper before the Buffalo Electrical Society on December 15th on the subject of the "Advance of Electric Traction."

From the statistics gathered up to date, said he, there were, it appeared, no fewer than 246 electric roads in this country, operating 2,024 miles of track and employing 3,830 motor cars, the single trolley system, with only a few exceptions, being that in general use. The storage battery he did not yet consider as altogether beyond the experimental stages, though it was not without some promise of ultimate success. Many devices were being constantly brought out with a view to perfecting a conduit system, but no practical demonstration affording a successful solution of the problem had yet been reached. Therefore the advance in electric traction, Mr. Kitton said, must be considered practically from the overhead trolley system. He then described in detail many of the improvements effected in matters of detail of both an electrical and mechanical nature, and pointed out the strong and weak points of the system. The ordinary street car is mounted on a single truck and is about sixteen feet in length, but there was a growing tendency towards adopting longer cars with double trucks; experience having shown that these were attended with less danger and more economy than the use of trail cars.

Referring to the double trolley system, Mr. Kitton explained that this was a method by which the entire system was insulated from the earth. In one or two places cars were being operated on this principle, not because of any particular advantage derived from its use, but more from pressure brought to bear on the railroad companies by other electric corporations who claim a pre-existing right to the "earth," or at least urge the right to its use as an electric return circuit to the exclusion of others whose currents overpower their own more feeble ones. As electric power currents cause serious interference in telephonic lines, the telephone companies are naturally opposed to the introduction of the single trolley system, and have carried their opposition into the courts, which in some cases have sustained the objections.

Mr. Kitton pointed to the recent proceedings of the street railroad convention in this city as evidence of the great strides being made in the advance of electric traction, and concluded by quoting the language of retiring President Lowrey, who was so thoroughly convinced that electricity is the coming power that he believed the Buffalo convention would be the last that would ever seriously consider horses for the operation of street railways.

AWARD OF THE JOHN SCOTT LEGACY MEDAL AND PREMIUM.

In the December number of the *Journal of the Franklin Institute* we notice the announcement that the Committee on Science and the Arts of the Franklin Institute, Philadelphia, has recommended the award of the John Scott Legacy Medal and Premium to Almer Thomas and Luzerne Merket, of North East Pa., for their "Improvements in Casting and Hardening Copper."

Messrs. Thomas and Merket are two of the directors of the Eureka Tempered Copper Co., of North East, Pa., well known in the electrical trade for the excellence of their goods.

The value and importance of pure copper for electrical machinery and electrical transmission is too well understood to need any illustration here. It is, however, of much importance to have the metal pure and of the proper temper to produce the best results. To obtain these qualities is a matter requiring great skill and experience, and the ordinary copper of commerce is not always reliable in these respects. The process of manufacture employed by the Eureka Tempered Copper Company, however, is a scientific achievement over the ordinary methods, and by their process copper of any required temper and absolute purity is produced.

It is well known that the ancients made their edge tools of copper and tempered them with great skill. The ability to do this has, in these later times, been considered a lost art, but the Eureka Tempered Copper Company claims to have discovered the process, and are able to supply the trade with any and all kinds of copper cast solid, tempered to any gauge that the work expected of it demands.

In making commutators, brushes and other parts of electrical machinery, it has been customary to use rolled or drop forge copper or brass, and bronze: the former does not wear well, and the latter is deficient in electric conductivity. Cast copper would be a better substitute, but, as ordinarily manufactured, small blow holes are liable to exist; these, of course, weaken the metal, and renders it unreliable for such purposes.

The copper of the Eureka Tempered Copper Company, however, is free from blow holes and tempered to a high degree. It has, moreover, greater conductivity than rolled or drop forge copper.

The company warrants its goods to have three times the wear of any metal for commutator segments, electric brushes, gear pinions, armature bearings and trollies. Their tempered copper wire has nearly three times the tensile strength of ordinary copper wire and will last three times as long.

Considering these valuable qualities of their products the award of this medal to the Eureka Tempered Copper Company would seem to be a just one, and the company may reasonably feel proud of the distinction conferred upon it.

FOREIGN NOTES OF INTEREST.

A group of French and Belgian capitalists is offering to undertake the construction of a telephone trunk line between Berlin and Warsaw, a distance of about 360 miles.

The regulations hitherto in force that telephone lines in Spain, were not to exceed 10 kilometres in length have been abolished, and concessions for longer lines will now be granted.

The central lighting station on the Ferranti system, which came into operation at Troyes, France, in August last now supplies 2,000 lights, and is paying its way very satisfactorily.

The Austrian Minister of Commerce has resolved to send two engineers to London to study the City and South London Railway, with a view to utilizing the system on the projected Vienna Metropolitan Railway.

Henley's Telegraph Works have recently manufactured a submarine telephone cable which has been laid by the Pilot authorities in Finland between Hanzo, the most southern point of Finland, to a lighthouse 2½ miles from the coast.

An accumulator has been brought out by M. Donato Tommasi, the distinguishing feature of which is the use of hollow cylindrical perforated electrodes. Each cylinder is filled with active material, and closed at the bottom by an insulating plug, into which is screwed a rod running up the centre of the cylinder and terminating in a flat projection. The lids of the cells are slotted, and the cylinders are hung in rows from these metal-edged slots by means of the projections on their central conductors. Each row of cylinders constitutes an electrode.

THERMO-ELECTRICAL RESEARCHES.*

BY MESSRS. CHASSAGNY AND ABRAHAM.

In the course of our study of the thermo-electrical elements, the comparison of several couples formed of different metals has furnished us with a valuable means of checking the accuracy of our measurements. This system of check consists in the fact that the values obtained verify very accurately the law of the intermediate metals.

For the known temperatures of the junctions we get, between the electromotive forces of the couples formed by three metals, A, B, C, the relation $E(AC) = E(AB) + E(BC)$.

The experiments were arranged as described in a former article.† In order to ensure the same temperature at the heated junctions, the wires of the metals under consideration were soldered at one end into the same mass of copper. The other extremities, which were soldered to copper wires, were kept in vessels of ice insulated by wedges of paraffin.

The experiments related to couples formed of the following metals:—iron, platinum alloyed with 10 per cent. of rhodium; copper, pure platinum.

We will now give the results of an experiment in which the junction was placed in the vapor of boiling water:

COUPLES.	Electromotive forces observed. Volts.
Iron platinum alloyed with rhodium.	0.0008945
Platinum alloyed with rhodium-copper	0.0001980
Platinum alloyed with rhodium-platinum	0.0007897

From these quantities we deduce for the electromotive forces of the couples iron-copper, iron- platinum, and copper-platinum, the following values, opposite which we have placed those that were observed directly.

COUPLES.	Electromotive Forces. Calculated. Volts.	Observed. Volts.
Iron-copper	0.0010925	0.0010926
Iron-platinum	0.0016842	0.0016842
Copper-platinum	0.0005917	0.0005917

This system of check, which was necessary for the continuation of our researches, shows, at the same time the degree of exactness of the measurements.‡

INTERNAL RESISTANCE OF ACCUMULATORS.—The expansion of the plates of an accumulator while discharging is the result of the absorption of sulphuric acid to form the sulphate, and the acid absorbed in this way during the discharge is restored during the charging; from which it is evident that the conductivity of the electrolyte is subject to continual variation; steadily increasing during the charging until the full proportion of acid is restored, declining during the discharge as the acid is absorbed; consequently the internal resistance during the discharge may not become so great as to lessen the practical efficiency of the cell; as a smaller percentage would be liable to entire absorption before the termination of the discharge, leaving only water which has a very high resistance as compared with that of dilute acid.

CABLE EXTENSIONS.—A fourth cable has now been laid by the Eastern Telegraph Company from Suez to Aden, a distance of 1,400 miles, and by May next a third cable will be laid from Aden to Bombay, a distance of close on 2,000 miles. The Eastern Extension has duplicated its cable from Madras to Penang, which are 1,500 miles apart. There are now three cables between London and Australia. Besides these extensions, negotiations are in progress for the laying of a cable to connect Madagascar and the Mauritius with the Eastern and South African Company's cable at Zanzibar.—On the coast of South America the Western and Brazilian Company are doubling the line from Rio de Janeiro to Buenos Ayres; and nearer home we have just had 600 miles of new cable laid for the Great Northern Company between the North of England and Sweden.—London *Electrician*.

* Comptes Rendus de l'Academie des Sciences.

† Recherches de Thermo-Electricitié (Comptes Rendus, Vol. cxi., p. 447, 1890).

‡ Experiments made at the Physics Laboratory of the Higher Ecole Normale.

ECONOMY IN CONDUCTORS FOR ELECTRICAL DISTRIBUTION.*

In considering what economies it is possible to introduce into a system of conductors laid down for the distribution of electrical energy, one has at the outset to consider the relative merits of the different systems which have been proposed before investigating the best proportions to be given to different parts of the system fixed upon, and the proper current densities to be employed in them.

With regard to this first question, I do not propose to say more than a very few words, or to deal with it in any but the most general way.

It is important to observe, in the first place, that the pressure to be used in houses for lighting by incandescence lamps has been practically limited to a maximum of 100 to 120 volts by the makers of the lamps, and that the pressure in buildings may not in any case exceed the 300 volts fixed by the board of trade. This consideration, while greatly hampering the system of simple parallel distribution, does not affect to any great extent the rival systems employing accumulators or secondary generators.

In his Cantor lectures before the Society of Arts, in 1885, Prof. George Forbes gave a very interesting account of various systems and their sub-divisions; and he showed that, except for a very limited area of compact form requiring a large amount of light per unit of area, this system of simple parallel distribution is impracticable on account of the enormous expense of mains to carry the large currents necessitated by the use of so low a voltage For a very small and compact area such as a block of buildings, it may be worth while to consider the applicability of this system, however, on account of its simplicity and the cheapness of the class of cable that may be employed.

No practical use of the series system for general station work has been made that I am aware of, though, of course, it is largely in use for outdoor lighting and transmission of power. It has the obvious advantage of requiring comparatively small conductors, but against that must be put the expenditure necessary for providing a complete system of automatic cut-outs for every lamp, motor, or other apparatus employed, and the difficulty of regulating with any reasonable degree of economy for the varying numbers of lamps alight on different circuits. The comparatively low efficiency of glow lamps for series lighting is also an important reason against the adoption of such a system.

The next system to which attention may be drawn is the series-parallel system, of which the modifications known as the three-wire, four-wire, and similar systems are the most important. These are in general use both in England and abroad, and give for certain distributions of lamps a very good result indeed.

The degree of economy to be obtained with a three, four, or n wire system over the simple parallel system depends on the certainty or otherwise with which you can rely on a continued balance of load between the different sections. This you would secure as far as possible by putting as many of each class of consumers in each section, and also, if practicable, by insisting upon the wiring of all buildings supplied being upon the same system as that of the mains, and the total load in every case distributed between the sections.

If you are sure that the load in any one section will never exceed that of any of the others by more than m per cent. of the full load of a section, and the system is one of n wires; then if E stands for the per centage reduction in amount of copper used from that necessary in an equivalent simple parallel system.

$$\text{E} = 100 \left\{ 1 - \frac{200 + m\,(n - 2)}{200\,(n - 1} \right\}$$

For example, let $m = 25$ and $n = 3$

then $\text{E} = 43.8$.

If, as in a case in which all the wiring is done upon the same system as that of the mains, we may take $m = 10$; and supposing $n = 4$, then

$$\text{E} = 63.3.$$

If, in the same case we take $n = 5$,

$$\text{E} = 71.3.$$

In considering these systems it is necessary, in any practical case, to take into account the increased cost of labor in putting them down, and of the conduits or pipes in which they are enclosed. In connection with this, it is worthy of remark that with underground systems of mains—such as are likely to be in vogue in future — the cost of the actual cables may amount to less than 50 per cent. of the total cost of the cables laid.

With regard to systems employing accumulators or secondary generators, there is at once a great gain in the allowance of very much high pressures in the mains. The cable is, however, very much more expensive, and the cost of the accumulators and their constant inefficiency must be taken into account in the one case, and in the other the cost of the converters and their inefficiency on light loads. In the case of accumulators it is necessary to distribute the energy from sub-stations upon some one of the low tension systems, so that there is only a partial gain in respect to copper; and with converters, and especially those for alternating currents, it is well-known that their cost per kilowatt output diminishes to a considerable extent as their size increases, so that with these also it may be and is advisable sometimes to employ sub-stations, so that the same remark will apply here.

I have now very briefly alluded to some of the conditions affecting the relative economies of the chief systems of distribution of electrical energy; and I have purposely refrained from examination of them in detail for the reason that every particular case will differ to some extent from any other, and in making a choice of the system to be employed to best meet its requirements, a special investigation should be made having regard to all the conditions involved.

Before taking up any problems, such as those referred to in the abstract sent out to members, a word must be said as to the relation of price to size of cable. Bare wires, as you all know, are sold at so much a pound in general; stranded cables being a little more expensive than single wires, and wires smaller than No. 20 or 22 a little dearer than those above this size. Speaking generally, however, cables of bare wire of approximately the same cross-sectional area are sold at the same price per pound. Small insulated wires of a definite thickness of insulation, such as one of two layers of cotton or silk, are also often sold at so much a pound, but with these we have nothing at present to do, unless it be to remark that with such wires the insulation resistance necessarily decreases as the wire increases in size.

Insulated cables for use in any of the cases we have to consider are, I believe, invariably sold by length.

For a given class of insulation, and a given insulation resistance per mile, you would expect—seeing that for a given insulation the mass of the insulator is directly proportional to the mass of the copper insulated—that the price should be very nearly proportional to the cross-sectional areas of the copper conductors. In practice this is very nearly so, for the price of a cable may be expressed by the equation

$$\text{P} = a + b\,\text{A},$$

where P = cost per mile in pounds.

A = area of conductor in $\frac{1}{1000}$ths of one square inch and where a and b are constants depending upon the class of insulation and the number of strands in the cable, with considerable accuracy with the cables of some of the best known makers.

Taking Silvertown cables for example:

Class L.

7 strands	P = 10.3 + 3.58 A	within	2.6 per cent.
19 "	P = 15.7 + 3.39 A	"	3.5 "
37 "	P = 22.5 + 3.32 A	"	0.7 "

Class D.

7 strands	P = 4.72 + 1.32 A	within	2.9 per cent.
19 "	P = 7.22 + 1.27 A	"	4.6 "
37 "	P = 12.2 + 1.25 A	"	0.4 "

The percentage errors given above are the maxima, and the average are from ⅓ to ½ these.

In a similar way the values of the constants for the other classes manufactured by the Silvertown Company may be tabulated, but I have not thought it necessary to do so here, more especially as I have not their most recent p ic sheet by me.

With Fowler-Waring cables (lead covered) you would not expect this law to hold with the same degree of accuracy, as the thickness of lead is not proportional to the diameter of the cable. We have, however, for seven-stranded cables P = 25.9 + 2.49 A, with a maximum error of 12½ per cent. and an average error of 4.8 per cent.

The cables of Messrs. Siemens are not manufactured upon the plan of having a given insulation resistance per mile for a given class of cable; the insulation resistance of their cables of a given class diminishes as the size of the cable increases. For example, for their classes L, M, and N, the insulation resistance per mile varies from 2,500 megohms for the smallest sizes to 300 megohms for the largest. You would not, then, expect to find the price of a cable proportional to its size, nor, in fact, is it actually nearly so.

With all cables, however, which are very nearly of the same size the price is, of course, very nearly proportional to the cross-sectional area of the copper, and over a narrow range the rule $\text{P} = a + b\,\text{A}$ still holds, the constants in any case being very easily determined by plotting a few points in the neighborhood of the size you want, and drawing the tangent to the curve (or the chord through points on either side of the size you estimate is about what you require) where the ordinate of the point of intersection of this tangent or chord with the axis of y gives a, and b is the trigonometrical tangent of the angle made by the line as drawn with the axis of x, it being supposed that prices are plotted as ordinates.

Now, in any case of central station work you can estimate from experience what is approximately the cross-sectional area of copper you want, so that we may take it that, for our purposes, the rule $\text{P} = a + b\,\text{A}$ holds universally. This may be regarded in the light that you pay a sum a for the privilege of being allowed to buy the cable you require from the makers you are dealing with, and for the rest the price of this cable is directly proportional to its size.

The most economical current density to employ for a constant and uniform current circuit working for a given number of hours per annum.

Let a = current in amperes;
n = number of hours of working per annum;
p = resistance of conductor of one square inch sectional area in ohms per mile;
c = value of the Board of Trade unit in pence;
d = sum of the rates of interest, depreciation, and repairs on capital laid out in cable;
x = sectional are of conductor required in $\frac{1}{1000}$ths of one square inch;
D = most economical current density to employ in amperes per square inch;
P = $a + b\,x$ as before;

then
$$x = a\sqrt{\frac{n\,c\,p}{2.4\,b\,d}}$$

and
$$\text{D} = 1{,}000\sqrt{\frac{2.4\,b\,d}{n\,c\,p}}$$

* Paper read before the Old Students' Association, London, by Hamilton Kilgour.

For copper conductors $p = 0.0425$, hence

$$x = 0.133\, a \sqrt{\frac{n\,c}{b\,d}}$$

and

$$D = 7{,}513 \sqrt{\frac{b\,d}{n\,c}}$$

For example, if we take Silvertown class L cable, and

$$c = 5$$
$$d = 13$$

we shall have the most economical current densities for different numbers of hours per annum given by the following table :

n	D 7 strands.	19 strands.	37 strands.
400	1,119	1,089	1,077
600	913	889	880
800	791	770	762
1,000	708	689	681
1,500	578	562	556
2,000	500	487	482
3,000	408	398	393

In this table p has been taken as 0.0446, which is rather higher than it should be.

No account of the increased resistance of the conductor due to heating has been taken account of in the foregoing ; but as the current density to employ in a given case is known approximately from previous experience after a little, an allowance can easily be made for the probable heating in the value of p you decide to use.

NOTES ON THE CHEMISTRY OF SECONDARY CELLS.*

(*Continued from page 9, issue of December 27.*)

As already explained, the constant discharge current of 10 amperes was, by the employment of some auxiliary cells, kept flowing through the accumulator under test even when its E. M. F. became very small. Towards the end of the discharge the fall of P. D. at the terminals of the cell under test became extremely rapid, so that, for example, on closing the circuit after the removal of the plugs at D′ (fig. 2), the P. D. fell from 1.9 to 0.6 volts in 33 minutes.

This rapid fall is probably due to lead peroxide being formed on the negative plates more rapidly than it could be removed by local action, since the chemical analysis showed decided evidences of lead peroxide on the plugs removed at D′ from the negative plates. At E′ (fig. 2) the E. M. F. of the accumulator under test became reversed, but rapidly recovered its original direction on stopping the discharge current.

It is a very striking example of the recuperative action of a secondary cell that you can completely discharge it, as you think, and then even charge it in the wrong direction, but it will, on being insulated, rapidly recover an E.M.F. in the original direction. Indeed, we were told of a curious case some time back. After the removal of the laboratory employed for testing ammeters from one part of a well known London factory to another, it was found that the E.P.S. accumulators always ran down very rapidly whenever an attempt was made to use them, in spite of their having been charged in the intervals. As the E.M.F. was always in the right direction, it was supposed that the cells had become partially short-circuited in the removal, and it was not for some time that the true explanation of the refusal of the cells to do their work was discovered. The real fact was that, in fitting up the new laboratory, the leads from the dynamo to the switch had been reversed, so that the unfortunate cells were charged in the wrong direction every time the dynamo was turned on.

The preceding incident also forcibly illustrates the sort of attention that secondary cells may receive in practice, and shows the necessity for the P.D. and specific gravity being occasionally measured even in places where the study of the behavior of cells is not the main business of the factory.

One of the great defects of the earlier specimens of the E.P.S. cells lay in the buckling of the plates. Mr. Capito tells us that it was Mr. Collet who noticed that all the plates generally curved in one direction, and who suspected that this arose from the unequal chemical action on the two sides of the last positive plate of the cell. Mr. Collet therefore proposed putting a negative plate at each end of this cell, and this plan—which has been always followed since—of using one more negative than positive plate, has much to do with removal of the buckling difficulty.

V.

EFFECT OF REST ON CHARGED ACCUMULATORS.

As the result of a number of tests described in our Edinburgh paper we found that if E. P. S. accumulators be charged with 9 amperes and discharged with 10, a number of times without intermission, between the P. D. limits of 1.8 and 2.4 volts per cell, until the cells are brought to a perfectly steady "working state" the quantity efficiency is about 97 per cent., and the energy efficiency 87; further, that if the cells be fully charged until the P. D. per cell is 2 4 volts, and then be left perfectly insulated for 16 days, the next discharge between the fixed P. D. limits only gives out about 65 per cent. of the ampere hours, and about 57 per cent. of the energy put in before the rest. Further, not merely is energy lost during the rest of an insula ed accumulator, but for several subsequent charges and discharges between the same P. D. limits after the rest the storage capacity and the quantity and energy efficiencies are all lower than before the rest.

For the purpose of examining into what took place in an accumulator, which was left charged, a small E. P. S. cell was charged until the P. D. was 2.4 volts, and then the positive plates were withdrawn and put into another vessel containing dilute acid of specific gravity 1.2, the negatives being left in the vessel in which they were charged. Both sets of plates were covered up with gutta percha hoods, the edges of which dipped under the liquid, and to the top of each hood was fitted, gas tight, a vertical graduated glass tube closed at the top. The hoods and the glass tubes were first filled with liquid, and the amount of gas that came off from the two sets of plates was measured from day to day by watching the descent of the liquid in the tubes.

No gas was seen to come off from the positive plates, but in the case of the negatives gas came off very slowly at first, then more rapidly, and finally more slowly again. The following table gives a record of the amount of gas that came off from the negative plates, the gas, on analysis, being found to be hydrogen :—

Hydrogen Gas Collected from Charged Negative Plates after Removal of Positive Plates.

DATE.	Time.	Cubic centimetres of gas collected.	Time of collecting gas in hours.
November 15th....	11 45	0	0
" 17th....	10 0	2	46
" 20th....	12 0	52	120
" 21st....	10 0	72	142
" 22nd....	10 0	87	166

If the lead of the positive plate be turned into lead sulphate by local action, 87 c.c. of hydrogen liberated corresponds with about 0.81 gramme of lead turned into sulphate. It is clear, then, that the lead of the negative plate is steadily being turned into some oxide or salt, and probably the loss of energy which we observed in the charged cell left insulated for many days was due to this local action at the negative plate. And further, as this action takes place apparently only at the negative plate, it is clear that in the subsequent discharge the cell will appear to be discharged before the positive plate is discharged, and charged up again without reducing all the lead sulphate on the negative plate. The local action at the negative plate while a cell is standing charged, has, therefore, for the first few discharges and charges after a long rest, exactly the same effect as if a portion of the negative plate had been bodily removed out of the cell. Hence we see that the peculiarities observed by us in curves 8 to 23 in our Edinburgh paper may be explained by this defective behavior of the negative plates.

VI.

CONSTRUCTION AND FORMATION OF E.P.S. PLATES.

The question arises why the E.P.S. accumulators are so constructed that the plugs in the positive plates contain some 48 per cent more peroxide of lead than is required to be converted into sulphate in the normal discharge. Two explanations suggest themselves. One is that, since the granules of lead peroxide begin, as we find, to be coated with a protecting coating of sulphate early in the discharge, it is impossible, with the present form of plate, for the interior of each granule of lead peroxide to be converted into sulphate, and, therefore, it is necessary to employ nearly twice as much lead peroxide as is actually needed for the chemical action. Another reason is the fear of the positive plate crumbling to pieces if it be completely formed ; and this reason Mr. Capito, who was formerly in the employ of the Electrical Power Storage Company, thinks, on the whole, is the more important.

In the construction of the original Faure accumulators, as well as of the early E.P.S. cells, both the positive and the negative plates were pasted with red lead (Pb_3O_4), and formed together for a period of some 50 hours. Later on litharge (Pbo) was used to coat the negative plate, red lead being used only for the positive one, and the plates were formed separately, the negative being much more formed at the works than the positive. Some time ago I was informed by a very competent authority that the following is the modern process of *forming* employed by the Electrical Power Storage Company :

Positive Plates.—8⅞″ by 7⅞″ by ¼″. Two amperes per plate, or 0.028 ampere per square inch, sent for 18 hours.

Negative Plates.—9″ by 9⅝″ by $\frac{3}{16}$″. One and a half to two ampere per plate, *i. e.*, 0.017 to 0.023 amperes per square inch, for 120 hours.

The actual time of forming either set of plates depends greatly on the length of stoppages during the formation. This is especially the case with the negative plates, therefore they endeavor to form the negative for the 120 hours without any stoppage of the current. On the receipt of a cell from the Electrical Construction Corporation, the purchaser is requested to form it for 40 hours more with the ordinary charging current used in working, which is at the rate of 0.026 ampere per square inch.

Mr. Capito tells us that, when he was at Millwall, such periods of formation as 120 hours were not used; and he thinks that this may be due to the fact that formerly the plates were not dried after pasting and before formation, as they are at present. This drying hardens the plates and produces a better cell; but he thinks that, as the paste is itself mixed with sulphuric acid, there is probably some sulphating of the negative plates during drying, and that several hours in the subsequent formation are probably spent in reducing this sulphate.

The reason, we understand, for the manufacturers only forming the positive plates for 18 hours, and leaving the purchaser to form them for the remaining 40 hours, is that if positive plates be *well formed* and then dried for carriage, the plugs become loose, which is not the case if the positive plates be only slightly formed before drying.

We were interested in learning from Mr. Capito whether, while superintending the manufacture of many thousands of accumulator plates, he had ever tried pasting the positive with lead peroxide ($Pb O_2$) in order to avoid the necessity of having to form this salt electrically out of the

*Read before the English Institution of Electrical Engineers, November 13th.

red lead with which the positive plates are usually pasted. This idea of applying a paste of lead peroxide directly to the positive plate, he told us, he had tried, but that the method turned out a failure, from the impossibility of getting the lead peroxide paste to stick on to the grid even when some red lead was mixed with the lead peroxide. He also mentioned a very interesting fact—that whereas a paste of red lead mixed with dilute sulphuric acid of density 1.1 gives an adherent deposit on formation, on the contrary, a powdery deposit is produced if the density of the liquid used in making the red lead paste be 1.2. We understand the process that has shown itself the best is to use dilute sulphuric acid of density 1.2 for mixing the red lead paste, and dilute acid of 1.2 for mixing the litharge paste for the negative plates.

THE ELECTRO MAGNET.*

BY PROF. SILVANUS P. THOMPSON.

ACTION OF MAGNETIC FIELD ON SMALL IRON SPHERE.

In dealing with the action of tubular coils upon iron cores, I showed how, when a very short core is placed in a uniform magnetic field, it is not drawn in either direction. The most extreme case is where a small sphere of soft iron is employed. Such a sphere, if placed in even the most powerful magnetic field, does not tend to move in any direction if the field is truly uniform. If the field is not uniform, then the iron sphere always tends to move from the place where the field is weak to a place where the field is stronger. A ball of bismuth or one of copper tends, on the contrary, to move from a place where the field is strong to a place where the field is weaker. This is the explanation of the actions called "dia-magnetic," which were at one time erroneously attributed to a supposed dia-magnetic polarity opposite in kind to the ordinary magnetic polarity. A simple way of stating the facts is to say that a small sphere of iron tends to move up the *slope* of magnetic field, with a force proportional to that slope; whilst (in air) a sphere of bismuth or one of copper tends, with a feeble force, to move down that slope. Any small piece of soft iron—a short cylinder, for example—shows the same kind of behavior as a small sphere. In some of Ayrton and Perry's coiled-ribbon amperemeters and voltmeters, and in some of Sir William Thomson's current-meters, this principle is applied.

SECTIONED COILS, WITH PLUNGER.

An important suggestion was made by Page, about 1850, when he designed a form of coil-and-plunger having a travel of indefinitely long range. The coiled tube, instead of consisting merely of one coil, excited simultaneously throughout its whole length by the current, was constructed in a number of separate sections or short tubes, associated together and to end, and furnished with means for turning on the electric current into any of the sections separately. Suppose an iron core to be just entering into any section, the current is turned on in that section, and as the end of the core passes through it, the current is then turned on in the section next ahead. In this way an attraction may be kept up along a tube of indefinite length. Page constructed an electric-motor on this plan, which was later revived by Du Moncel, and again by Marcel Deprez in his electric "hammer."

WINDING OF TUBULAR COILS AND ELECTRO-MAGNETS.

The mention of this mode of winding in sections leads me to say a few final words about winding in general. All ordinary coils, whether tubular or provided with fixed cores, are wound in layers of alternate right handed and left-handed spirals. In a preceding lecture I mentioned the mistaken notion, now disproved, that there is any gain in making all the spirals right-handed or left-handed. For one particular case there is an advantage in winding a coil in sections; that is to say, in placing partitions or *cloisons* at intervals along the bobbin, and winding the wire so as to fill up each of the successive spaces between the partitions before passing on from one space to the next. The case in which this construction is advantageous is the unusual case of coils that are to be used with currents supplied at very high potentials. For when currents are supplied at very high potentials there is a very great tension* exerted on the insulating material, tending to pierce it with a spark. By winding a coil in *cloisons*, however, there is never so great a difference of potentials between the windings on two adjacent layers as there would be if the layers were wound from end to end of the whole length of coil. Consequently, there is never so great a tension on the insulating material between the layers, and a coil so wound is less likely to be injured by the occurrence of a spark.

Another variety of winding has been suggested, namely, to employ in the coils a wire of graduated thickness. It has been shown by Sir William Thomson to be advantageous in the construction of the coils of galvanometers to use for the inner coils of small diameter a thin wire; then, as the diameter of the windings increase, a thicker wire; the thickest wire being used on the outermost layers, the guage being thus proportioned to the diameter of the windings. But it by no means follows that the plan of using *graded wire*, which is satisfactory for galvanometer coils, is necessarily good for electro-magnets. In designing electro-magnets it is necessary to consider the means of getting rid of heat; and it is obvious that the outer layers are those which are in the most favorable position in getting rid of this heat. Experience shows that the under layers of coils of electro-magnets always attain a higher temperature than those at the surface. If, therefore, the inner layers were to be wound with the finer wire, offering higher resistance, and generating more heat than the outer layers, this tendency to over-heating would be still more accentuated. Indeed, it would seem wise rather to reverse the galvanometer plan, and wind electro-magnets with wires that are stouter on the inner layers, and finer on the outer layers.

Yet another mode of winding is to employ several wires united in parallel, a separate wire being used for each layer, their anterior extremities being all soldered together at one end of the coil, and their posterior extremities being all soldered together at the other. Magnetically, this mode of winding presents not the slightest advantage over winding with a single stout wire of equivalent section. But it has lately been discovered that this mode of winding with *multiple wire* possesses one incidental advantage, namely, that its use diminishes the tendency to sparking which occurs at break of circuit.

EXTENSION OF RANGE BY OBLIQUE APPROACH.

I now pass to the means which have been suggested for extending the range of motion, or of modifying its amount at different parts of the range, so as to equalize the very unequable pull. There are several such devices, some electrical, others purely mechanical, others electro-mechanical. First, there is an electrical method. André proposed that as soon as the armature has begun to move nearer, and comes to the place where it is attracted more strongly, it is automatically to make a contact, which will shunt off part of the current and make the magnetism less powerful. Burnett proposed another means; a number of separate electro-magnets acting on one armature, but as the latter approached these electro-magnets were one after the other cut out of the circuit. I need not say the advantages of that method are very hypothetical. Then there is another method which has been used many times with very great success, the method of allowing the motion of the armature to occur obliquely, it being mechanically constrained so as to move past, instead of towards the pole. When the armature is pulled thus obliquely, the pull will be distributed over a definite wider range. Here is a little motor made on that very plan. A number of pieces of iron set on the periphery of a wheel are successively attracted up sideways. An automatic device breaks the circuit as every piece of iron comes near, just at the moment when it gets over the poles, and the current being cut off, it flies on beyond and another piece comes up, is also attracted in the same way, and then allowed to pass. A large number of top motors have been made from time to time on this plan. I believe Wheatstone was the first to devise the method of oblique approach about the year 1841. He made many little electro-magnetic motors, the armatures of which were in some cases solid rims of iron arranged as a sort of wheel, with two or more zig-zag internal teeth, offering oblique surfaces to the attraction of an electro-magnet. Such little motors are often now used for spinning Geissler's vacuum tubes. In these motors the iron rim is fixed, and the electro-magnet rotates. The pole of the electro-magnet finds itself a certain distance away from the iron ring, it tries to get nearer. The only way it can get nearer is by swinging round, and so it gradually approaches, and as it approaches the place where it is nearest to the internal projection of the rim the current is cut off, and is swings further. This mode may be likened to a cam in a mechanical movement. It is, in fact, nothing else than an *electro magnetic cam.* There are other devices, too, which are more like electro-magnetic *linkages.* If you curve the poles or shape them out you may obtain actions which are like that of a wedge on an inclined plane. There is an electro-magnet in one of Paterson and Cooper's arc lamps wherein the pole-piece, coming out below the magnet, has a very peculiar shape, and the armature is so pivotted with respect to the magnet, that as the armature approaches the core as a whole, its surface recedes from that of the pole-piece, the effect being that the pull is equalized over a considerable range of motion. There is a somewhat similar device in De Puydt's pattern of arc lamp.

*Abstract from Cantor Lecture delivered before the Society of Arts, London.

*The tension on the insulating material, tending to pierce it with a spark, is proportional to the square of the difference of potentials (per unit thicknes) to which the insulating material is subject. It is incorrect to talk about the tension of the conductor or about the tension of the current; for the tension or electric stress is always an action affecting the di-electric or insulating material.

HIGH PRESSURE ALTERNATING MAINS.—*Industries* says: "Reports have of late been freely circulated that the Dept ord electric light mains show a very much higher pressure at the London than at the Deptford end. Several eminent scientific men are said to be investigating this phenomenon. We should like to know more about this apparently impossible effect. We may mention another fact, which may be foretold on theoretical grounds, and which, while being apparently similar, is really quite different from that referred to above. For example, if a dynamo is excited to give, say, 5,000 volts at the termimals before the mains are connected, it will give considerably more directly they are thrown on, especially if the load is very light, but the increased pressure will be at Deptford as well as in London. The rise of pressure can be roughly calculated beforehand if the particulars of the dynamo and mains are given. A higher pressure in London than Deptford at a given time appears quite incapable of explanation with our present knowledge."

BROKEN ARC LAMP GLOBES.—One of the most frequent causes of breaking of arc lamp globes is the undue heat produced after the carbon has burned close to the holder.

ON THE ILLUMINATION OF A HORIZONTAL PLANE.*

BY F. LOPPÉ.

The writer considers the problem of lighting a horizontal plane by means of a number of similar lights arranged so that the illumination at no place on the ground shall be less than a given quantity, E, and so that the energy expended in producing the light shall be as small as possible.

Two special cases are treated. In the first a large area is supposed to be illuminated by means of many lamps placed in rows, so that the poles stand at the corners of squares of equal size. In the second a street is supposed to be illuminated by means of lamps placed alternately on each side of the road, in the manner usual in practice.

It is assumed for simplicity that the energy required for producing the light is proportional to the amount of light produced. The problem may, therefore, be stated in the following way: Given a certain amount of light, which, with certain limitations, may be distributed in any manner, how shall this light be apportioned so that the minimum illumination of the surface may be as great as possible?

The author first considers the illumination of a square (side $2a$), lighted by four lamps (height h) placed at the corners. It is shown that the light at the centre of the square is

a minimum if $h < a\sqrt{3}$

and a maximum if $h > a\sqrt{3}$

As in practice the first condition always holds since lamps are placed farther apart from each other than from the ground, the illumination at the centre of the square is a minimum; and in the problem of lighting an area in the manner stated above, the quantity E refers to the centres of the squares.

In working out the condition that the total light used to produce the minimum illumination E may be as small as possible, it is shown that $L/4a^2$ must be a minimum where L is the candle-power of each lamp, and where the relation expressed by the following equation:—

$$2a^2 = \left(\frac{4h}{E}\right)^{\frac{2}{3}} L^{\frac{2}{3}} - h^2$$

connects the three unknown quantities, a, h, and L, with the quantity E, which is supposed given. If we assume one of the former three quantities known, we can find the best relation between the other two. By assuming L, or the candle-power of the lamps used, to be known, the best value for h is shown to be

$$h = 0.87\sqrt{\frac{L}{E}}$$

where E is measured in terms of the illumination produced by a candle placed at unit distance from the surface lighted.

If, on the contrary, h is assumed known, the best value for L is given by the equation

$$L = 1.30\ E\ h^2$$

The second case, that referring to street lighting, is then considered, and it is shown that if L is fixed, the best value of h is

$$h = 0.62\sqrt{\frac{L}{E}}$$

while if h is known, the best value for L is

$$L = 0.92\ E\ h^2$$

RATIO OF TEMPERATURE AND LIGHT.—As the temperature of an incandescent body increases, not only does the actual quantity of radiant energy increase, but its wave lengths diminish. Experience has shown that after incandescence is reached, increasing the temperature in a given ratio increases the light emitted in a much greater ratio.

SAFETY DEVICES.—The best safety device for high potential current circuit is perfect insulation.

L' Electricien.

INDUCTION AND INDUCTION COILS.*

The phenomena exhibited by the variation of the number of lines of induction through the core of an ordinary induction coil may be divided into two parts. Firstly, when the discharge is non oscillatory, and, secondly, when it is oscillatory. It is with the former of these divisions only that I deal with in this paper.

If l, lines of induction, are threaded through the core of a coil of n turns, joined up to a circuit of resistance R, then the quantity q of electricity produced in the circuit will be

$$q = \frac{n\,l}{R} \qquad (1)$$

Also, if an E. M. F., capable of producing a steady current C, is put in a circuit, then each time the current is started a quantity of electricity

$$q = L\frac{c}{R} \qquad (2)$$

will be kept back that would have been generated but for the existence of the coefficient L.

Owing to this factor L impeding the starting of the current in the circuit in a similar manner to that in which the inertia of a body opposes the force setting it in motion, it has been aptly called the electro-magnetic inertia of the circuit. But the shorter but less expressive term of inductance is now more generally used.

The quantity q in (1) is quite unaffected by the presence of any other circuits upon the same electro-magnet. For if l_1 of the same lines of induction are threaded through another coil of n_1 turns, then the quantity

$$q_1 = \frac{l_1\,n_1}{R_1} \qquad (3)$$

will be induced in this second circuit while q remains unaltered.

Also when the current, c, is started in the primary circuit the quantity

$$q_1 = m\frac{c}{R_1} \qquad (4)$$

will be induced in the secondary circuit, while the value q in (2) will also remain unaltered.

From (1) and (2) we get

$$l = c\frac{L}{n} \qquad (5)$$

And, thus, the number of lines of induction threaded through a coil can be determined when the inductance and number of turns upon the coil are known.

Also from (3) and (4)

$$l_1 = c\frac{m}{n_1} \qquad (6)$$

And from (5) and (6) we get

$$\frac{l_1}{l} = \frac{m}{L}\frac{n}{n_1}. \qquad (7)$$

A formula by which can be determined the fraction of the whole number of lines of induction generated by the primary circuit that are usefully threaded through the secondary circuit.

If l equidistant lines of induction cross an area a then the tension along those lines of induction, that is, the pull across the area a

$$= \frac{l^2}{8\pi a} = \frac{c^2}{8\pi a}\frac{L^2}{n^2}. \qquad (8)$$

The energy absorbed from the primary circuit in generating the lines of magnetic induction through the core of simple electro-magnetic $= \frac{E\,q}{2}$ where E is the E. M. F. of the battery.

*W. MOON, in London *Electrical Review*.

From (1) and (2)

$$\frac{E\,q}{2} = \frac{c\,n\,l}{2} = \frac{L\,c^2}{2} \qquad (9)$$

To get as great a pull with as little expenditure of energy as possible in creating the lines of magnetic induction, we must make the quotient of (8) and (9) a maximum

$$\frac{l}{4\pi a c n} = \frac{L}{4\pi a n^2} \qquad (10)$$

This last expression is useful in the construction of rapidly responding apparatus such as telegraph relays. But in other apparatus it is necessary to get as great a pull with as small a rate of expenditure of heat in the coils as possible; in that case

$$\frac{L^2}{8\pi a n^2 r}$$

must be made a maximum, where r is the resistance of the coils of the electro-magnet.

The energy expended by a battery of E. M. F., E, during a time, t, sufficiently long to admit the current arriving at its permanent state

$$= E\,(c\,t - q) \qquad (11)$$

where q is the quantity of electricity damped back by L on starting the current.

Filling the value of q in (2), in (11) the energy expended by the battery becomes.

$$\frac{E^2}{R}\left[t - \frac{L}{R}\right] \qquad (12)$$

But since from (9) the part of this energy absorbed from the primary circuit in creating the magnetic field.

$$= \frac{E^2}{R}\frac{L}{2R}$$

It follows that the difference between the values (12) and (9) gives the amount expended in heat.

$$= \frac{E^2}{R}\left[t - \frac{3}{2}\frac{L}{R}\right]$$

If there is no secondary circuit this heat will be expended by the current in the primary circuit. But if a secondary circuit exists part of this heat will be expended in that circuit also.

If the same lines of induction are discharged through several secondary coils then the energy embodied in the lines of induction will be divided between the several coils in proportion to the number of turns of each, and inversely proportional to their resistances. Thus the energy expended in the coil of n_1 turns and resistance R_1 would be

$$\frac{E^2}{R^2}\frac{L}{2}\left[\frac{\frac{n_1}{R_1}}{\frac{n_1}{R_1} + \frac{N}{R}}\right]$$

Obviously it is immaterial whether the coil of n turns is a secondary or a primary circuit, and since $\frac{E^2}{R^2}\frac{L}{2}$ is the energy embodied in the lines of induction threaded through the two coils, the sum of these last two values, or

$$\frac{E^2}{R^2}\frac{L}{2}\left[\frac{2\frac{n_1}{R_1} + \frac{n}{R}}{\frac{n_1}{R_1} + \frac{N}{R}}\right]$$

will represent the energy absorbed from the primary circuit on starting the current.

Thus it will be seen that the whole energy

taken from the primary circuit on starting the current cannot be twice as great as when there is no secondary circuit, but approaches more closely to that value as $\frac{n_1}{R_1}$ becomes great as compared with $\frac{n}{R}$.

The time of discharge is important in induction phenomena, as it is by the variation of this factor that the laws of conservation of energy are maintained. Let t be a time of sufficient duration to incude nearly the whole of the discharge. And e and e_1 the mean E. M. F. in the primary and secondary circuits during this time, then

$$e = \frac{n\,l}{t} = \frac{L\,c}{t} \qquad (14)$$

$$e_1 = \frac{n_1\,l_1}{t} = \frac{m\,c}{t} \qquad (15)$$

And the energy given off in the discharge of the secondary circuit

$$= e_1\,q_1 = \frac{n^2_1\,l^2_1}{t\,R_1}$$

$$= \frac{m^2\,c^2}{t\,R_1} = \frac{E^2}{R^2}\,\frac{m^2}{t\,R_1} \qquad (16)$$

By adding this last quantity to the energy expended in creating the magnetic field and to that expended in heat in the primary circuit, and equating the result to the energy expended by the battery, the value of t can be determined.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
74 FEDERAL STREET,
BOSTON, Dec. 27, 1890.

The Standard Electric Supply Company report large and increased sales.

The factory of the Thomson-Houston Electric Co., in Lynn, has been shut down through the holidays.

The Eastern Electrical Supply and Construction Co. report a large increase in their sales for the month of December.

The Bell Rock Electrical Conductor Company are to add a large number of braiders to their plant in Maplewood.

P. A. Stewart, fireman for the Wright Electrical Engineering Co., was presented on Christmas evening with a gold watch by the men in his "gang."

A new fire alarm system has just been completed in Westboro. Danvers is also to have a small system erected, which will cost about $1,500.

Mr. H. Seaverns, formerly with the H. E. Swift Electric Company, has connected himself with the Eastern Electrical Supply and Construction Company as salesman.

Melville S. Brigham, constructing electrician, has on hand a contract to equip the houses of the members of the fire department in a suburban town with a system of tappers.

A crusade is being instituted against "dead" wires in Boston. It is estimated that there are over 5,000 miles of overhead wires in the city, of which 525 miles belong to the fire alarm system.

The C. & C. Motor Company have just installed a 20-horse power motor in the works of the Tremont Rubber Company at 65 Franklin street, this city. This motor will run nearly 200 sewing machines.

The men who were injured by the explosion of the boiler, at the factory of the Johnston Electric Train Signal Co., in Woburn, something like a week ago are doing nicely, and are expected to be out in a few days.

The telephone company is offering to take entire charge of the fire alarm systems in the suburban towns. The charges varies from $200 to $1,500 per annum, according to the number of boxes and miles of wire.

At an adjourned meeting of the Lowell Board of Aldermen, last Monday night, the Commercial Telegraph Company was granted locations in a number of streets throughout the city, the company to be responsible for all damage caused by the use of the wires.

The Western Union Telegraph Company will occupy part of the new Stock Exchange building on State street, which is now in course of erection. The building will be ready for occupancy February 10th, 1891, and is one of the largest and most beautiful structures in Boston.

C. J. Van Depoele has been granted a patent for a magnetic shield for electric motors, the combination, with an electric motor and a vehicle upon which said motor is mounted, of a sheet iron casing constituting a magnetic shield and permanetly interposed between the motor and the interior thereof, whereby the passage of magnetic lines from the motor to the interior of the vehicle is prevented.

Superintendent E. W. Rice, Jr., of the Thomson-Houston works has patented a method of regulation for the preventing injury to an electric motor upon starting from a state of rest, which consists in maintaining in series circuit with the armature of the motor a counter-potential generator until the speed of the armature becomes such as to generate of itself sufficient counter electro-motive force to render injury from the passage of an excessive current no longer liable, and then shunting or disconnecting from circuit the counter potential generator.

The New England Printing Telegraph Co. have completed the erection of their line from Donaldsonville, Conn., to this city. This line is about 100 miles long, and is one of the finest built lines in the country, the poles averaging forty-two to the mile. The cross arms used are of the best selected pine, and are fitted with locust pins placed twenty inches apart. The two No. 6 wire which forms the lines are tied to the insulators with No. 8 wire ties. The work has been done under the supervision of Mr. C. F. Hutchinson, the superintendent of the company, and reflects great credit upon him.

The Baltimore (Md.) City Council, here on a trip to inspect the electric street railway system, visited the factory of the Thomson-Houston Electric Company in Lynn the past week. Special cars were provided on the Revere Beach and Lynn Railroad and electric cars from West Lynn to the factory. The party was in charge of H. B. Prindle, of the Thomson-Houston Co. Besides the Baltimoreans, Supt. of Streets Jones and his assistant were present, as were Chief Electrician George W. Mansfield and H. L. Cargill of the Thomson-Houston Co. On the return to Boston a lunch was served at Young's Hotel. The party left for Baltimore on a special train over the southern division of the Boston and Maine Railroad. W. J. P.

NEW YORK NOTES.

Mr. Alexander Mac Gruthar, late superintendent of the Edison Phonograph Works, Orange, N. J., left last week for Detroit, where he will be interested in the manufacture of pearl buttons.

It is authoritatively announced that the North American Phonograph Company will hereafter give the option of purchasing phonographs and phonograph-graphophones. The practice heretofore has been to rent only.

Mr. James F. Kelly, general manager of the wire department of the Edison General Electric Company, has returned home after an extensive business trip throughout the West, including San Francisco and Portland, Oregon.

The annual meeting of the stockholders of the Edison General Electric Company will be held at the office of the company, Edison Building, 44 Broad street, at noon, Monday, January 19th, 1891. Trustees for the ensuing year will be elected. The meeting will also take action on the question of ratifying the action of the Board of Trustees in declaring a dividend on the stock paid in trust by the Farmers' Loan and Trust Company, and dissolving said Trust. The transfer books were closed on December 29, 1890, and will be reopened on February 3, 1891. R. J. G.

PHILADELPHIA NOTES.

The business of the de Kosenko & Hetherington Manufacturing Company having expanded to such preportions, they have been compelled to find more ample quarters, and they have just moved into the *Times* annex building on Sansom street.

Messrs. Patrick & Carter, the well-known manufacturers of electrical supplies, at 114 South Second street, will remove from their present quarters about January 1st, 1891, to the large buildings, No. 125 South Second street, and No. 131 Gothic street, both of which have been altered and fitted for the firm's occupancy. The largely increasing business of the firm has rendered more spacious quarters absolutely necessary.

Considered in the light of its relations to the great commercial interests of the world, no line of American railways is more comprehensive, and few so far-reaching in their vast ramifications as the Philadelphia and Reading Railway system. Its lines, direct or allied, reach every nook and corner of the great State of Pennsylvania, and take within their mighty scope the great cities of the country, and by direct connections reach one hundred and ninety-three summer resorts situated in the Eastern, Middle, and Southern States.

NEW PUBLICATIONS.

The Edison Manufacturing Co., of Orange, N. J., has just issued a new and enlarged catalogue of the Edison-Lalande battery. It is very complete in its description of the various uses to which this famous battery is applicable, and several fac-similies of letters from users are given speaking in flattering terms of the merits of the battery. Various diagrams of curves are also given, and each type of all is illustrated.

The Phonogram is the title of a new monthly magazine published by the Phonogram Publishing Company, World Building, New York. *The Phonogram* will be devoted to the service of sound and recording of speech. Mr. D. H. McRae is the manager, who, in his salutatory, announces that it is also a part of his company's plan "to keep pace with the progress of electricity in its application to the most useful ends." No. 1 of *The Phonogram* is quite interesting.

Mr. Wm. J. Hammer, well-known through his connection with successful electric displays, has just issued and is sending to his friends a very artistically gotten-up pamphlet desciptive of and illustrating the various electrical exhibits over which Mr. Hammer had supervision. In his pamphlet also are given fac-similes of letters from Mr. T. A. Edison, Prof. Elihu Thompson, Edward H. Johnson, and others, all testifying in terms of highest praise to Mr. Hammer's ability as a consulting and supervising electrical engineer. Mr. Hammer's office is in Temple Court, 5 Beekman street, New York City.

PURE COPPER.—In electrical work it is always more economical to use the purest copper obtainable.

THE ELECTRIC AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS ISSUED DECEMBER 16 AND 23, 1890.

442,617. Electric-Arc Lamp. John E. Giles, Hazleton, Pa. Filed Aug. 21, 1889.

442,623. Electric Trolley Switch and Trip. Richard C. Hopson, Saginaw, Mich. Filed May 5, 1890.

442,649. Electric Heater. Charles H. Talmage, Kansas City, Mo. Filed Apr. 11, 1890.

442,654. Portable Electric Motor and Cloth-Cutting Machine. Elbert D. Weyburn, Chicago, Ill., assignor to the Weyburn Special Machine Company, same place. Filed Apr. 5, 1890.

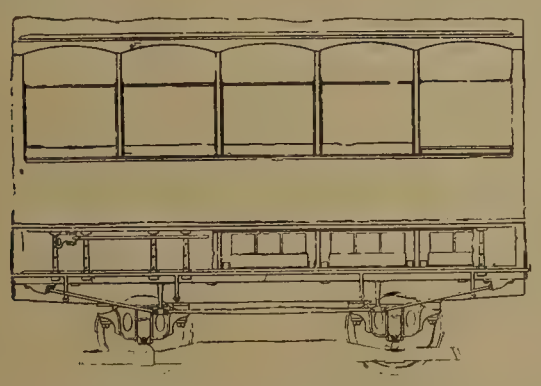
442,666. Bracket for Combined Electric and Gas Lighting. John Gunn, New York, N. Y. Filed Mar. 12, 1890.

442,668. Regulation of Electric Motors. Edwin W. Rice, Jr., Lynn, Mass. Filed Oct. 20, 1890,

442,705. Electric Meter. Alexander W. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, same place. Filed July 22, 1890.

442,734. System of Telegraphic and Telephonic Exchange. John R. Smith, Neosho, Mo., and Wallace Childs, Fort Smith, Ark. Filed Sept. 27, 1889.

442,744. Storage-Battery Electric Car. John Stephenson, New York, N. Y. Filed Aug. 2, 1890.



NO. 442,744.—STORAGE BATTERY ELECTRIC CAR.

442,746. Pendant Cleat. Arthur P. Bush, Boston, Mass., assignor to Paine & Francis, same place. Filed June 4, 1890.

442,799. Train-Telephone. Robert S. Carr, Hamilton, Ohio, assignor of two-thirds to W. B. Carr and George P. Stevenson, both of same place. Filed Feb. 17, 1890.

442,816. Safety Device for Overhead Conductors. Robert A. Morgan, Jr., Boston, Mass. Filed May 14, 1890.

442 843. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed July 1, 1890.

442,856. Means for Reducing Inductive Disturbances in Telephone Circuits. John J. Carty, New York, N. Y. Filed Sept. 18, 1890.

442,868. Underground Conduit for Electric Conductors. Josiah S. Du Bois, Camden, N. J. Filed Mar. 15, 1886.

442,870. Dynamo-Electric Machine or Motor. Nathan H. Edgerton, Philadelphia, Pa. Filed Oct 22, 1890.

442,881. Means for the Transmission of Meteorological Indications. Henry J. Haight, New York, N. Y. Filed Nov. 29, 1889.

442,882. Multiple-Circuit Closer. Henry J. Haight. New York, N, Y. Filed Mar. 14, 1890.

442,883. Combined Electric Indicating and Telephone System. Henry J. Haight, New York, N. Y. Filed May 9, 1890.

442,932. Electric Cooking Apparatus. Ernest Abshagen, Chicago, Ill., assignor, by direct and mesne assignments, of five-eighths to George M. Clark, Henry M. Hubbard and William H. Hubbard, all of same place. Filed Aug. 4, 1890.

442,933. Electric Steam and Hot Water Generator. Ernest Abshagen, Chicago, Ill., assignor, by direct and mesne assignments, of five-eighths to Geo. M. Clark, Henry M. Hubbard, and William H. Hubbard, all of same place. Filed Aug. 4, 1890.

442,954. Method of Welding Metals Electrically. Charles L. Coffin, Detroit, Mich. Filed June 9, 1890.

442,969. Portable Electric Lamp. Desmond G. Fitzgerald and Arthur H. Hough, London, England, assignors to the Mining and General Electric Lamp Company, Limited, same place. Filed Sept. 9, 1890. Patented in England.

442,996. Electric Switch. John O'Brien, New York, N. Y. Filed Aug. 28, 1890.

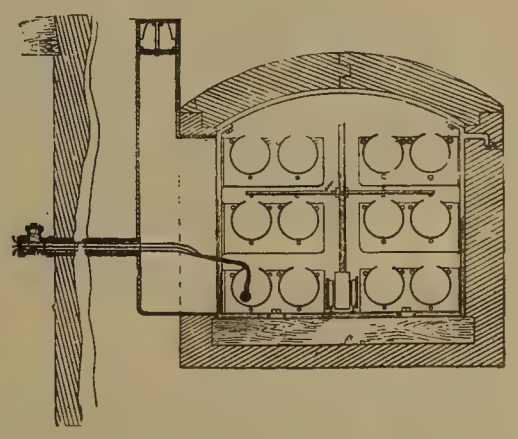
443,004. Trolley Line Switch. William M. Ramsey, Allegheny, Pa. Filed Aug. 7, 1890.

443,005. Trolley Line Insulator. William M. Ramsey, Allegheny, Pa. Filed Aug. 7, 1890.

443,042. Magnetic Ore Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.

443,043. Magnetic Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.

443,044. Magnetic Ore Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.



NO. 442,868.—UNDERGROUND CONDUITS FOR ELECTRIC CONDUCTORS.

443,048. Method of Protecting Buildings from Lightning. Nathaniel D. C. Hodges, Plainfield, N. J. Filed Sept. 28, 1889.

443,068. Electric Cut-Out. David J. Cartwright, Boston, and John S. Potter, Newton, Mass.; said Cartwright assignor to said Potter. Filed July 14, 1890.

443,074. Electric Signaling Device for Moving Vehicles. Otis J. Depp and Schuyler J. Munn, St. Louis, Mo., assignors of one-fourth to Peter M. King, same place. Filed Aug. 4, 1890.

443,081. Trolley Switch for Electric Railways. John Jones, New York, N. Y., assignor of two-thirds to C. P. Stevens, Denver, Colo. Filed Sept. 25, 1890.

443,084. Electric Railway. Edward M. Bentley, New York, N. Y. Filed Apr. 9, 1887.

443,097. Electric Street-Light. George M. Kim, Allegheny, Pa. Filed May 19, 1890.

443,111. Printing-Telegraph. Frank B. Rae, Chicago, Ill. Filed Aug. 9, 1888. Renewed Apr. 15, 1890.

443,134. Printing-Telegraph. Samuel V. B. Essick, Brooklyn, N. Y. Filed Nov. 7, 1888.

443,135. Printing-Telegraph. Samuel V. Essick, Brooklyn, N. Y. Filed Mar. 10, 1890.

443,136. Printing-Telegraph. Samuel V. Essick, Brooklyn, N. Y. Filed July 5, 1890.

443,145. Telephone Circuit and Apparatus. James L. McQuarrie, Boston, Mass., assignor to the New England Telephone and Telegraph Company, same place. Filed June 27, 1890.

443,157. Electrical Signaling Apparatus. Ambrose B. Wyckoff, Washington, D. C., assignor of three-fifths to Joseph Warren Coulston, Philadelphia, Pa. Filed May 5, 1890.

443,167. Electrically-Operated Railway-Switch. Samuel L. Powell, Lewiston, assignor of one-half to Frederick D. Morrison, Baltimore, Md. Filed Feb. 21, 1890.

443,174. Insulator. William L. R. Emmet, East Rockaway, N. Y. Filed Sept. 18, 1890.

443,181. System of Electrical Distribution. Henry A. Rowland and Louis Duncan, Balfimore, Md. Filed Sept. 10, 1888.

443,187. Electric Insulator. Forée Bain, Chicago, Ill. Filed Mar. 25, 1890.

443,195. Cut-Out. George W. Mingle, Philadelphia, Pa. Filed Aug. 1, 1890.

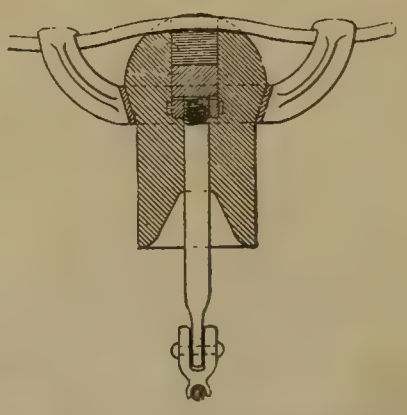
443,219. Galvanic Battery. Horatio J. Brewer, New York, N. Y. Filed June 16, 1890.

443,224. Electric Welding Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 6, 1890.

443,227. Mounting for Electric Motors. Andrew L. Riker, New York, N. Y. Filed Apr. 23, 1889.

443,282. Electric Safety Device for Elevators. Herbert E. Holmes, West Springfield, and Charles F. Grosvenor, Ludlow, Mass. Filed Mar. 26, 1890.

443,283. Electric Safety Device for Elevators. Herbert E. Holmes, West Springfield, and Charles F. Grosvenor, Ludlow, Mass. Filed Apr. 14, 1890.



NO. 443,005.—TROLLEY LINE INSULATOR.

443,291. Electro-Mechanical Central System for Regulating Clocks. Carl A. Mayrhofer, Berlin, Germany, assignor, by mesne assignments, to the Electro-Pneumatic Time Company, New York, N. Y. Filed Dec. 29, 1888. Patented in Switzerland.

443,360. Recording Pressure-Gage. Jarvis R. Edson, New York, N. Y. Filed June 12, 1890.

443,381. Telegraph-Transmitter, Samuel W. Smith, New York, N. Y. Filed June 2, 1890.

443,407. Dynamo-Electric Machine. Chas. P. Scheuritzel and John L. Hess, Brooklyn, N. Y. Filed February 5, 1890.

443,435. Watchman's Time-Recorder. Isham D. Fuller, Chicago, Ill., assignor, by mesne assignments to the Fuller Watchman's Electrical Detector Company, same place. Filed July 2, 1890.

443,451. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed October 4, 1886. Divided and this application filed September 5, 1890.

443,452. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed September 23, 1886. Divided and application filed June 1, 1887. Again divided and this application filed September 5, 1890.

443,454. Electrode for Secondary Batteries. Isidor Kitsee, Cincinnati, Ohio, assignor to Mayer Sulzberger, trustee, Philadelphia, Pa. Filed February 11, 1890.

TRADE NOTES.

The Pope Manufacturing Company of Boston, New York and Chicago has issued a convenient calendar, called the "Columbia Desk Calendar," for 1891. There is a leaf for every day in the year and ample space on each for memoranda. There is also printed on each leaf a little paragraph of useful information. The calendar will be found very useful to business men.

Queen & Co., of Philadelphia, have recently taken an order for a "magnetic vane" ammeter, capacity 1,350 amperes. The instrument will have a dial some 12 inches in diameter, encased in a heavy japanned iron circular box. This is the largest ammeter that the firm has undertaken, and will, no doubt, be a handsome addition to the switchboard of the Central Passenger R. R. Co, at Louisville, Ky. Queen & Co. are also making "magnetic vane" ammeters with capacities of 300, 400, and 500 amperes for such companies as the Brush and Edison. These instruments have dials about 8" across and are mounted in iron or brass cases as ordered. They are used by the above companies on their finest switchboards, where it is desired to have meters in harmony with the other work. On the magnificent switchboard of the steamer "Plymouth" may be seen two of Queen's "magnetic vane" ammeters, capacity 400 amperes each. These instruments have been advertised but little as yet, but the demand is large and increasing, as the makers of dynamos are beginning to realize that in order to show up their apparatus in the most advantageous manner it is necessary to send out with each installation, first-class ammeters and voltmeters. Queen & Co. also report a brisk demand for Ayrton & Perry ammeters and voltmeters, which are largely used as portable instruments.

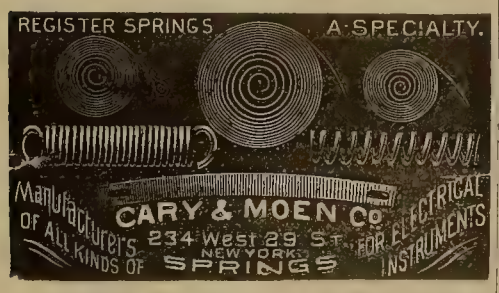
FOR SALE.—Eight Second-hand C. & C. Motors; good as new; 9½ amperes, ½ horse power, 13 volts; price, $18 each. Address,
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IF YOU HAVE A BATTERY,
Gravity or Leclanche, use the DELANY BATTERY STRIP. It prevents salts from creeping, keeps batteries and shelves clean, prevents local action and prolongs life of battery. *Warranted.* Per dozen, Gravity, 60 cents; Leclanche, 50 cents.
PATRICK B. DELANY,
SOUTH ORANGE, N. J.

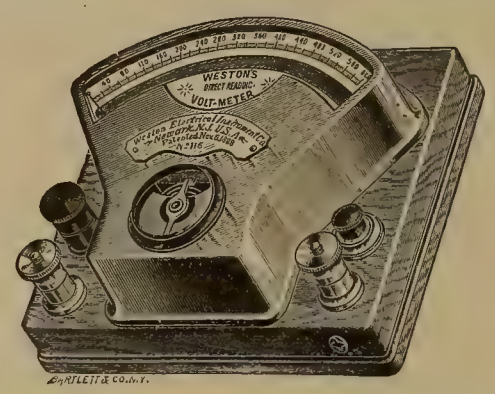
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Voltmeters and Ammeters.



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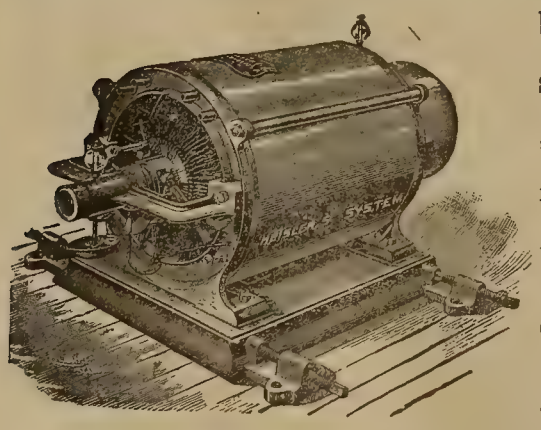


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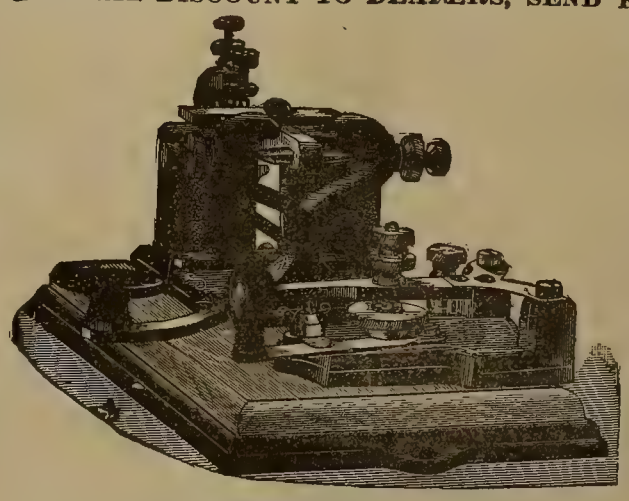


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Plant may be located where Power can be secured Cheapest, even if Miles Distant from the Lighting.

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Key,	1.00
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The above Outfit consists of a beautiful Sounder wound to 20 ohms, and one of my unrivaled Nickel Plated, Legless, Steel Lever Keys; One Cell 5x7 Battery (or 6x8 Battery, 10c. extra); 15 ft. Insulated Office Wire, 1 lb. Vitriol, 1 Instruction Book, all safely packed and will be shipped on receipt of price, or sent C. O. D., subject to inspection, if you send me $1.00 with order. State whether you wish Key and Sounder on same Base or separate. Write your address plain and full, also state by what Express Co. wish goods shipped. Address,
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Give a beautiful, steady, noiseless light, using only from 8 to 9 amperes, and can readily be adjusted for any direct current circuit of 100 to 125 volts. Additional resistance unnecessary. ***Safe, Simple, Satisfactory.***

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Is a great success for stage and scenic uses, yielding vastly superior effects to calcium. Can be installed wherever constant, direct currents exist. Much cheaper than the old fashioned methods Outfits furnished at shortest notice. Prices and testimonials on application. Write at once for prices and further information, mentioning voltage of station or plant, to

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BOSTON, MASS.

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American Circular Loom Co., Insulated Wires and Cables, 620 Atlantic Avenue.
American Conduit and Construction Co., Clement Conduits, Jamaica Plain.
American Electric Register Company, Electric Registers for Street Cars, 620 Atlantic Avenue.
American Fire Alarm Co., Thermostats and Fire Alarms, 71 Kilby Street.
The Holtzer-Cabot Electric Co., General Electrical Supplies, 111 Arch Street.
Wilson, R D. and Co., 113 Devonshire, W. Electric Securities.
Zeigler Bros., Annunciators, etc., 73 Pearl Street.
Duralite Company, 85 Water Street.

BROOKLYN, N. Y.

Elektron Manufacturing Co., 79-81 Washington Street.
Mason, J. H., Primary Batteries, 114-120 Park Avenue

CAMDEN, N. J.

Applegates Electric Floor Mat Manufacturing Co., Electric Mats, 37 Market Street.

CHICAGO, ILL.

Central Electric Co, General Electrical Supplies, 118 Franklin Street.
Bain, Foree, Electrical Expert, 84 Market Street.
Pumpelly Storage Battery Co., 229 La Salle Street.
Electrical Supply Co., Annunciators, etc., 171 Randolph Street.
Bleckert & Nelson, Electric Light and Combination Fixtures, 83-87 Fifth Avenue.
Electric Merchandise Co., Electric Railway Supplies, 11 Adams Street.
Adams, Waldo P., Electrical Constructor, 144 Adams Street.

CLEVELAND, O.

Fletcher & Fletcher Electric Co., Annunciators, 13 South Water Street.
Forest City Electric Works; Switches and Cut Outs.
Lyman, A. B., Electrical Instruments, 34-36 South Water Street.

CONCORD, N. H.

Page Belting Co., Link Belts.

DETROIT, MICH.

Detroit Electrical Works, Woodward Avenue and Railroad Crossing.
Detroit Motor Co., Motors, 212 Griswold Street.
Fisher Electric Co, Dynamos and General Supplies, 187 Larned Street.
Brownlee & Co., Poles,
Commercial Electric Co., 55 and 57 Gratiot Avenue.
Lockwood Instrument Co., Electrical Measuring Instruments, 61 Buhl Block.

FITCHBURG, MASS.

Colburn, I. W., & Co., Dynamos.

HARTFORD, CONN.

Ahearn, James, Electric Light Fixtures and Supplies, 280 Asylum Street.
The American Writing Machine Co., Typewriters.

MINNEAPOLIS, MINN.

Lennon, J. M., Electrical Expert, 22 Loan and Trust Building.

MONTREAL, QUE.

Ness, T. W., Electrical Supplies, 644 Craig Street.

NEW YORK CITY.

Alexander, Barney & Chapin, General Electrical Supplies, 20 Cortland Street.
Aluminum Brass and Bronze Co., 53 Chambers Street.
Anglo-American Electric Light Manufacturing Co, "Times" Building, Park Row.
Ansonia Brass and Copper Co, 19 Cliff Street.
A. B. C. Motor Co., 44 Gold Street.
Bergmann Electric and Gas Fixture Co., 527-537 West 34th Street.
Bishop Gutta-Percha Co., Wires and Cables, 420 426 E. 25th Street.
Binney, H., Patents and Litigation, 245 Broadway.
Bogart, A. L., Electrical Gas Lighting Apparatus, 22 Union Square.
Bunnell, J. H. & Co., General Electrical Supplies, 76 Cortlandt Street.
C. & C. Electric Motor Co., Electric Motors' 402 and 404 Greenwich Street.
Clark Electric Company, Arc Dynamo, 192 Broadway.
Crocker-Wheeler Motor Co., 14th and Washington Sts.
Charles A. Schieren & Co., Leather Belting, 45-51 Ferry Street.
Cary & Moen Co, Springs, 234 West 29th Street
Crosby Electric Co., Batteries, 89 South Fifth Avenue.
D. Van Nostrand Co., Electrical Books, 23 Murray St.
Desant Electric Co., Electric Signals, 45 Broadway.
Edison General Electric Co., 44 Broad Street.
Edison Manufacturing Co., Batteries 19 Dey Street.
The Electric Construction and Supply Co., 16 Cortland Street.
Empire City Electric Co., General Electrical Supplies, 17 Dey Street.
E. S. Greeley & Co., Electrical Supplies, 5 and 7 Dey Street.
Freeman, Walter K., Transformer System, 150 Nassau Street.
Hall Signal Co., Railway Automatic Signals, 50 Broadway.
Interior Conduit and Insulation Co., Electrical Conduits, 16 and 18 Broad Street.
John Stephenson Co., Tram Car Builders, 47 East 27th Street.
Kintner, Charles J., Patent Expert, 45 Broadway.
Lynch, Eugene T., Jr., Electrical Engineer, 120 Broadway.
Law Telephone Co, Batteries, 85 John Street.
Leclanche Battery Co, Batteries, 149 West 18th Street.
National Electrical Manufacturing Co, Electrical Supplies, 14 and 16 Vesey Street.
New York Insulated Wire Co., wires of all descriptions, 649-651 Broadway.
Okonite Co., Insulated Wires and Cables, 13 Park Row.
Prescott, George B., Jr., Wires, 16 Dey Street.
Paillard Non-Magnetic Watches, 192 Broadway
River and Rail Electric Light Co., Storage Batteries, 45 Broadway.
Reese, S. W., & Co., Stencils, Stamps, etc, 182 Fulton Street.
Rogers Manifold and Carbon Paper Co., Typewriter Supplies, etc., 75 Maiden Lane.
Sabine, J. B., Patent Attorney, 181 Broadway
Sawyer-Man Electric Co., 510-534 West 23d Street.
Shaver Corporation, Molecular Telephones, 207 Broadway.
The S. T. Smith Co., Typewriter Supplies, 14 Park Place.
Wyckoff, Seamans and Benedict, Typewriters, 327 Broadway.
W. H. Gordon & Co, Wires, Electric Light and Power Supplies, 115 Broadway.

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Queen, J. W & Co, 924 Chestnut Street
Partrick & Carter, Gen'l Electrical Supplies, 114 S. 2d Street.

PITTSBURGH, PA.

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PIQUA, O.

Cincinnati Corrugating Co., Metallic Lath.

PROVIDENCE, R. I.

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ST. PAUL, MINN.

Acme Electric Co., Manufacturers Dynamos and Motors, Gilfillan Block.
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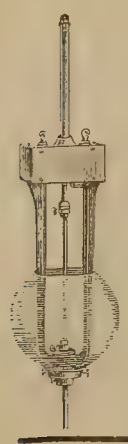
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Yours truly,

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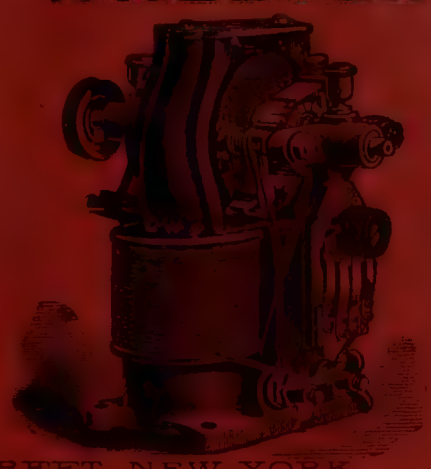
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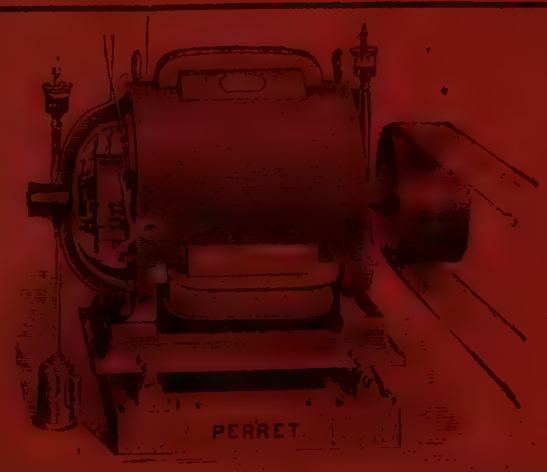


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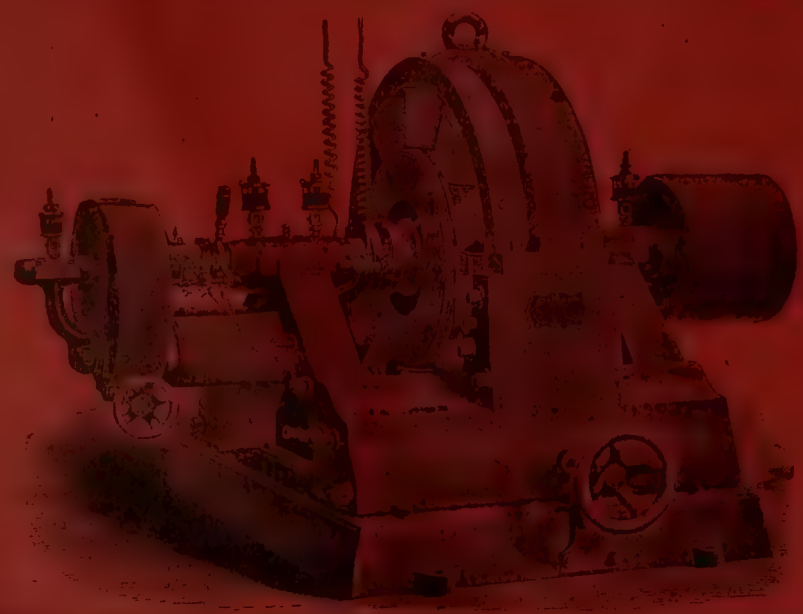
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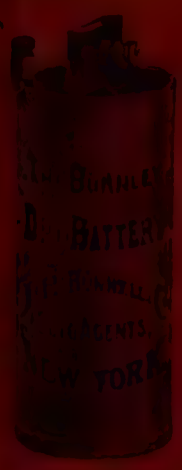
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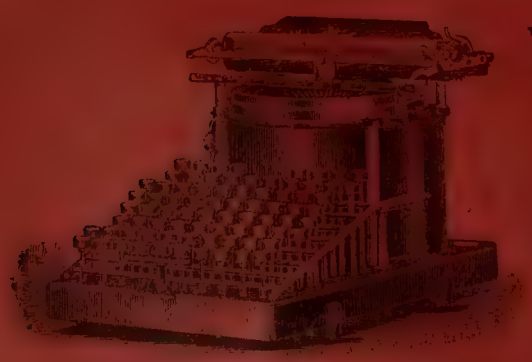
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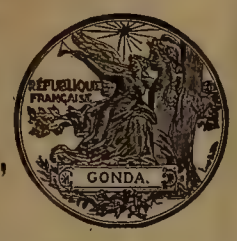
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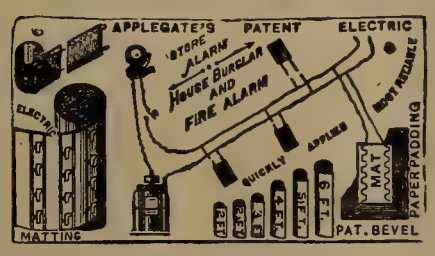
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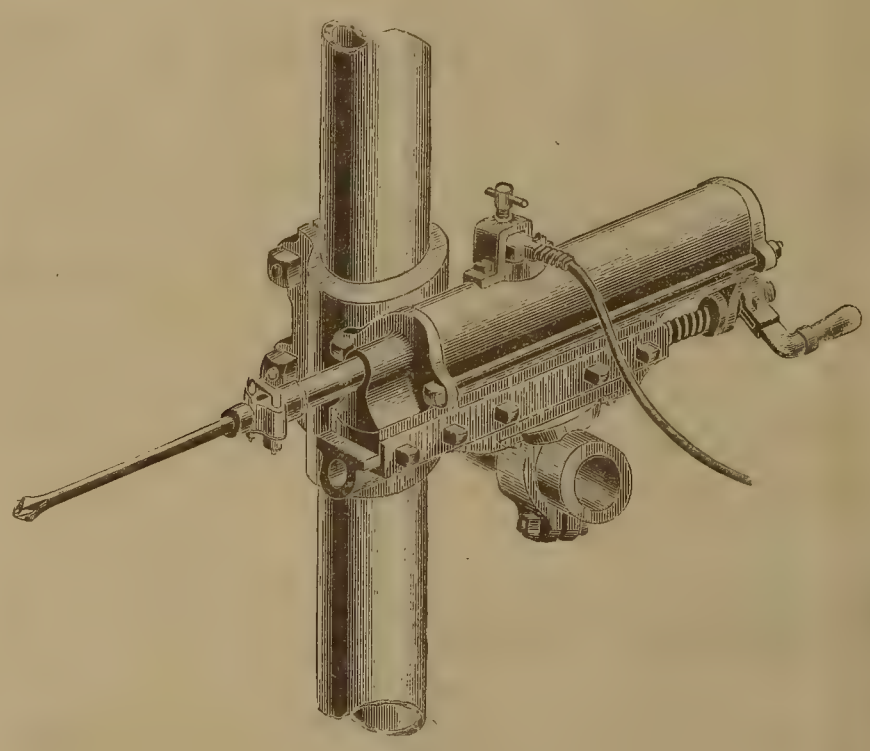
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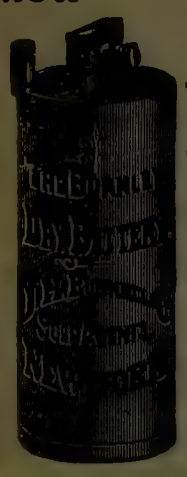
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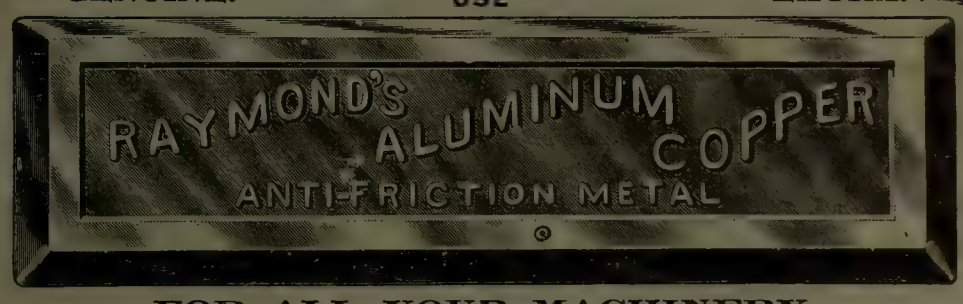


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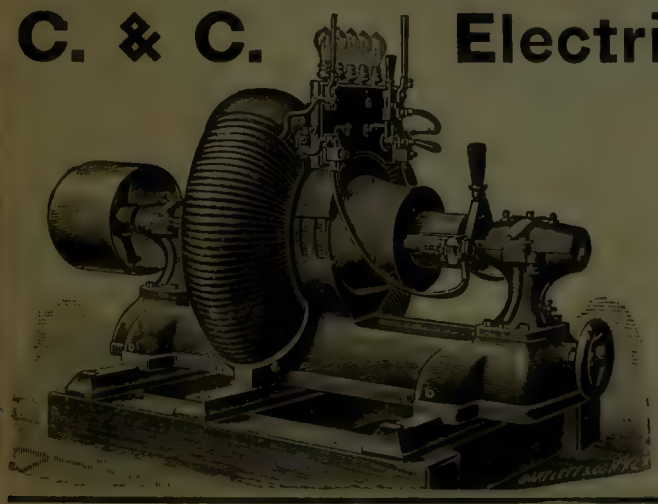
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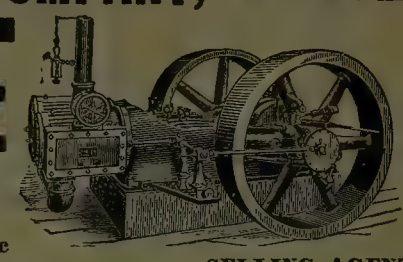
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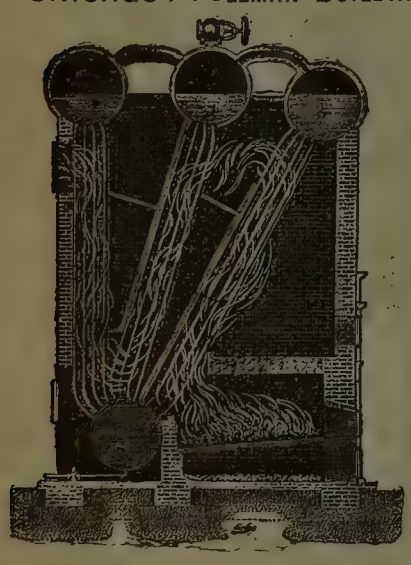
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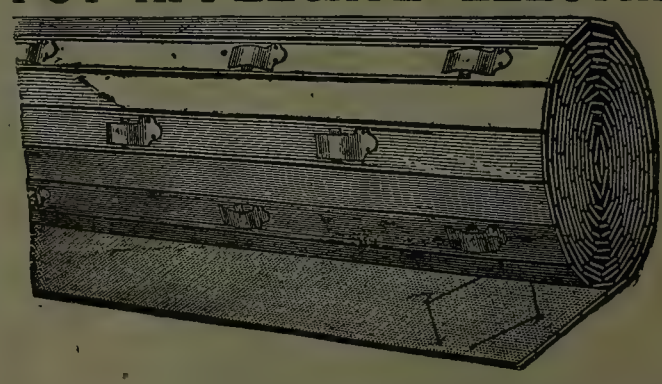
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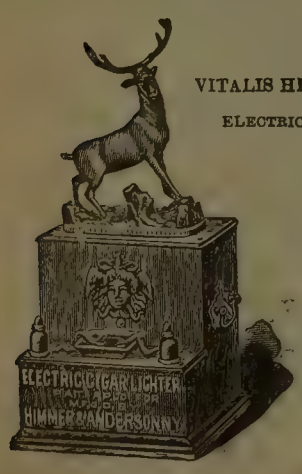
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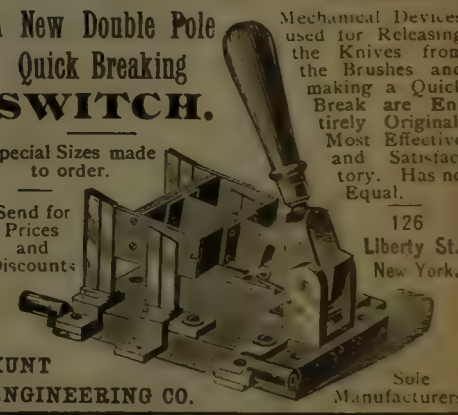
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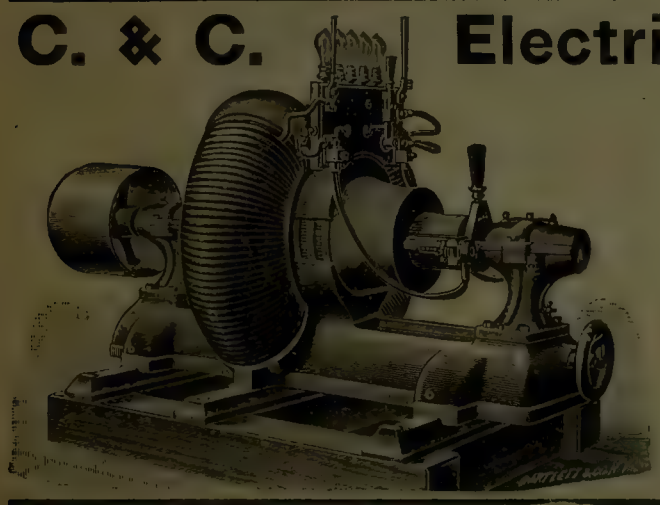
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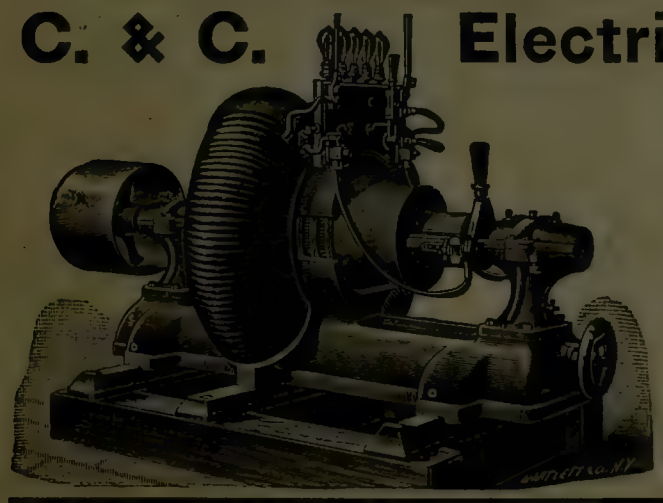
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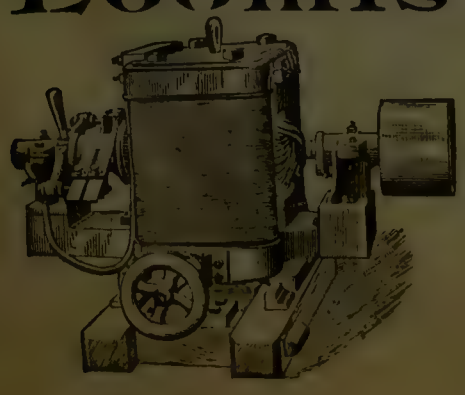
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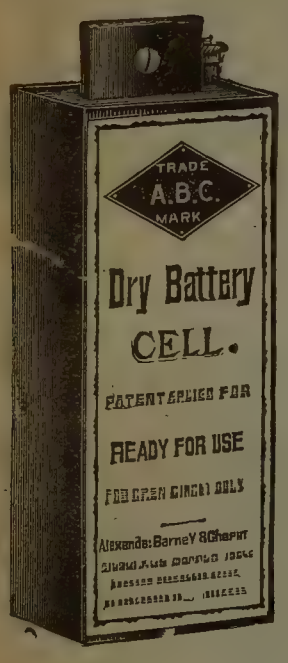
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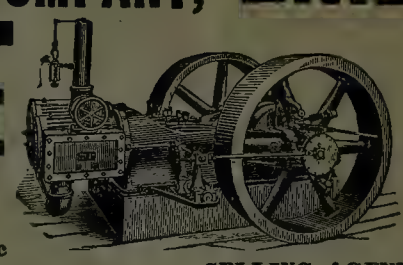
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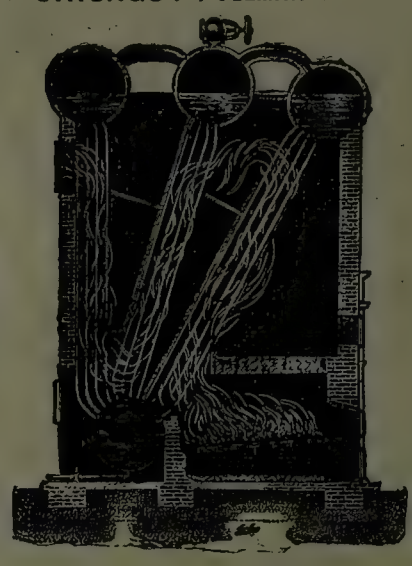
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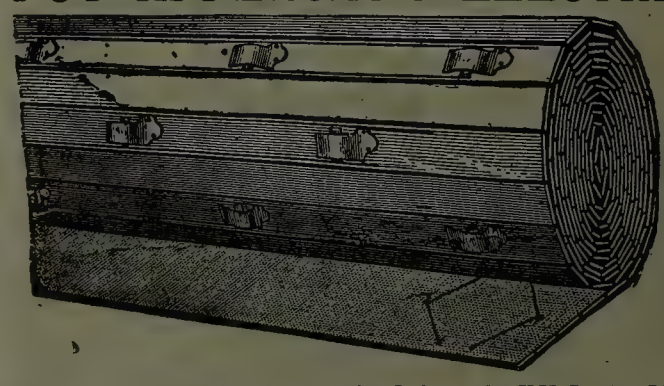
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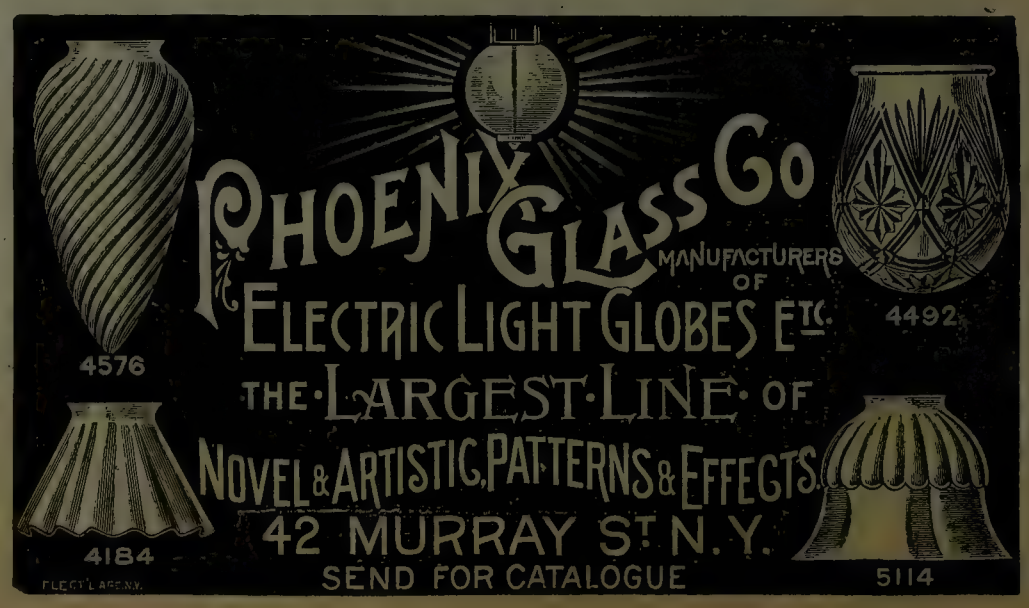
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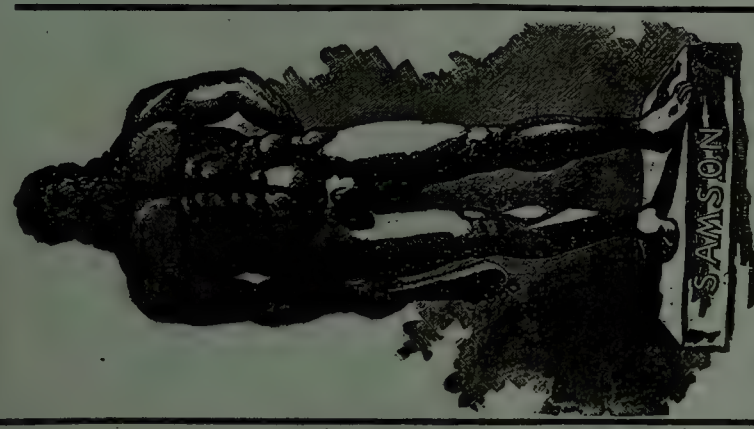


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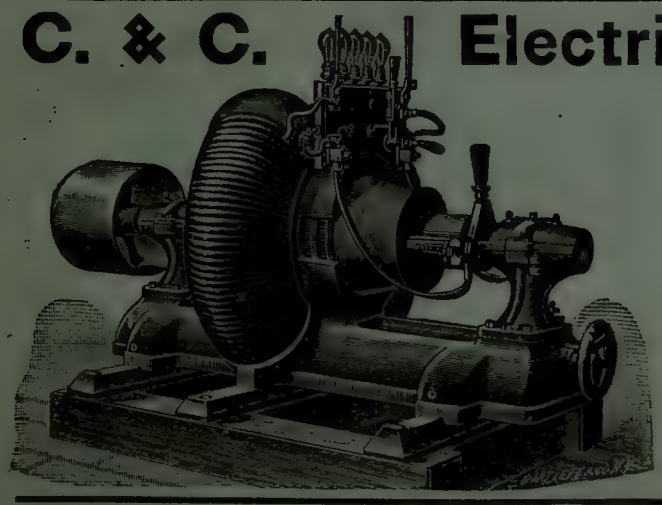
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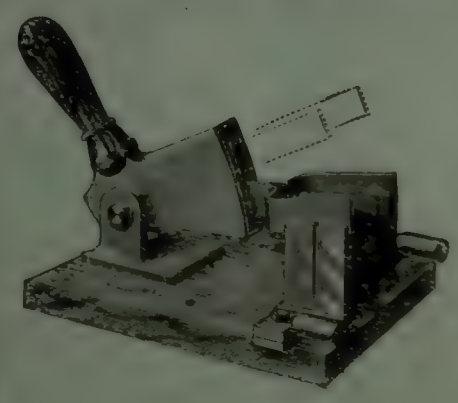
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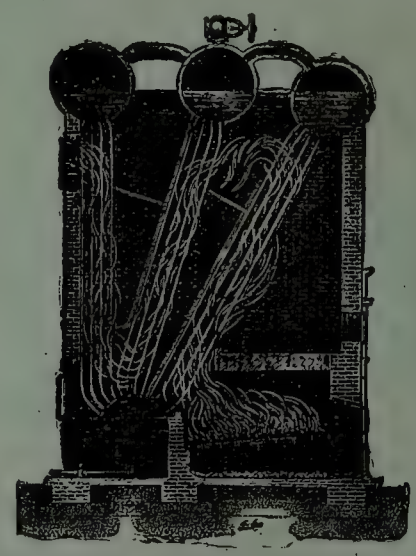
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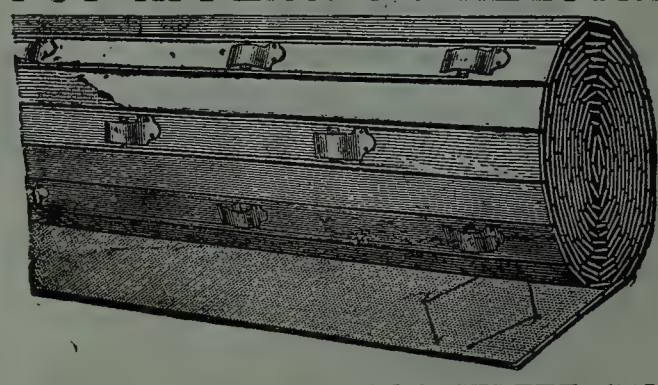


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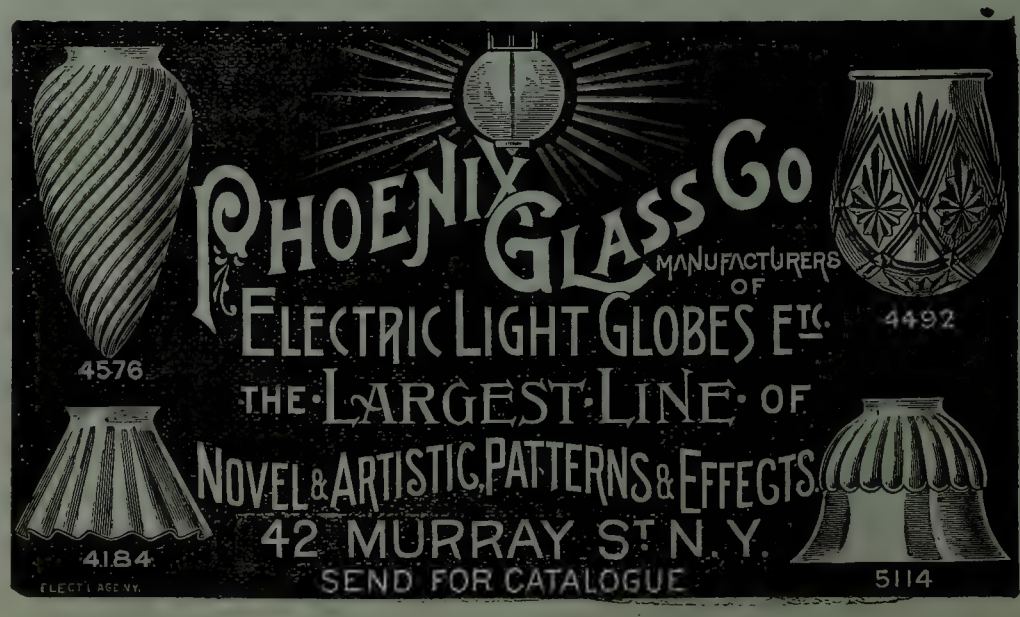
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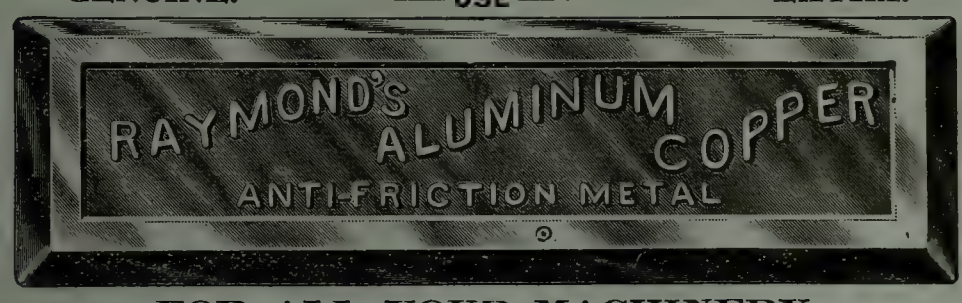


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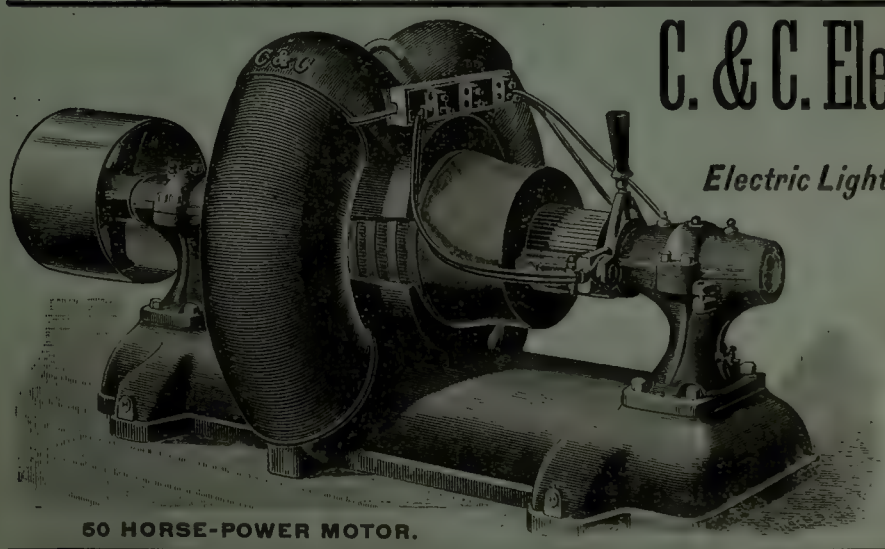
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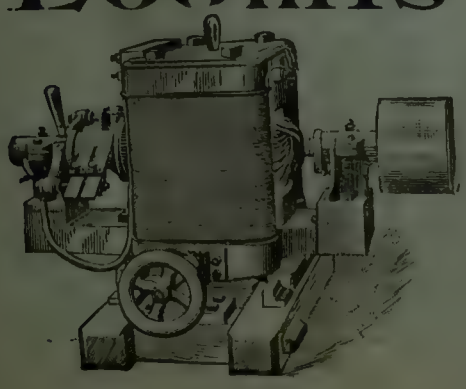
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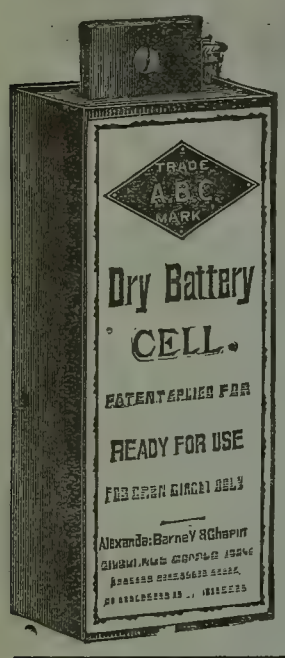
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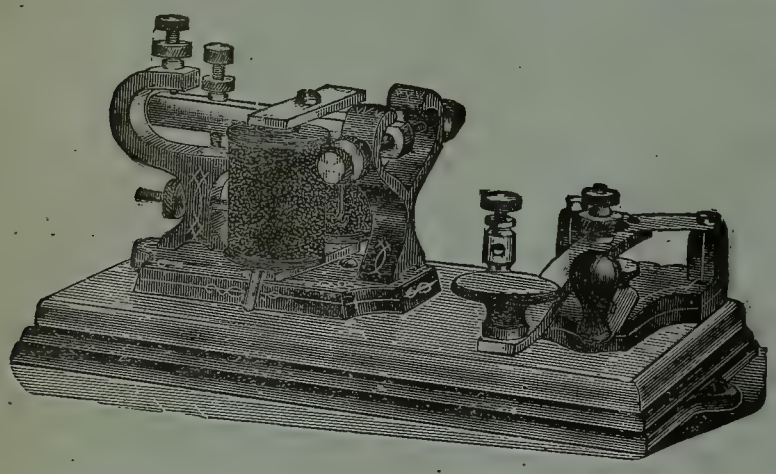
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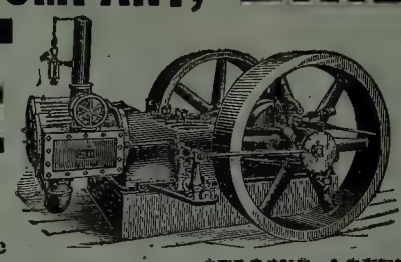
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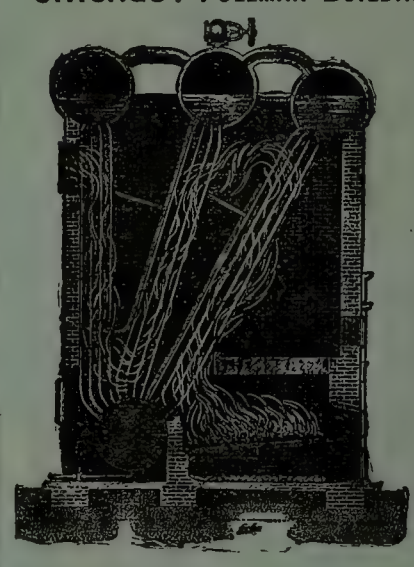
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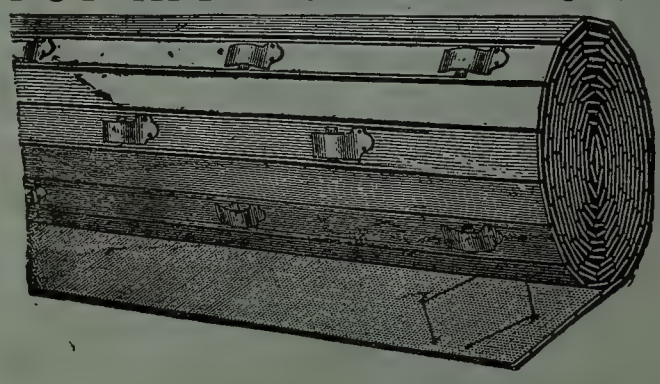
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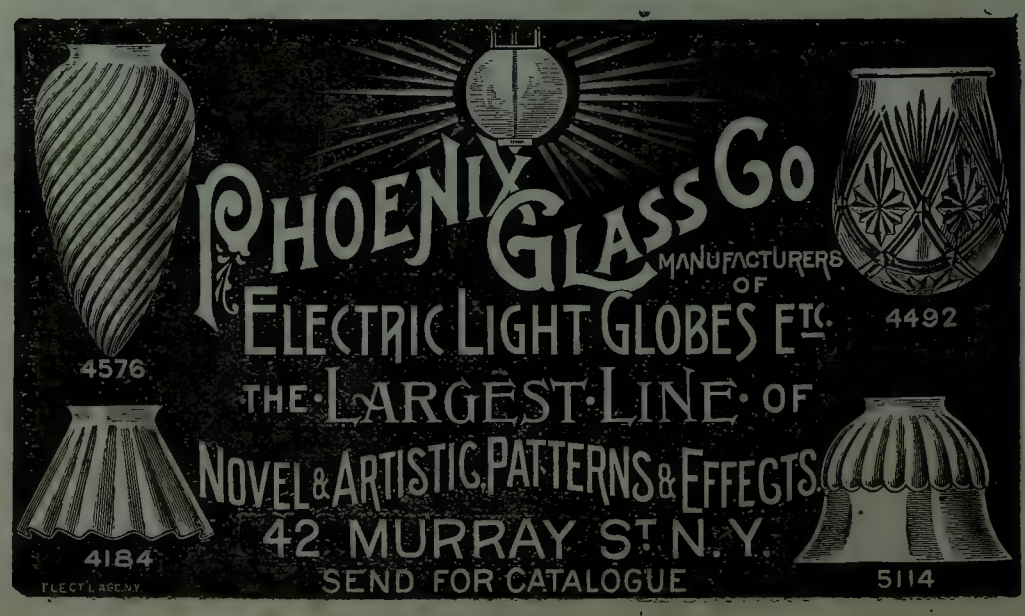


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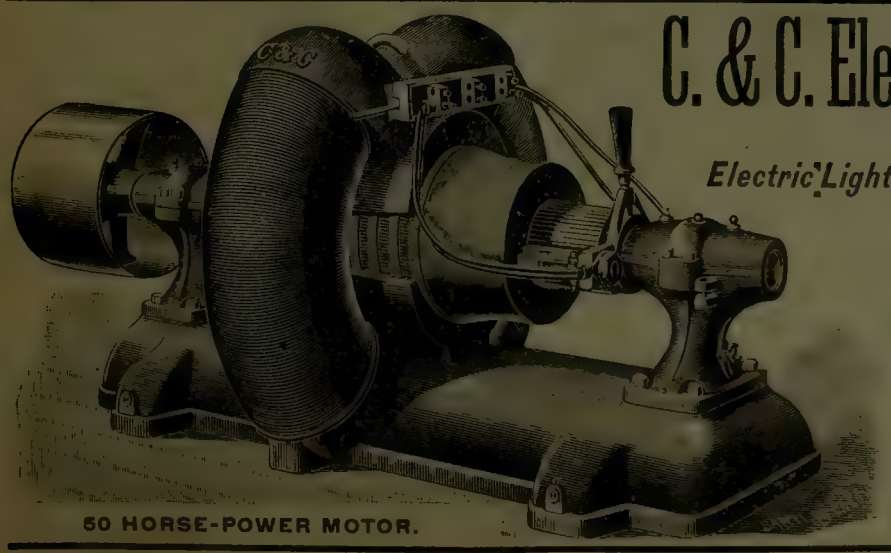
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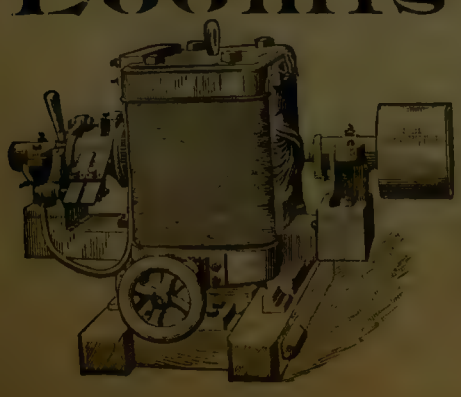
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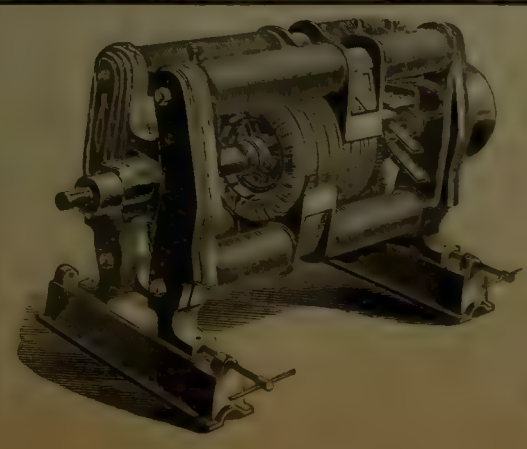
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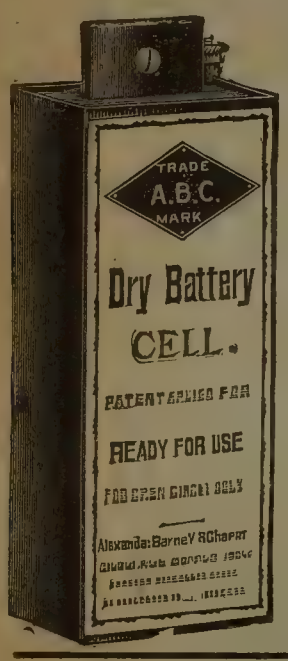
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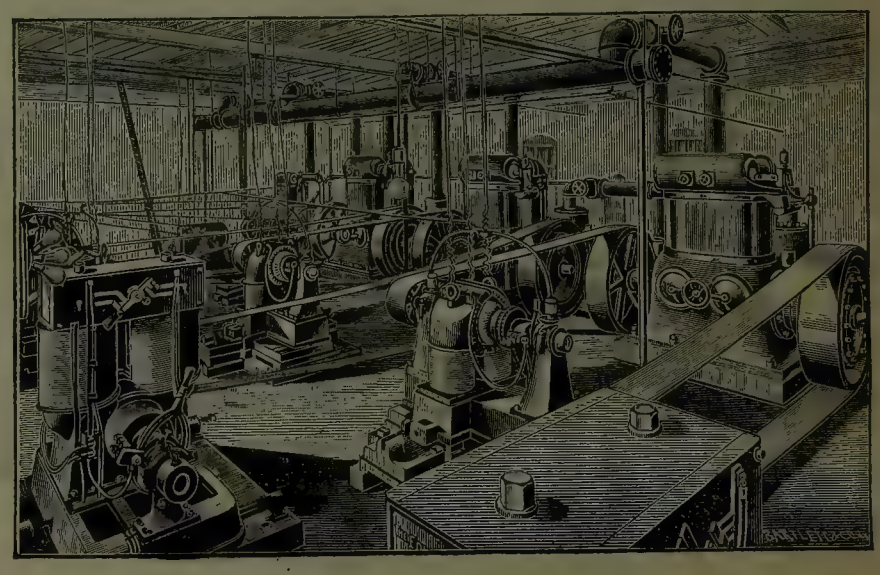
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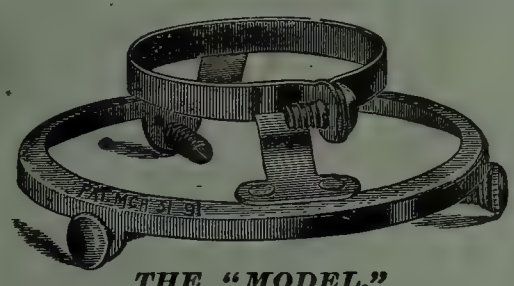
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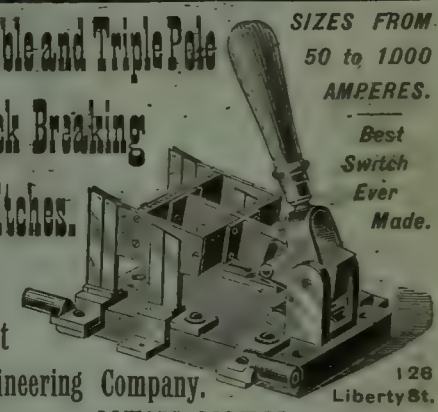
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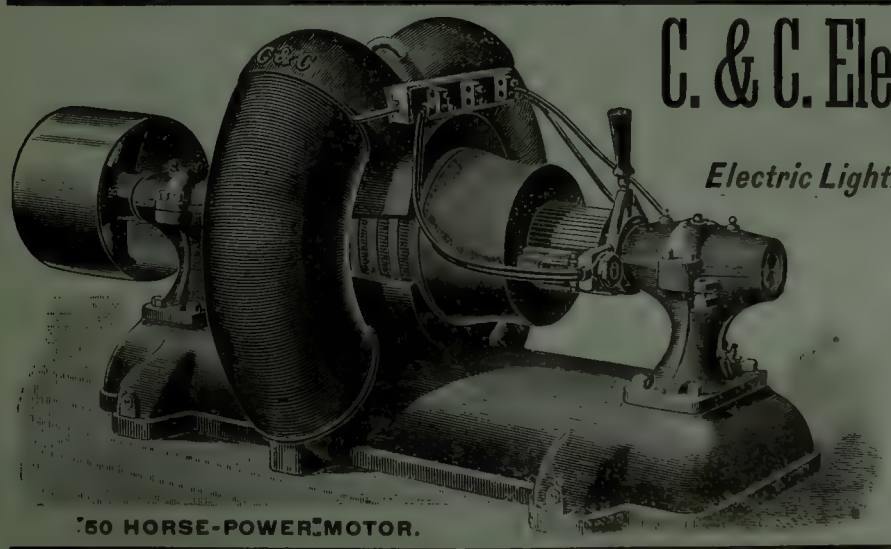
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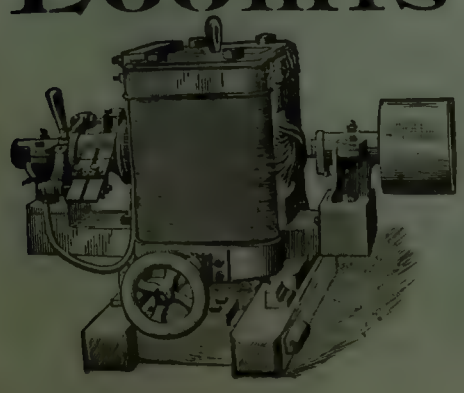
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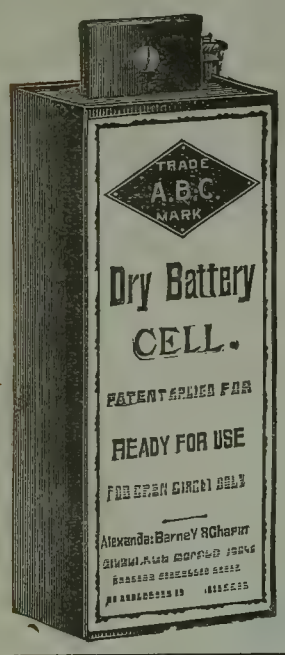
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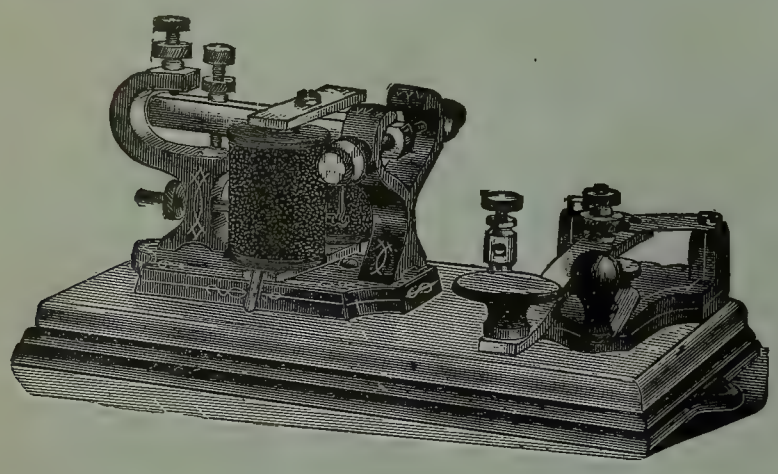
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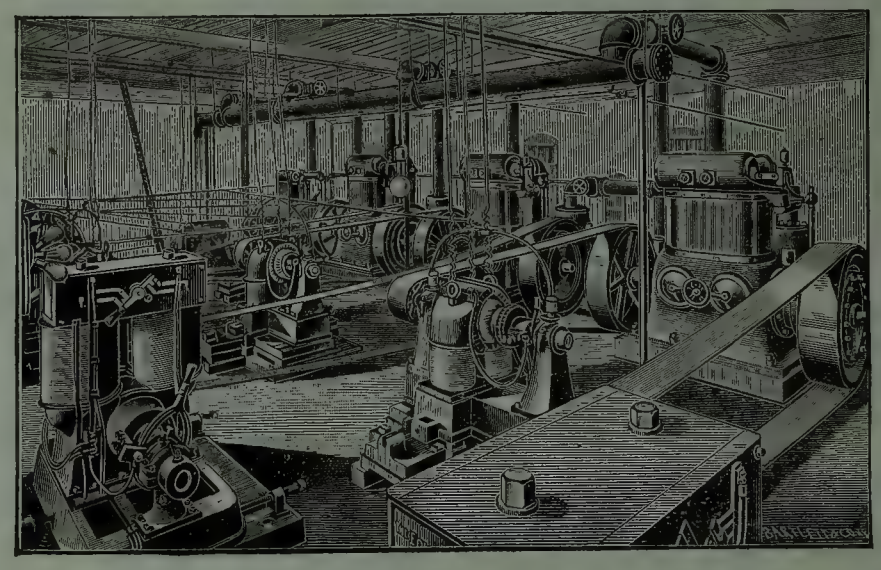


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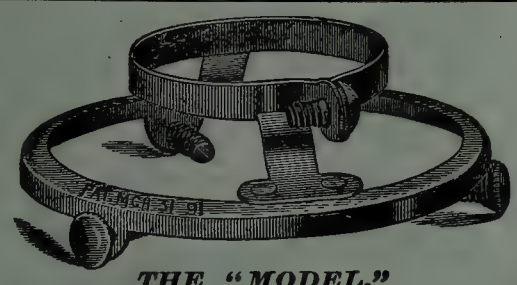
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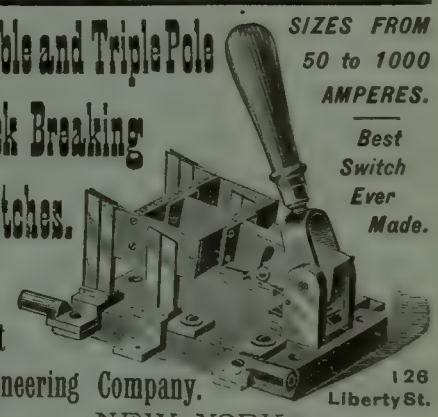
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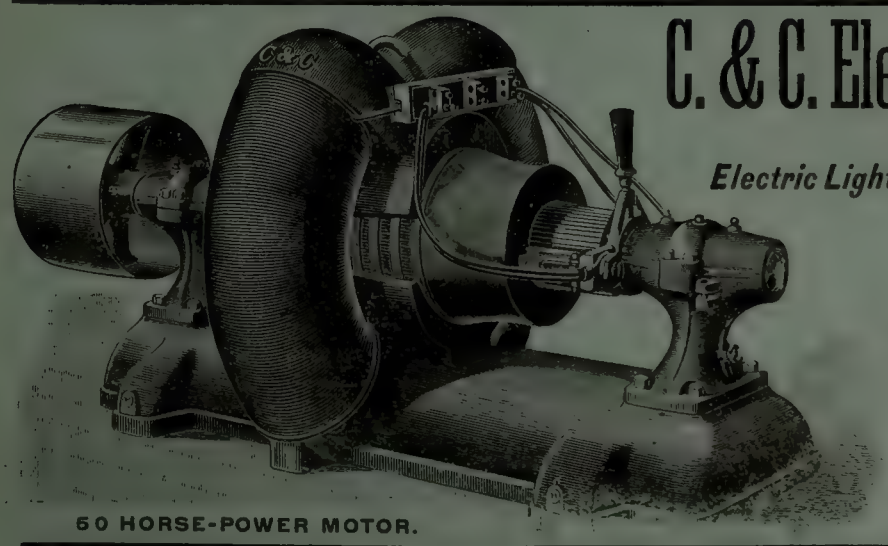
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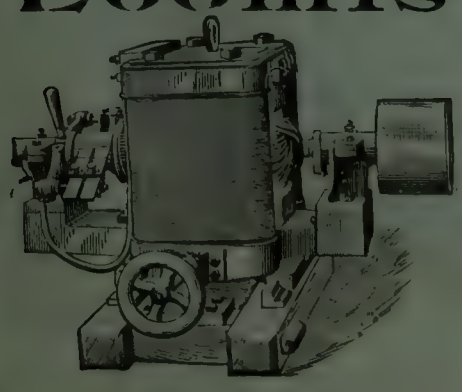
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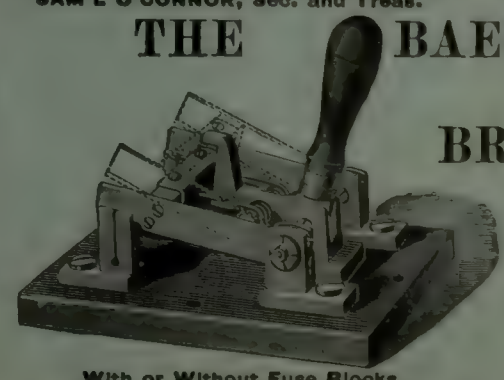
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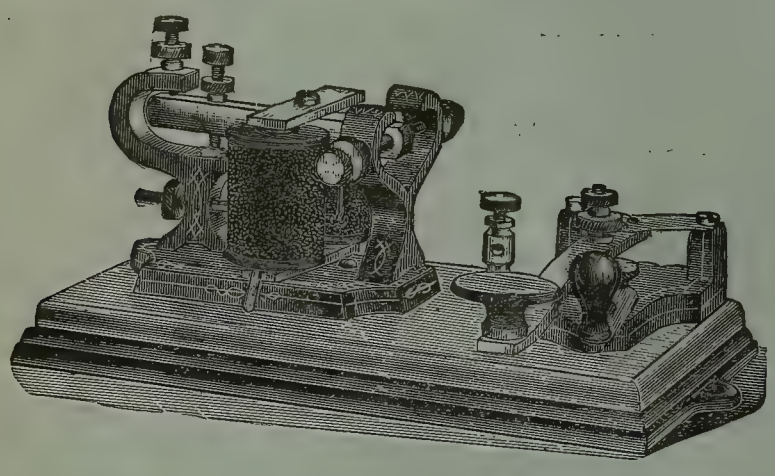
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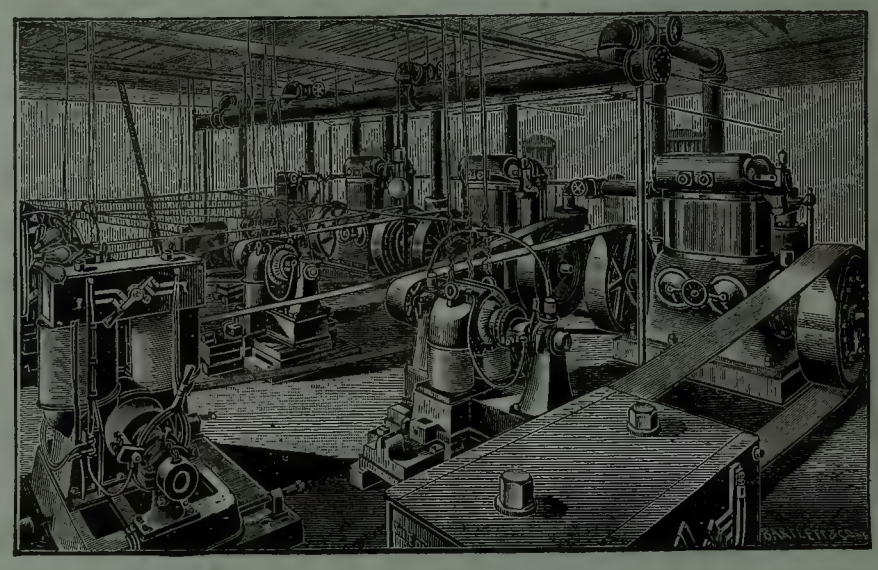


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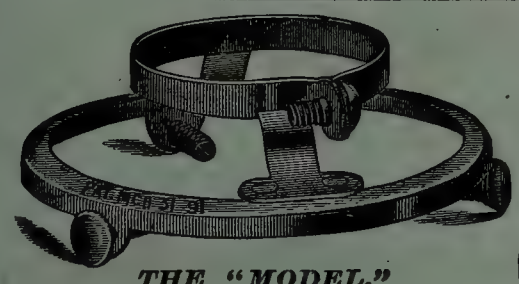
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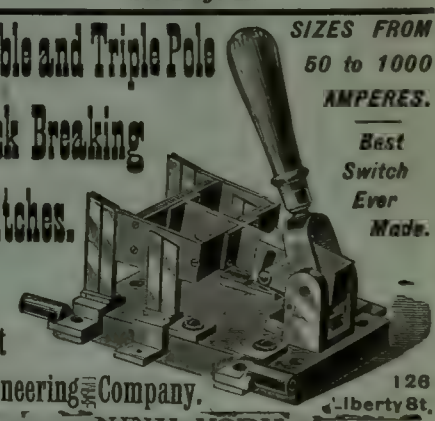
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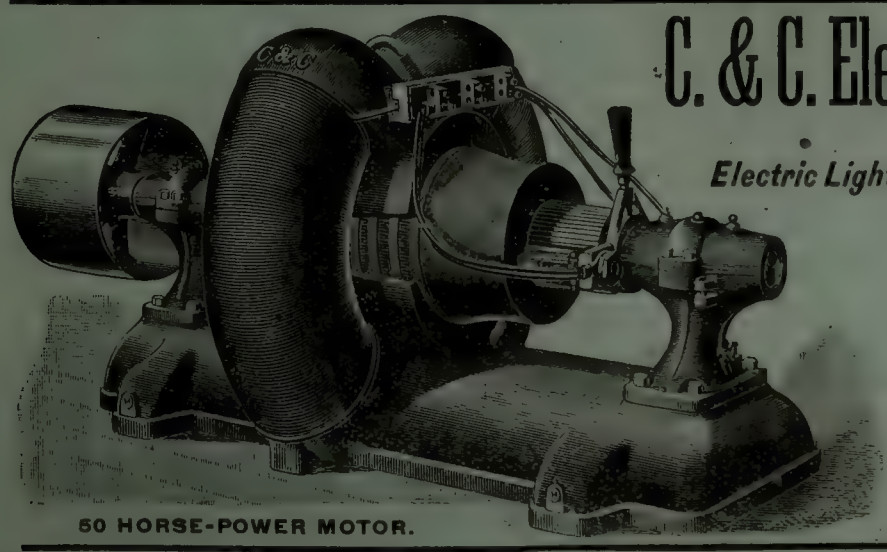
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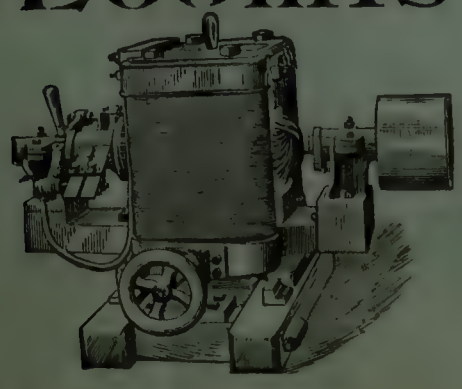
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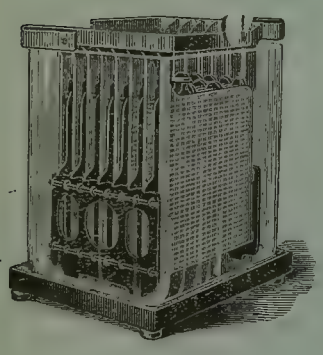
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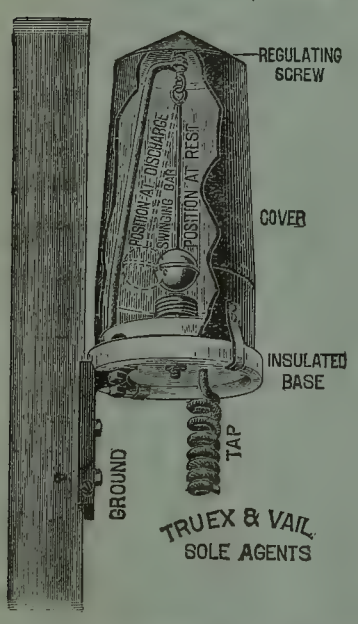
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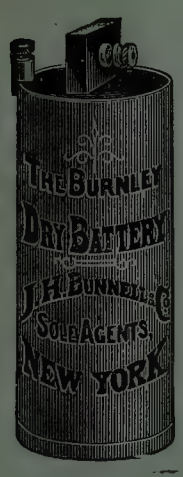
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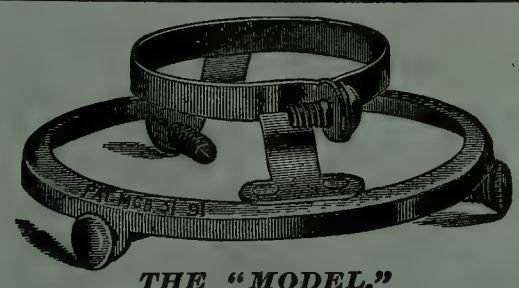
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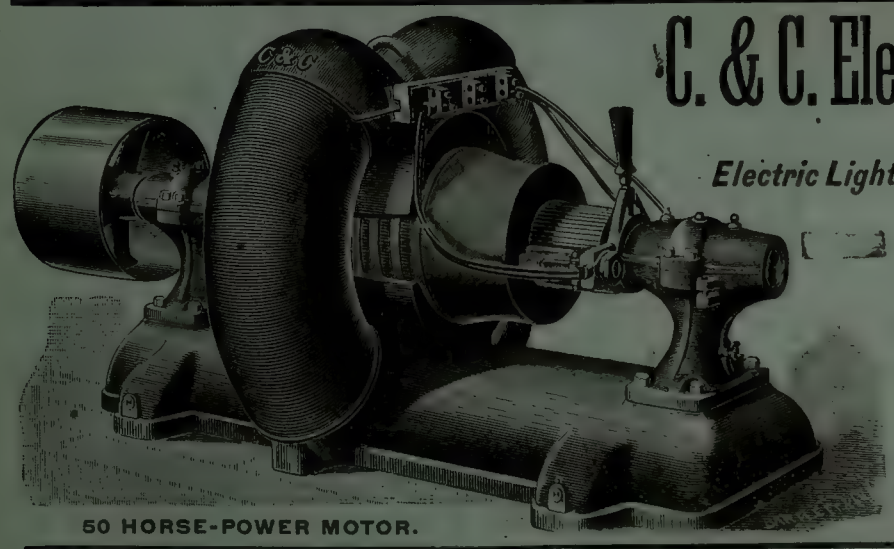
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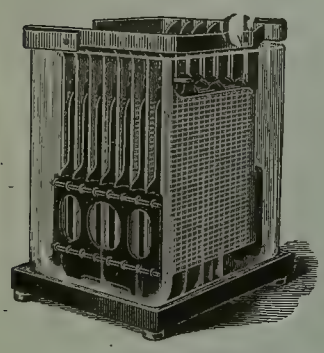
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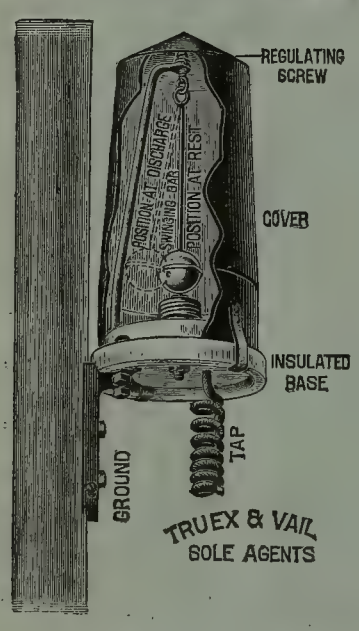
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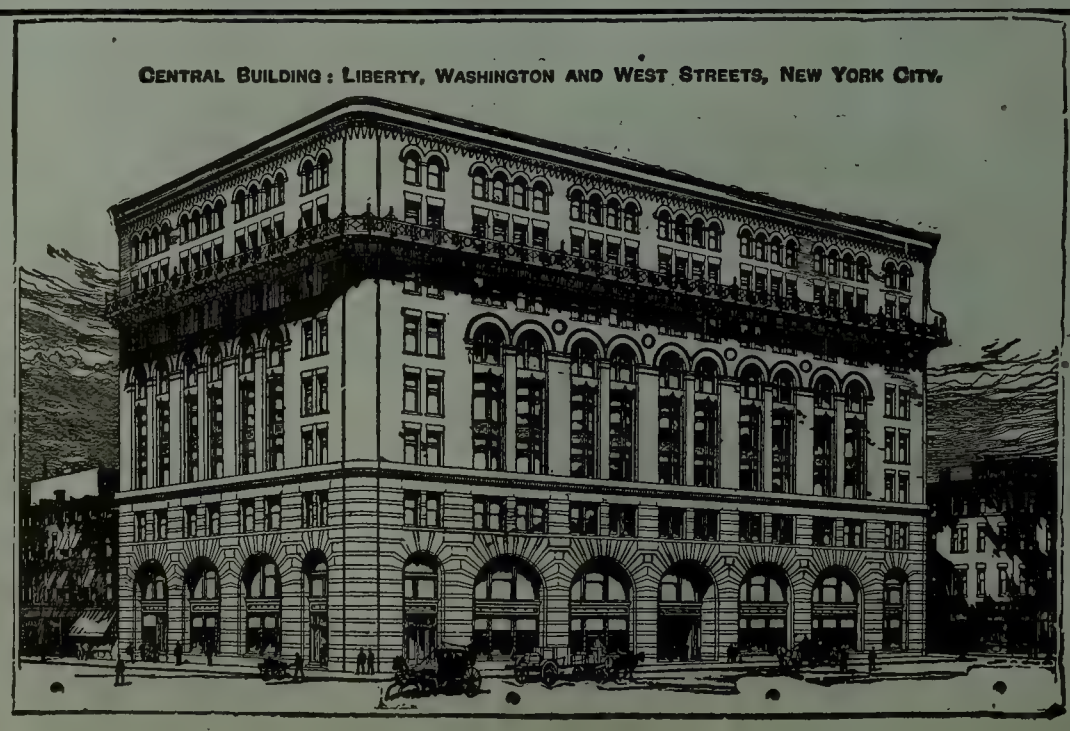
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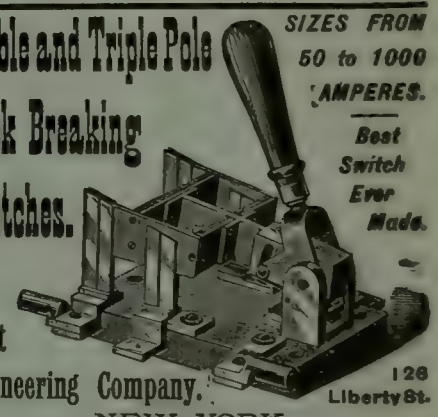
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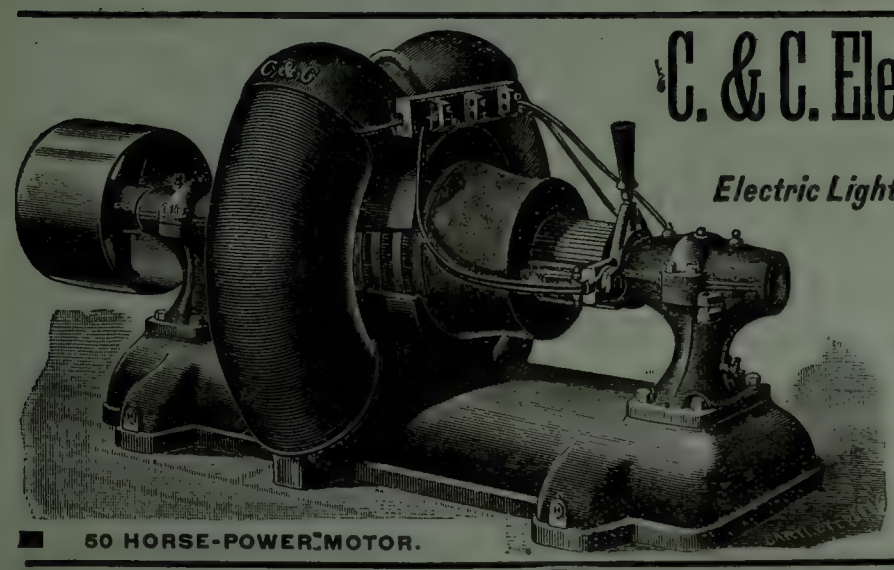


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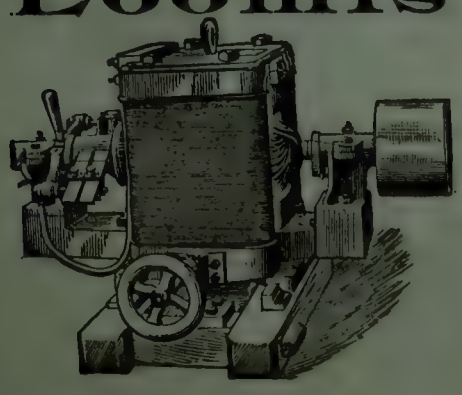
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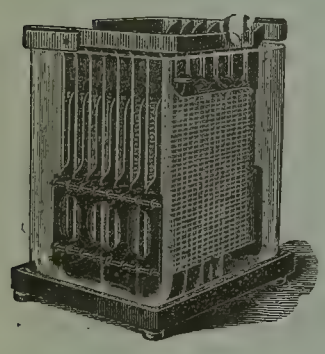
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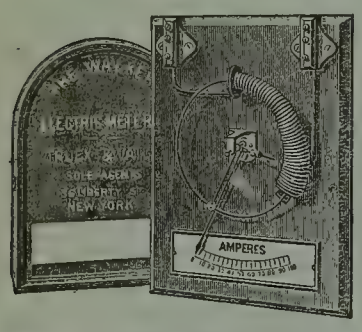


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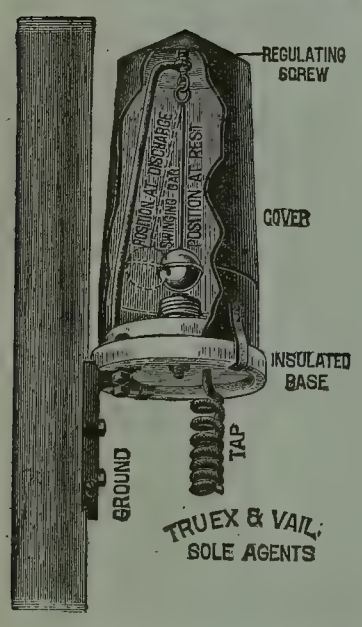
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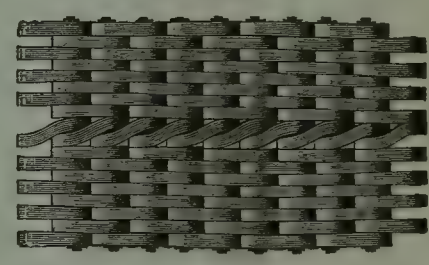
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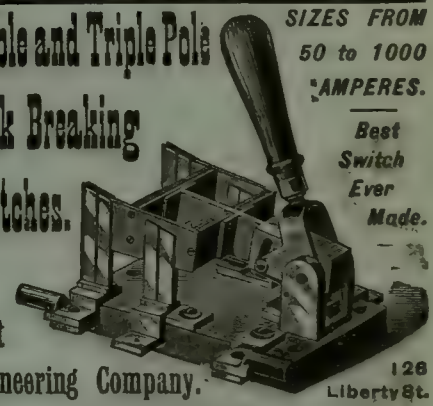
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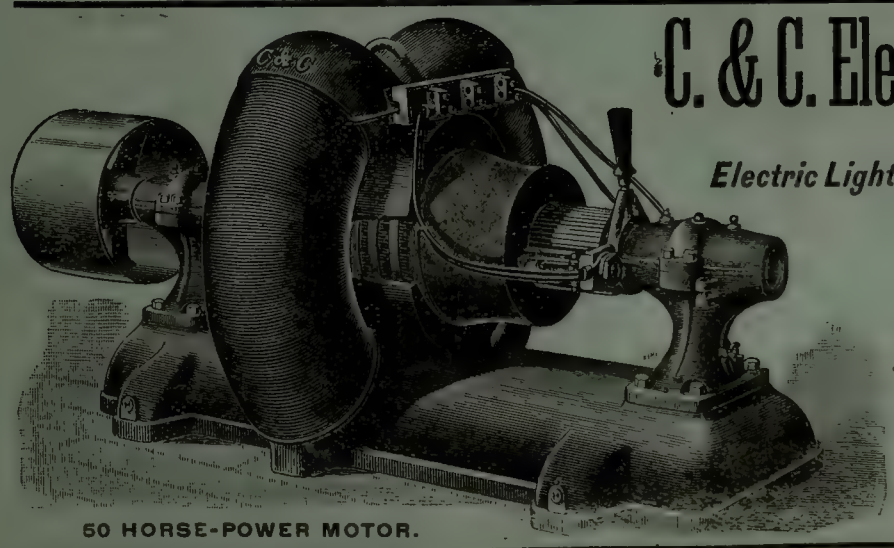


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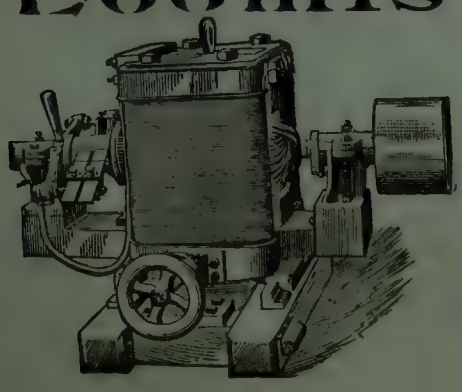
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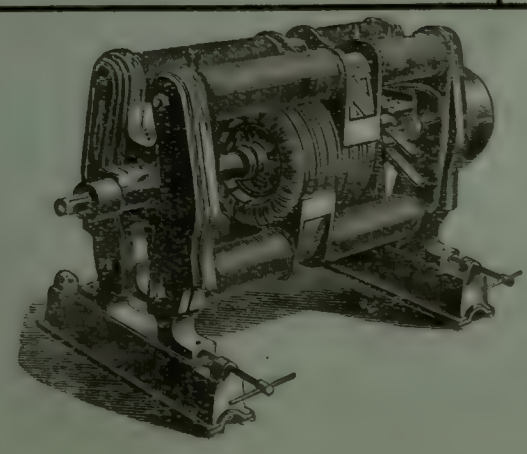
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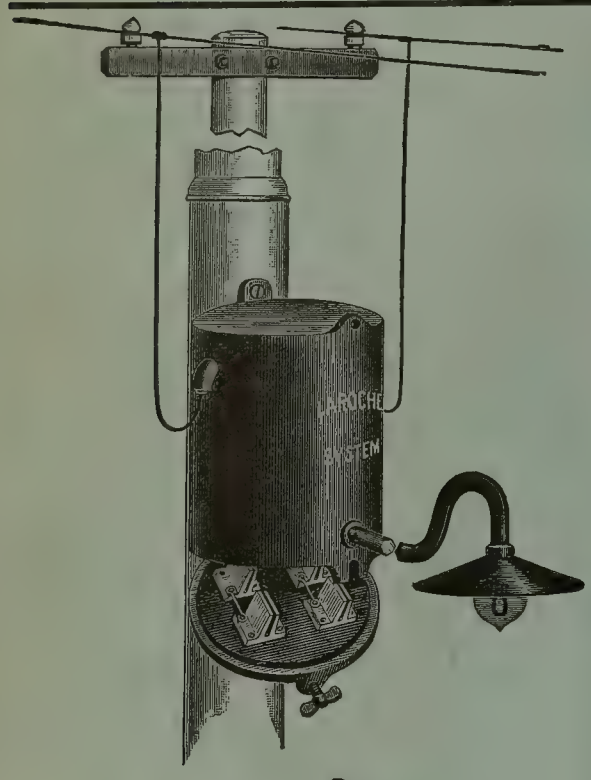


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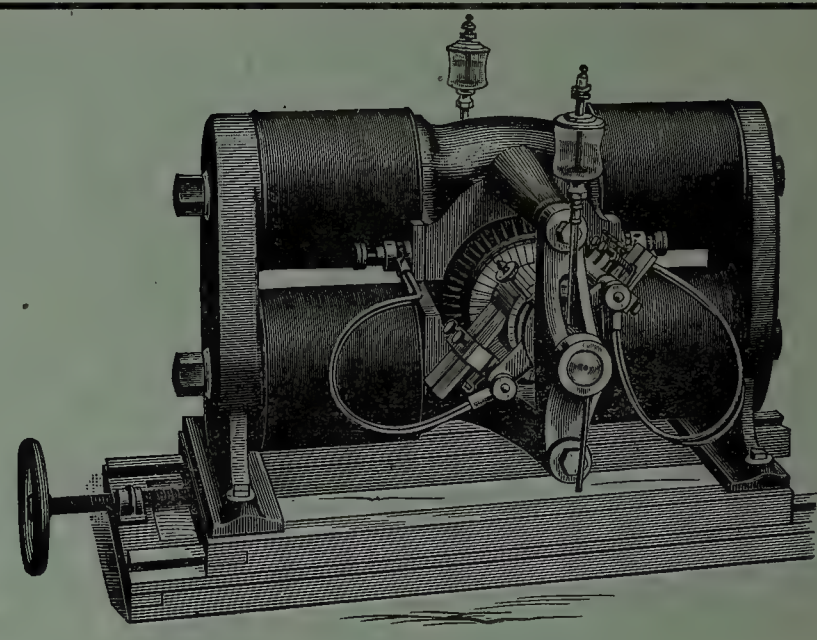
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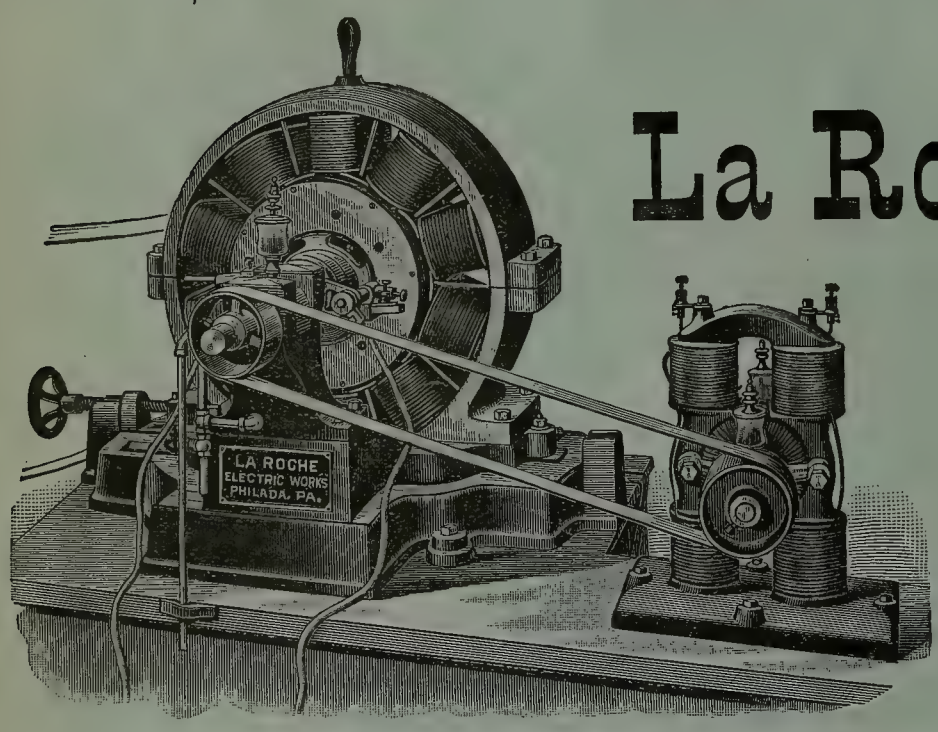
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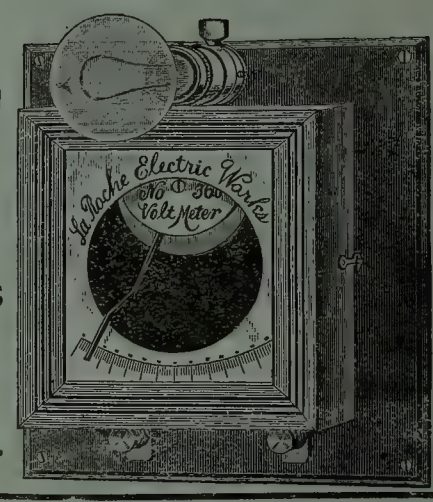
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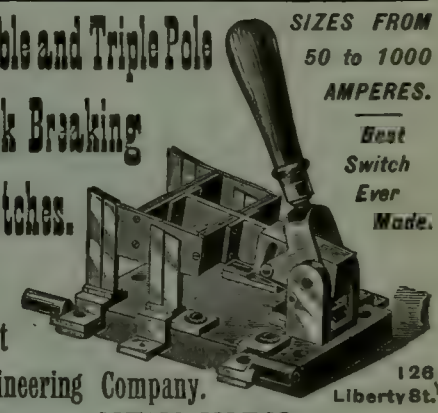
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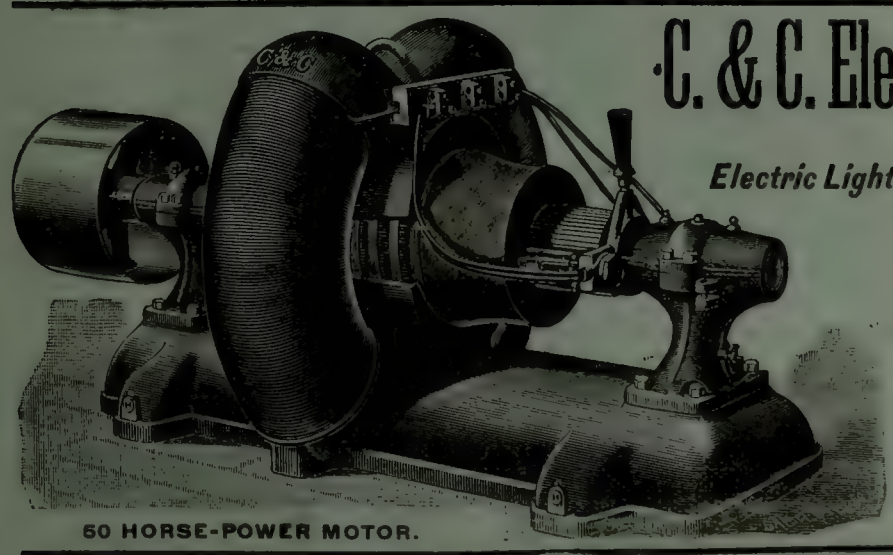
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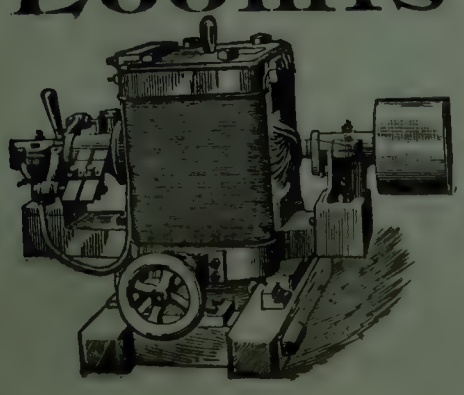
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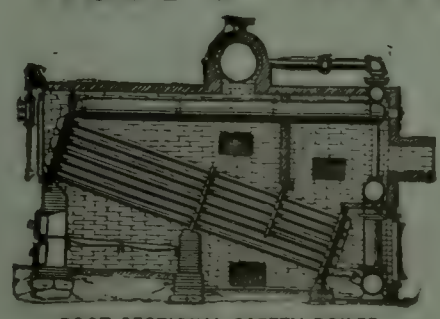
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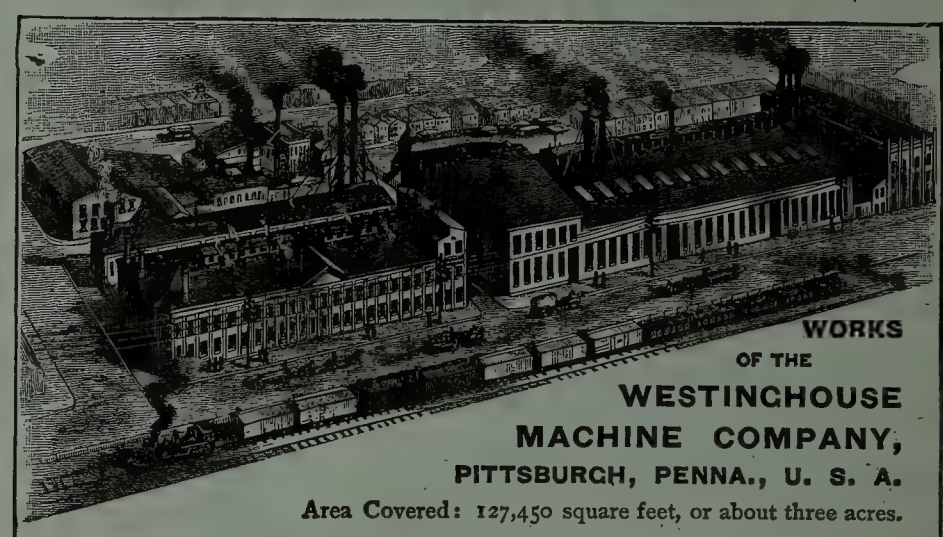
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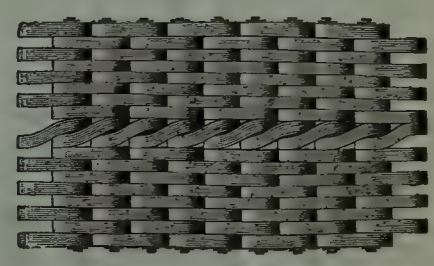
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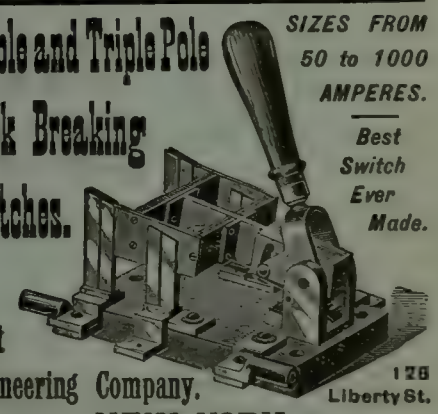
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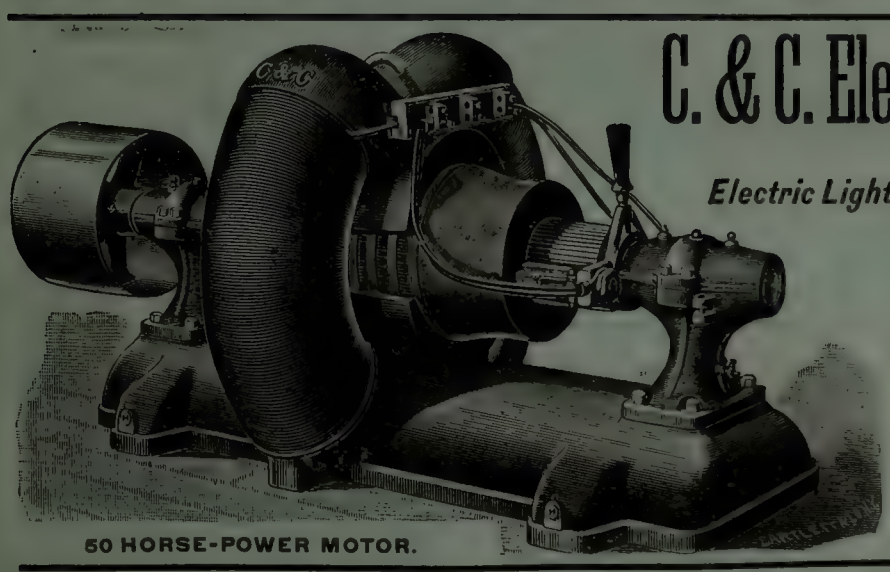
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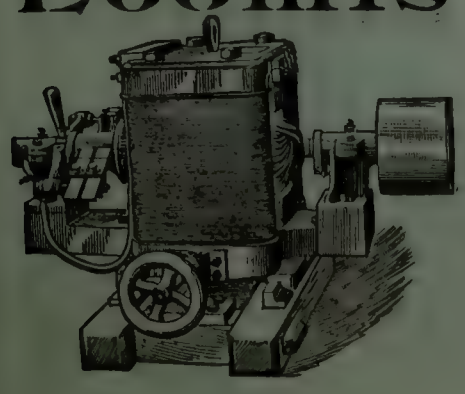
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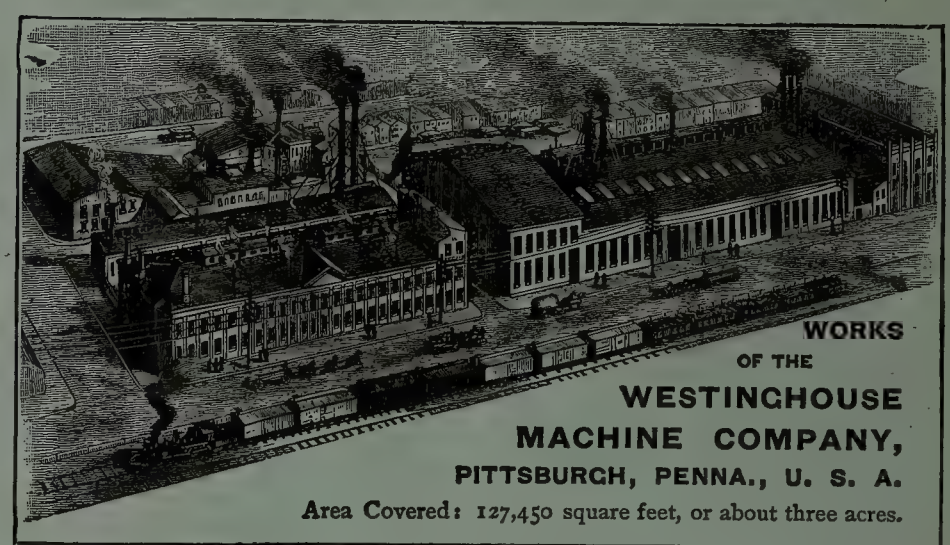
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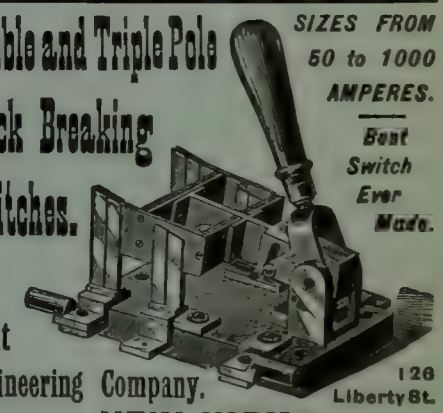
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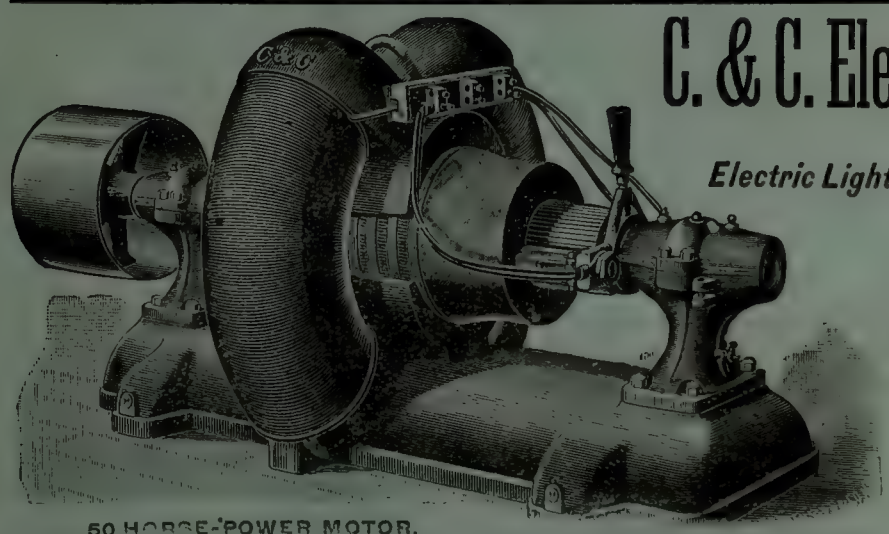
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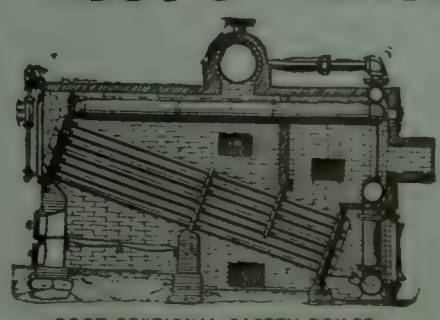
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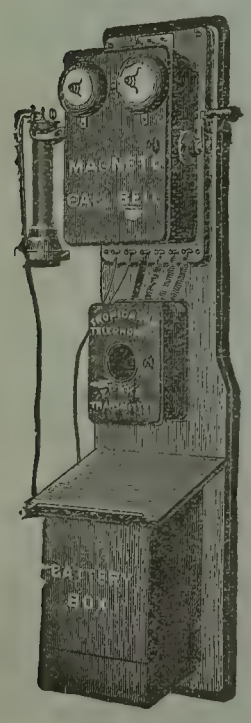
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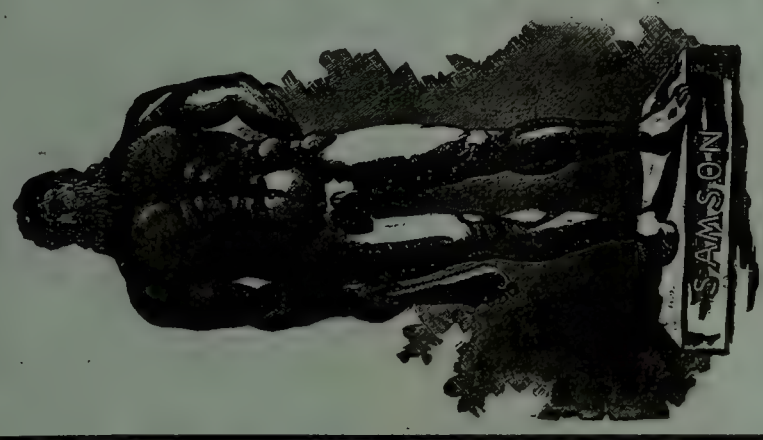
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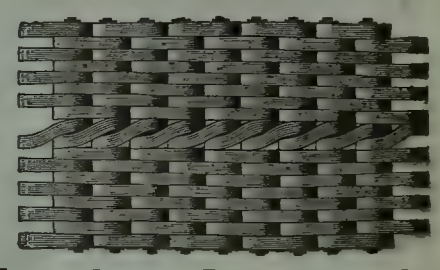
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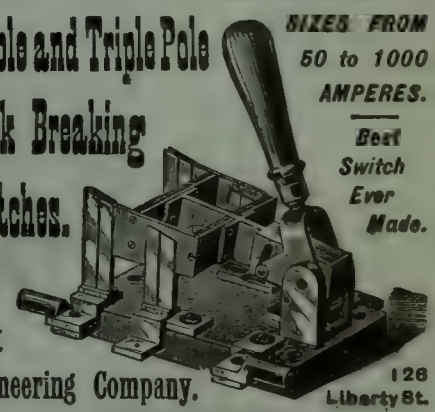
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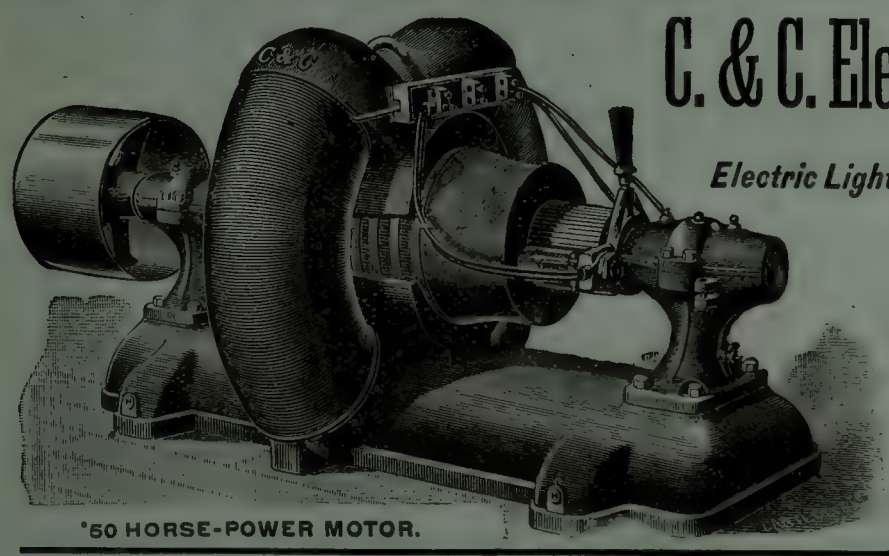
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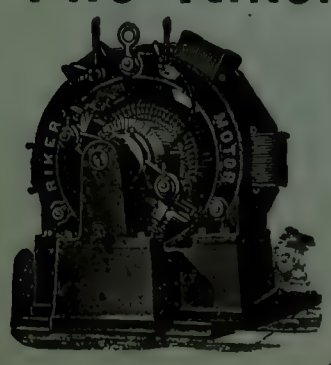
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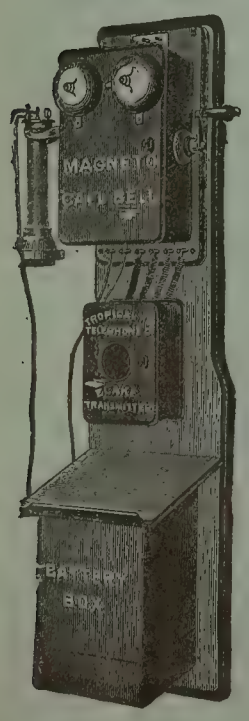
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THE ELECTRICAL AGE.

Established 1883. - An Illustrated Weekly Electrical Journal. - 10 cents per copy.

VOL. X.—No. 17. NEW YORK, APRIL 23, 1892. Subscription, $3.00 per year. Foreign Countries, $4.00 per year.

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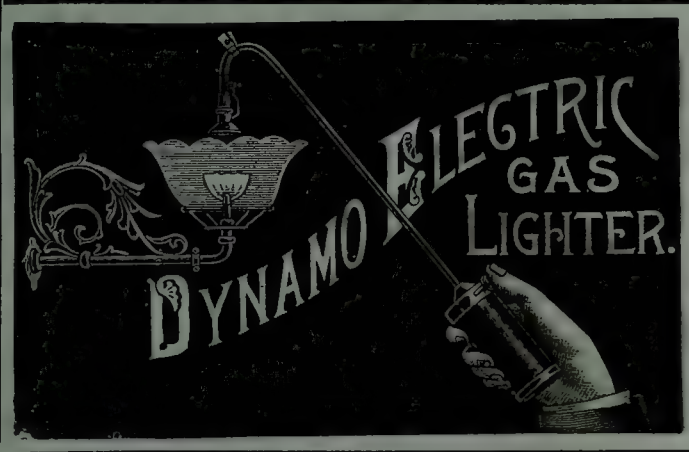
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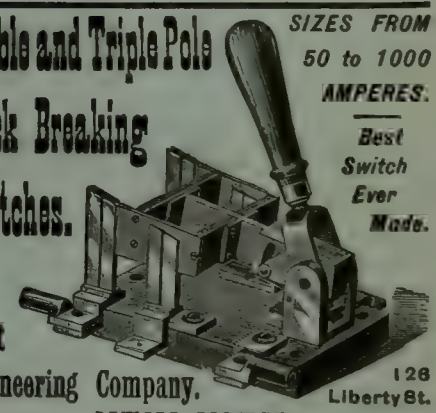
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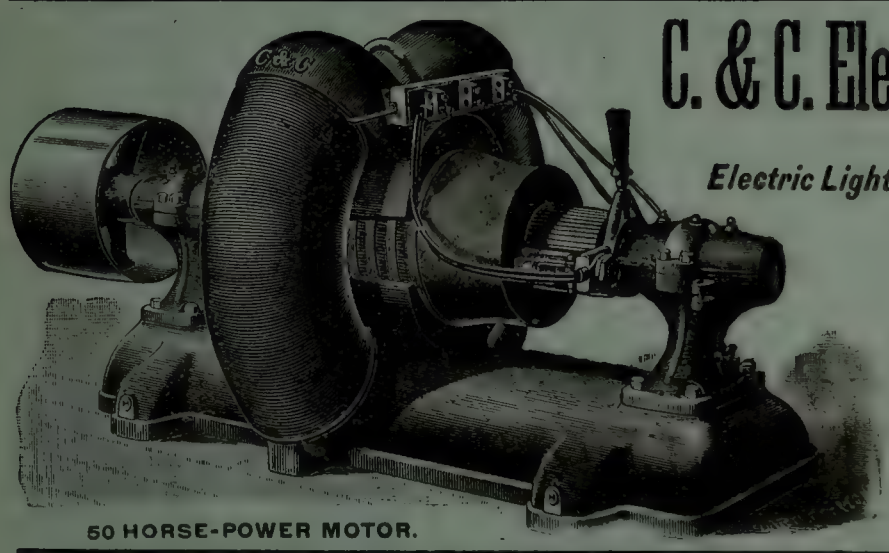
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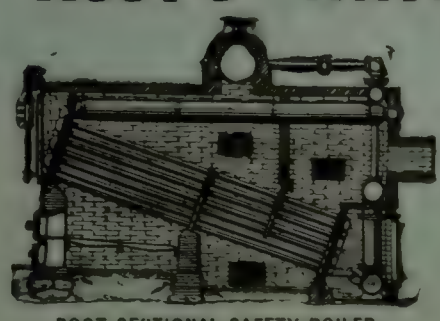
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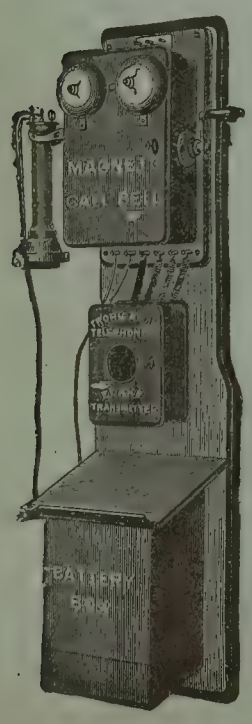
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THE ELECTRICAL AGE.

VOL. X. NEW YORK, JANUARY 2, 1892. No. 1.

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NEW YORK, JANUARY 2, 1892.

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A HAPPY NEW YEAR TO ALL.

We wish all of our readers and friends a Happy New Year.

We also wish that the new year will bring prosperity as well as happiness. Everything looks bright for the electrical trade during the year we are just entering and we hope that fortune will deal liberally with all our friends. What the future has in store for each of us it is beyond finite mind to predict, but that should not deter us from hoping for the best. Prosperity, we think, will come to those who are worthy of it.

OUR CHANGES.

The new year has always been considered a favorable time for the inauguration of a change of any character. As applied to the individual the custom is commonly known as "turning over a new leaf," and the same expression might be appropriately used with reference to newspaper publications, in which important changes are often made on the first of a new year.

This first issue of the ELECTRICAL AGE for the year 1892, it will be noticed, contains some important changes.

In the first place the absence of STREET RAILWAY NEWS from within the cover of the paper will be noticed, and in the second place our new title heading will at once attract the attention of our readers.

STREET RAILWAY NEWS will hereafter be published by us as an independent paper—that is independent from the ELECTRICAL AGE—and it will issue a day later than the latter journal. This step, we consider, will be decidedly advantageous to all concerned.

Each issue of the ELECTRICAL AGE will hereafter contain nearly double the quantity of reading matter that it has had since the establishment of STREET RAILWAY NEWS, and the matter will all be under one cover.

The same is true as to STREET RAILWAY NEWS. Our street-railway friends will hereafter have a distinctively street-railway paper of their own, and they will not be required to look for it within the cover of another paper, STREET RAILWAY NEWS will henceforth shine by its own light, and we feel that our street-railway friends will greatly appreciate the change we have made in their behalf. Greater space will be devoted to their interests and their paper will be an absolutely independent one. These are points which we have every reason to believe will be favorably regarded by them.

Every endeavor will be put forth to improve both papers in every department, and with our increased facilities to aid us in our efforts we think that both journals will, under the new order of things, attain a popularity never before reached by a trade journal.

As to our new heading we would say that we were impelled to make this change solely on the ground of securing greater distinctness, and as there is nothing more distinct than a plain, readable letter we decided to discard the heading used during the past year in favor of the plainer and more effective one at the head of this page.

We did not adopt the new heading under the belief that all of our readers would be pleased with it, but rather with the idea that they would be better pleased with a more distinctive heading—one they could easily read at a distance.

The separation of the two papers will be more satisfactory in every way to our friends, and, being independent of each other, as they will be henceforth, their individualities can be more strongly emphasized than heretofore, when both were issued together. Every department of applied electricity will be fully covered in the ELECTRICAL AGE, and STREET RAILWAY NEWS will be devoted to street railway interests solely.

A RETROSPECT.

At the close of each year one naturally turns back and asks "What has been accomplished during the past twelve months?"

This question, applied to electrical development, might be answered by saying that a great deal has been accomplished in this direction during the past year, and that trade in general has been prosperous.

Among the most important events that have transpired during the year just passed may be mentioned the decision in the Edison lamp suit; the decisions in the storage battery cases, and the successful result of the experiment of long-distance transmission of electrical-power between Lauffen and Frankfort, in Germany, during the Frankfort exhibition.

Many new inventions have been produced, and investigators have accomplished a great deal in the direction of new developments. In this line may be mentioned particularly the remarkable experiments made in connection with a lecture on alternating currents of high frequency delivered by Nikola Tesla at the annual meeting of the American Institute of Electrical Engineers in this city early in the summer.

Electric railroads have increased in number at a wonderfully rapid rate, and the faithful horse and mule are rapidly being crowded to the wall. The most notable event in electric railroading during the year was the granting of permission to four Brooklyn Railroad Companies by the city council to substitute electric-power for horses on their lines.

Electric lines have been established in every direction, and the greatest of satisfaction is given in their operation.

The electrical execution law remains unchanged and several criminals have suffered the death penalty by this method.

Accidents, due to contact with wires conveying high tension currents, have been remarkably few, and the same may be said as regards fires arising from similar causes.

The electrical department of the World's Fair has been organized during the year and the work is well under way.

The telephone and the telegraph have been developing in their respective directions quietly but steadily; the mileage of each has been largely increased, and the service has greatly improved.

The issue of a patent to Emile Berliner on a telephone was the event of the year in telephony on account of the important relations this patent bears to existing telephone patents. It is thought by many that the effect will be to prolong the telephone monopoly.

During the year the affairs of a great electrical manufacturing concern in this country were seriously involved, but by good financiering and faith in the future of the business the company has been put upon a solid basis, with every prospect of taking a leading part in electrical manufacturing.

The gearless-motor for electric cars is the product of the inventive genius of 1891, and promises to supersede many of the other classes of motors used for this purpose.

Altogether the year 1891 compares very favorably with any preceding year in the matter of electrical development, and there is every reason for congratulation on the results accomplished and unbounded hope in the future.

ELECTRICITY AND STEAM AT SPRECKELS' SUGAR REFINERY.

Through the courtesy of Mr. Charles Watson, engineer and manager of the sugar refinery of Claus Spreckels in Philadelphia, we are enabled to give the first reliable description of two of the departments of this vast establishment which possess special interest to our readers.

When it was fully decided to erect the refinery, no time was lost in executing the plans, and the work was rushed night and day to completion. As an evidence of the speed and perfect order that was maintained, we may incidentally note the details of the construction of the electric-light station:

It was noticed early in the course of construction that a want of proper illumination at night was very materially delaying the work, so that it was decided to finish the electric-light station as soon as possible. This conclusion was reached at 11 A.M., and at 4 P.M. of the same day forty men were at work on the excavation for foundations, and in ten days light was distributed from this centre. To fully appreciate the amount of work done in the interval it must be understood that both engines and dynamos were unordered and at their warehouse at the works of the Westinghouse Companies in Pittsburg. Furthermore, the work was not at all of a temporary nature, but was intended as a permanent part of the refinery. In this short space of time the contracts were let, the building erected, and the machinery, consisting of three 150 H. P. Westinghouse standard automatic engines, and three Westinghouse alternating-current dynamos with exciters, and a capacity of 4,500 incandescent lamps, connected ready for use, with all the necessary wiring of lamps and fixtures. Fig. 1 is an excellent perspective view of the plant.

It is perhaps not out of place to give here some of the credit for this work to the contracting and constructing engineers, M. R. Muckle, Jr., & Co., of Philadelphia, and to note that the station is still running as it was started, no changes having been found necessary, notwithstanding the haste with which it was finished. It may be that this early success of Mr. Spreckels is in great part due to the ability of his management to select competent and responsible contracting engineers, as the same degree of permanence is a characteristic throughout the plant.

The raw sugar is unloaded from the vessels at the covered docks, which are owned by Mr. Spreckels, and built for this purpose. On one side is a power-hoist and platform travelling at the rate of 18 feet per minute, and on the other is an electric crane and electric car to facilitate transportation to the refinery. Placed upon either conveyance the crude sugar requires handling but once, and no further attention until it arrives where it is needed. Both systems are entirely successful, and are in themselves a considerable factor in the economy of operation of the plant; but between them they are competitive, and are to determine the character of the similar mechanism for additional docks soon to be built. Neither plan must be considered in the light of an experiment, as the success of both was assured before their installation, but one will probably be found more convenient than the other and settle the type of conveyor for the new docks. Compared with the costly plan of laboriously rehandling many times by horse and man (which is in general use) neither of these methods suffers, and it would appear that the advantages of either would show better by contrast.

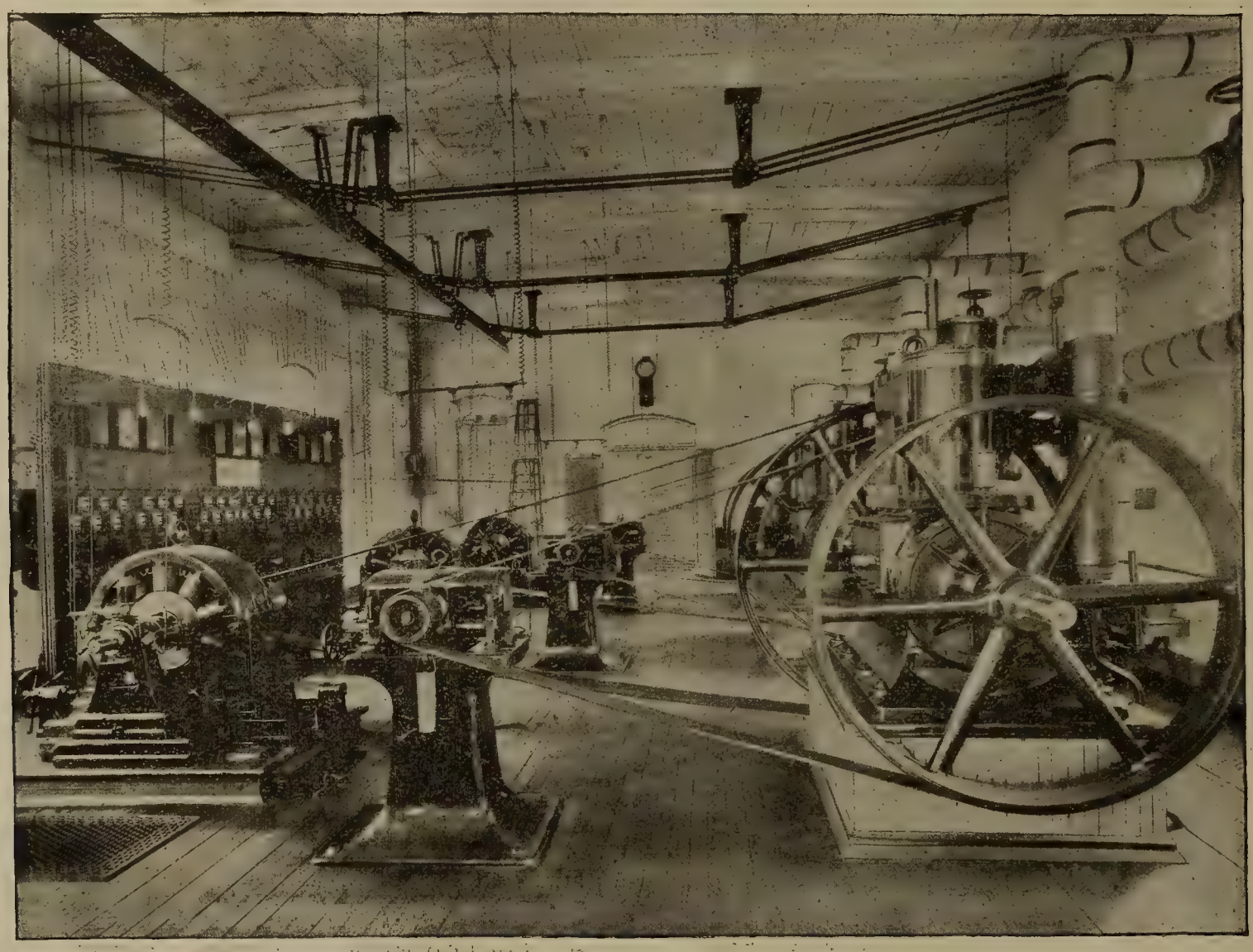
In the last step in the process of refining sugar probably the most radical departure is made at this establishment from the usual practice. Each centrifugal machine is worked from a common platform, running the whole length of the room, and belted direct from a 60 H. P. Westinghouse standard automatic engine. These are in two rows, on either side of the room, and are governed by the operators from the platform above; yet the 27 engines, running at the rate of 320 revolutions per minute in the third story of the building, stopping and starting every few minutes, and as often changing from full load to a frictional one, have no perceptible effect in causing a vibration of the building. The perspective view of one of these lines of engines, given herewith, will give a good idea of the arrangement, and show at the same time the location of the centrifugal cages above and back of the engines.

The advantages claimed for this form of connection is that the viscid mass is more evenly and rapidly distributed over the surface by the constant pull of the engine, until it reaches the speed of its regulation, which is in about 15 seconds. In the case of centralized power with friction clutches, the whole adjustment may be destroyed in an instant, as the machine reaches its speed with a surge however carefully the power may be applied.

Throughout the whole plant the same careful consideration of the conditions affecting the economy of operation of the plant is seen.

The exhaust steam from the engines is used for heating purposes as far as it will go, and the water of condensation is trapped back to the boilers, which are of the Babcock & Wilcox type, fitted with Roney mechanical stokers, and aggregating 7,500 H. P. In the steam mains are inserted separators, whose water is also returned to the boilers.

Sixty-seven engines are used in various parts of the buildings, of which 61 are Westinghouse, and the others are parts of the machines they drive, so that we have here an excellent example of subdivided power.



ELECTRIC LIGHT PLANT SPRECKELS' SUGAR REFINERY, PHILADELPHIA.

TELEPHONE AFFAIRS IN BALTIMORE.

The efforts of the Protective Association, in Baltimore, to bring the telephone company to terms have evidently not been very successful. The Association, however, is planning an attack on new lines. It is proposed to secure 1,000 subscribers who are willing to order out their 'phones at one time if such action is found to be necessary, and then to await the action of the Legislature. If that body is willing to act in the matter and prescribe a fair rental for telephones then the instruments will be retained. In the event of contrary action the instruments may be ordered out and the fight carried on by the force method.

Commenting on this subject the Baltimore *Herald* of the 11th inst says:

"It is thought that the Legislature will consider favorably a bill limiting the rental of telephone instruments to $60 a year and making that rate uniform for a single wire. Public opinion certainly is favorable to such action, and there is only the Telephone Company to oppose it. Doubtless the Protective Association, through its committee, would have a potent influence with the Legislature, and a law might be framed which would be fair to all concerned.

"In seeking legislative relief from the telephone extortion full justice ought to be done to the company. Nothing can be gained by crippling it with hard regulations. The rental price of instruments should be set at a maximum rate, which shall be a fair return for the service rendered. Then the conditions of the privileges to be granted should be couched in plain terms, so as to leave no room for disputings between the company and its patrons. The corporation should be vouchsafed justice and the public should be protected from unreasonable extortion.

"Such a law is not only necessary, but practicable. It is necessary, because quasi-public monopolies never make concessions to their patrons except in the presence of competition or stern legal enactment. There is no competition and can be none, hence relief can be had only in an act of the Legislature placing a limit upon what the Telephone Company may rightfully demand in payment for its service.

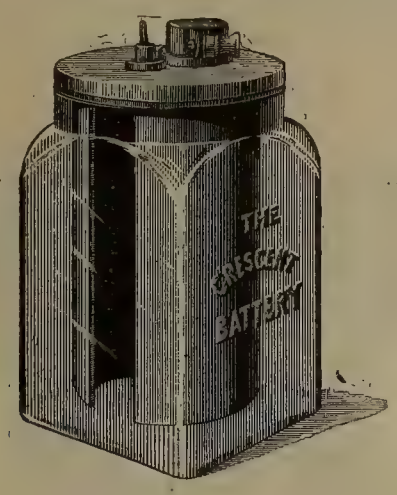
"The law proposed is practicable, because it will treat both parties to the telephone contract with perfect fairness. It will relieve the patron in his helplessness, and will save the corporation from constant friction and trouble with its subscribers. By all means, let the Legislature act with promptness and firmness upon this question."

The long-distance telephone line construction work has reached Lockhaven, Pa. The poles erected in the city are very tall in order to carry the wires above the electric light and other wires now in use.

THE "CRESCENT BATTERY."

The Minneapolis Electric and Construction Company, 27 South Fourth street, Minneapolis, Minn., has just manufactured an open-circuit battery, which it claims to be the best battery on the market. It is said that all objectionable features found in other batteries are eliminated in this cell.

The carbon element is of the best quality, moulded in a solid body, and has the pole-pieces extending through the cover of the cell, which makes a tight



CRESCENT BATTERY.

and secure attachment to the cover and a perfect carbon connection. The carbon element is crescent-shaped, giving a large surface, and enabling the condition of the zinc to be easily seen through the opening without removal from the jar. The best rolled zinc, well amalgamated, is used, but any of the standard zincs will fit the battery. The cover is provided with a rubber band, which makes a tight joint with the jar and prevents creeping of salts for telephone service, electric gas lighting and bell work generally.

This battery, which is called the "Crescent," is guaranteed to give perfect satisfaction. As it gives a perfectly continuous current, free from any painful convulsive effects caused by variations of the same, it will be especially useful to physicians and dentists and others who in their profession make a therapeutic use of electricity. It is said that when 50 cells are connected in series with a milliampère metre and a rheostat, the expensive switchboards usually required are not needed, the rheostat alone regulating the current from a minimum to the full power of the battery.

It is said that there is no action in the battery when not in use, it requires no attention for months, and gives its full current as soon as connection is made. It is both clean and reliable.

A REPORT DENIED.

The following letter explains itself, and sets at rest a report which has gained some currency in the past few days concerning the Boston Electric Club:

BOSTON ELECTRIC CLUB,
SECRETARY'S OFFICE, NO. 146 FRANKLIN ST.,
BOSTON, December 17, 1891.

EDITOR ELECTRICAL AGE: It having been announced in some of the electrical journals that "the New England Electric Club is to be formed to take the place of the Boston Electric Club," will you kindly, in justice to the Boston Electric Club, state in your next issue that such is not a fact. The Boston Electric Club is not dead nor has it surrendered its charter. We have simply given up our permanent headquarters and disposed of our furniture and effects. Henceforth the club will be perpetuated in the form of monthly dinners, lectures, etc. Our constitution and by-laws have been revised, annual dues reduced to an almost nominal figure, such other changes made that we think will tell beneficially, and on the first Monday evening in January (the 4th) we propose having our inaugural dinner. I know nothing of the New England Electric Club except what has been published, nor have I seen any one who can tell me anything about it.

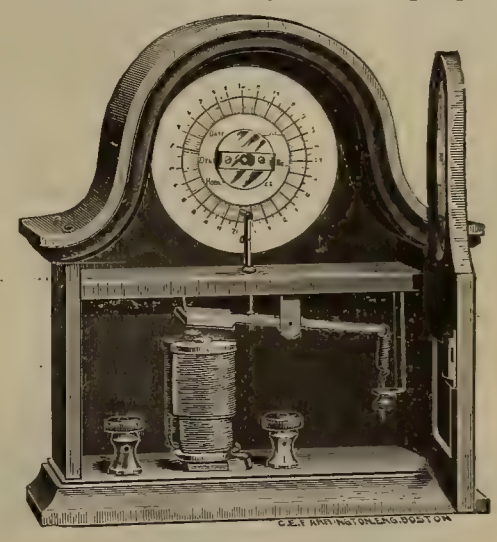
Very truly yours,
R. F. NOSS, *Secretary.*

CONSOLIDATION OF DISTRICT MESSENGER COMPANIES.

The announcement is made that the American District Telegraph and the Mutual District Messenger Companies of this city will be consolidated within a few months. It is said that a syndicate has obtained control of the Mutual District Telegraph Company and the Mutual District Messenger Company, which companies were under one control, and the business of the two is to be conducted in the interest of the American District Company. It is stated that the organization will be kept distinct for a while, but where the offices of the two companies happen to be close together they will be united. The actual consolidation is expected to follow after outstanding contracts have expired. There will be some changes among the officers. Mr. Marcellus Hartley, president of the two Mutual Companies will retire, and Mr. E. R. Chapman will succeed him; Mr. H. L. Hotchkiss is vice-president under the new order of things. W. W. Ryder is secretary, and A. Blackburne, treasurer.

WADE DYNAMO REGISTER.

We illustrate and describe herewith a dynamo register that should be in every electric-light plant, and



DYNAMO REGISTER.

one which when once used the station superintendent will be unable to do without. The register gives a correct and indelible record of each circuit and automatically keeps the superintendent informed how each dynamo has run every night.

As will be seen from the illustration, it consists of an electro-magnet with a pivoted armature, to which is attached a recording pen, which follows the movement of the armature and records on a revolving dial all the fluctuations of the current.

The dial gives the date, the number of the dynamo and the hours the dynamo is run, and is divided into two portions of 12 hours each, and again subdivided into hours, half hours and quarter hours. A bell connected to the armature gives an alarm instantly should anything happen to one of the circuits.

The illustration clearly shows the interior construction of the register. The entire mechanism, which is of the simplest construction and not likely



WESTINGHOUSE ENGINES AND CENTRIFUGAL MACHINES, SPRECKEL'S SUGAR REFINERY.

to get out of order, is enclosed in a handsomely finished case, exposing nothing but the dial, which is seen through a heavy glass in the door of the case. The box may be locked to keep meddlers from interfering with the works. It seems impossible to secure a more faithful watch of a dynamo tender.

With a daily book record of the information given by the register, superintendents can easily arrive at the average work of the dynamos covering any period of time.

TROLLEY BASE AND INSULATORS AND BRUSH-HOLDERS.*

The trolley base illustrated herewith was designed for the purpose of allowing the trolley to follow the trolley wire at any angle, and with equal pressure at all points. The principle consists in the application of an universal joint at the base of the trolley arm.

The springs, shown in the illustration, act on the chain attached to the centre of the revolvable disc, which forms a part of the universal joint. The tension of the spring tends always to bring the trolley pole to a vertical position. The disc is made

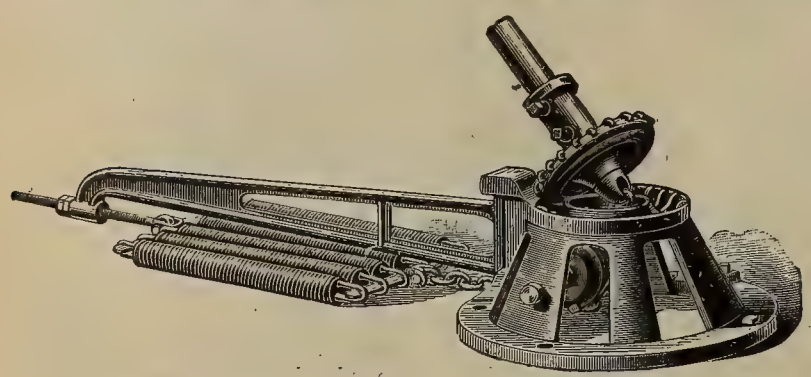


FIG. 1.—TROLLEY BASE.

oval in shape in order that the side pressure may be just sufficient to balance the weight of the trolley pole. As a result of this construction, the poles tend to press directly against the trolley wire, even should the latter be several feet on either side of the central line.

Another great advantage in this style of base is that the trolley pole can be lowered to a horizontal position, and moved in a circle in either direction.

In designing this trolley base the manufacturers had in view the simplifying and cheapening of the present method of overhead construction, including

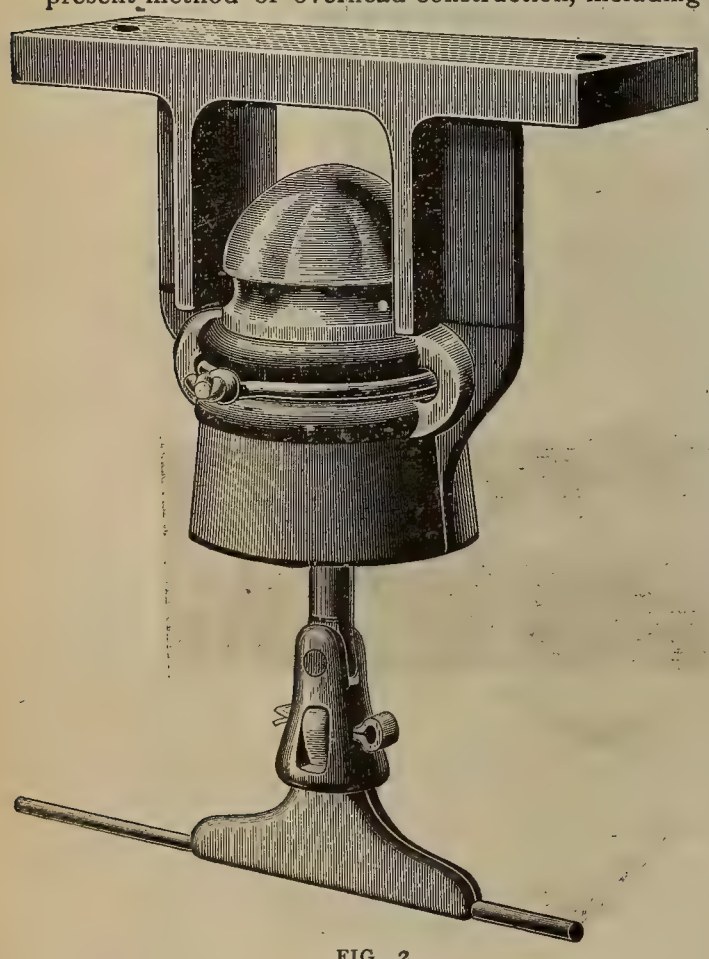


FIG. 2.

doing away with unsightly frogs and brackets in narrow streets. As the trolley follows the wire at any angle it renders the use of brackets unnecessary, as the trolley wire may be suspended close to the pole.

Figures 2 and 3 show two designs of glass trolley-wire insulators, for interior and bracket work. These insulators are provided with "La Grip" trolley-wire clamps, and the supports are made of malleable iron in two castings, which are held together by means of twisted wire. This construction makes the replacing of the glass insulators a matter of but a moment's time.

The chief feature of the insulator is the fact that it is made of glass, which, as is well known, is the best of all practical insulators.

* Wightman Electric Manufacturing Co., Scranton, Pa.

The People's Line, of Scranton, Pa., is to be completely equipped with these insulators, experience having proved that much power can be saved by their use.

Fig. 4 illustrates some recent improvements made by the Wightman Electric Manufacturing Company in Thomson-Houston motor brush-holders.

As will be noticed the point of attachment of the tension-springs are placed so as to bring the springs out of the reach of heat caused by arcing, or by contact at the brushes.

To avoid the usual breaking of the springs due to crystallization at the point of bending the company has done away with the bending entirely. Each spring is provided with removable cast terminal eyes, which greatly facilitates the replacing of springs.

Fig. 5 is a full-sized illustration of this spring.

WESTON INSTRUMENTS AT THE FRANKFORT EXHIBITION.

It may be remembered that the Weston Electrical Instrument Company, Newark, N. J., decided at the last moment to exhibit its Weston Standard Portable Ammeters and Voltmeters and other electrical measuring instruments at the Frankfort Electrical Exhibition. In taking this course the company was well aware that its instruments would be subjected to close scrutiny by many of the most competent and eminent electricians and electrical engineers of Europe, and would be brought into direct competition with those made by such prominent firms as Siemens & Halske, Hartmann & Braun and other makers of high-grade instruments. The Weston Electrical Instrument Company, however, felt great confidence in the merits of its goods, and was certain that if the instruments were thoroughly examined and tested, their great accuracy, permanency, portability and convenience would commend them to the favorable notice of the European electricians and engineers, and that it would be able to secure many orders for them.

Recent developments show that the confidence of the manufacturers in the merits of the Weston instruments was not too great. The company has received most favorable notice in many of the German scientific journals, and, what is more important, numerous orders for its voltmeters and ammeters from many of the best electrical engineering firms in Germany and other countries; including Siemens & Halske, Ganz & Co., Shuckert & Co., Lahmeyer & Co., Allgemeine Electricitäts Gesellschaft, The Societa Generale Italiana di Elettrecita and the Brush Electrical Engineering Company. It has also received orders from many of the most distinguished electricians of Europe, notable among whom are Prof. H. F. Weber, of Zurich; Prof. Kittler, Prof. Kohlrausch, Prof. Perret and Prof. Lichtheim. Prof. Weber was a member of the Testing Commission of the Frankfort Exhibition, and had an opportunity of thoroughly examining into the merits of the Weston instruments.

We understand from the Weston Company that the instruments sent to Frankfort were not especially made for exhibition purposes, and that, as a matter of fact, they were not equal to those sent out daily in the regular course of its business. Indeed, they were much inferior to the regular product, and would not have been passed for sale. This arose from the fact already stated, that the company did not decide to exhibit in Frankfort until about the time the exhibition was to open, and all the available space had by that time been taken by other exhibitors. Room was secured, however, by the Exhibition Committee building an annex expressly for the Weston Electrical Instrument Company. The time required to prepare for so extensive an exhibit of the many varieties and ranges of its instruments, and the numerous parts entering into their construction, was necessarily very short. In addition to this the Weston Company was greatly pressed with orders at the time, and was engaged in largely extending its facilities for manufacturing and standardizing the instruments. It was therefore extremely difficult to get out a sufficient number of the instruments to properly represent the work of the company. Under these circumstances it was impossible to spend the time necessary to secure close adjustment of the instruments intended for exhibition without greatly interfering with regular commercial work.

The Weston Electrical Instrument Company feel justified in expecting a still more favorable reception of its instruments after the filling of the numerous orders already received; because if the relatively poor ones sent as an exhibit were so favorably received, it is fair to suppose that those of its usual standard quality will be still more appreciated.

MR. SPRAGUE'S EDISON STOCK.

Mr. Frank J. Sprague, of Sprague Motor fame, was one of the victims of the wrecked broker firm of Field, Lindley, Wiechers & Co., whose downfall was caused by the irregular business methods of E. M. Field, the senior partner.

Mr. Sprague has procured an indictment against Field for grand larceny. He charges Field with misappropriating 350 shares of stock in the Edison General Electric Company of the par value of $35,000. It appears that on Nov. 4 Mr. Sprague borrowed from Field, Lindley, Wiechers & Co., the sum of $25,000 fixing as collateral 300 shares of the Edison stock.

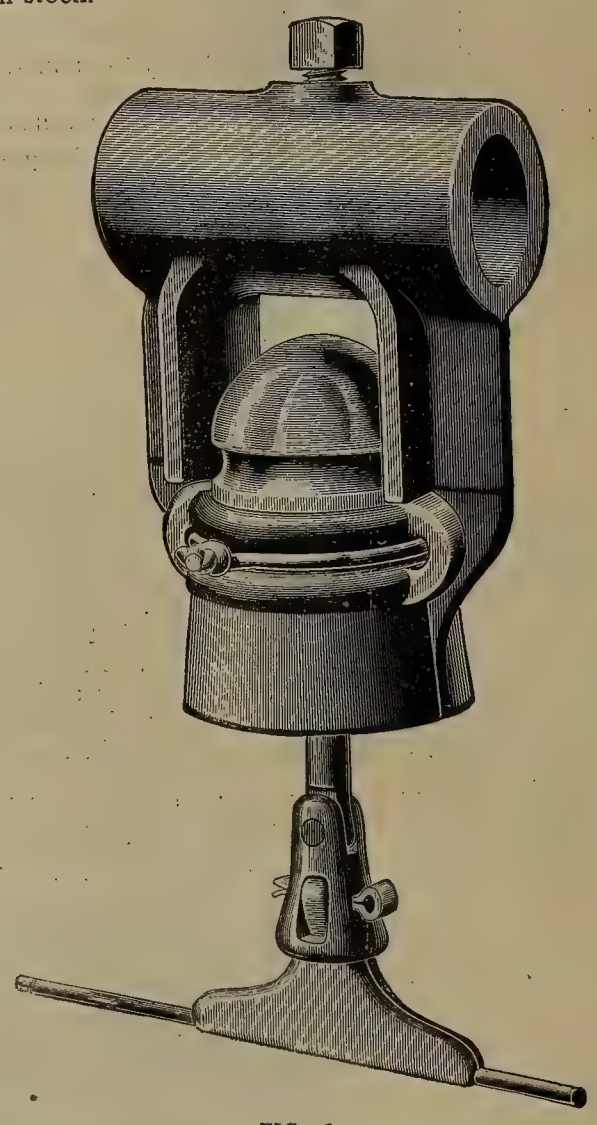


FIG. 3.

On the very same day, and in fact hardly an hour after it came into his possession, Field sold the stock through his brokers, at a handsome advance over the loan to Sprague.

The next day he had the assurance to demand additional margin from Mr. Sprague, who promptly placed in his hands a certificate for fifty more shares of stock, on which Field raised a loan of $4,000

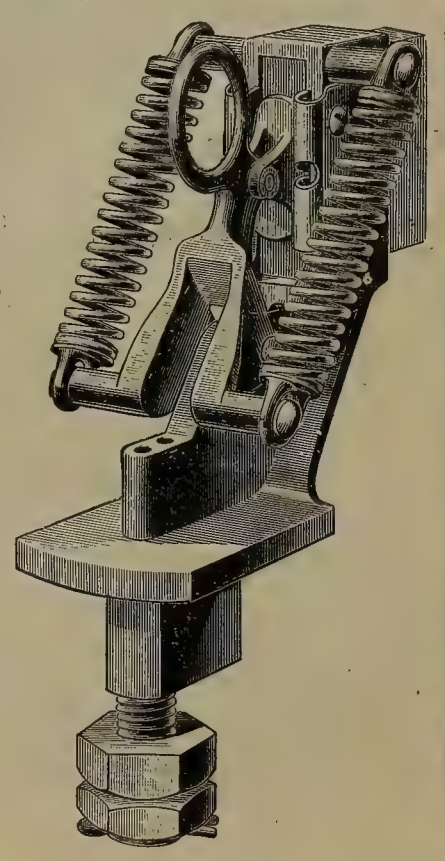


FIG. 4.



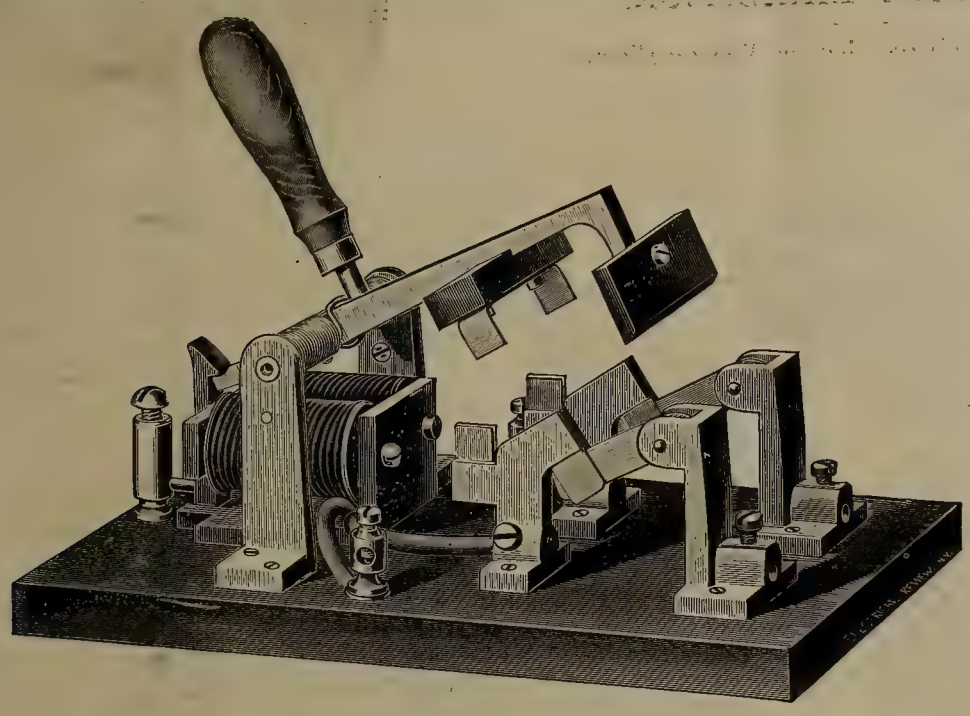
FIG. 5.

from the firm of Watson Bros. After the failure Mr. Sprague undertook to take up his loans, and on finding that his securities had disappeared placed the matter in the hands of his counsel, who got out an injunction restraining the further transfer of the stock. The Stock Exchange was also notified and the missing stock was declared to be not good delivery.

HILL'S SELF-ACTING SWITCH.

The switch shown in the accompanying illustration was designed by Mr. W. S. H. Hill to be used when charging storage batteries from arc-lighting circuits to prevent the circuit from being opened and the streets being left in darkness should any accident happen to the batteries, or any of their connections.

The switch has four contacts. An electro-magnet, and a lever actuated by a spring, when the lever is raised, as shown in the cut, the magnet, the four contacts and the batteries to be charged are all connected in series between the two binding posts. The latch that holds the lever up is held by the pull of the magnet on an armature. Should anything occur to open the circuit for an instant, the magnet will be discharged and the latch be drawn back by a spring,



HILL'S SELF-ACTING SWITCH.

releasing the lever which will then drop and close the circuit between the two main line contacts. At the same time the connection between the main and the battery contacts is broken, thereby disconnecting both ends of the battery circuits and preventing the battery being short circuited on itself.

With slight modification the same device is used to cut out the batteries when they have been sufficiently charged. In this case the position of the magnet is reversed and it is made to release the latch when a predetermined amount of current passes through the magnet, the circuit through the magnet being connected to the terminals of the batteries, and in shunt thereto.

These switches are manufactured by the W. S. Hill Electric Co., 54 Devonshire St., Boston, Mass., and are guaranteed to do all that is claimed for them in a satisfactory manner.

CORRESPONDENCE.

PRIMARY BATTERIES AND MOTORS FOR SEWING MACHINES.

TO THE EDITOR OF THE ELECTRICAL AGE: I have read with considerable interest the letter published in this week's issue of the ELECTRICAL AGE, over the signature of Mr. Lew Rogers, "upon primary batteries and motors for sewing machines;" and I cannot say that I quite agree with some of his conclusions.

Mr. Rogers says "the machine itself runs all right; why attach to it something that requires time and trouble to care for?" Although the attachment of a motor to the sewing machine is not an absolute essential, yet it is without doubt a very desirable accessory. It would be equally allowable to argue that because a mechanic could do his work on a foot-lathe, why should he run it by power? There are thousands of ladies throughout the United States, and every other country for that matter, who are absolutely forbidden by their physicians to work the treadle of a sewing machine, on account of the injurious effect upon the spine, while it is impossible to run the machine by hand and at the same time to keep perfect control of the work. To all such an efficient motor operated by a constant current battery in which there is practically no local action would be an inestimable boon.

Again, I must dissent from Mr. Rogers' statement that there are many motors to choose from for this class of work. There are a large number of small motors on the market and some of them are fairly efficient for the work for which they were designed, but they are nearly all of them high speed motors. For sewing machine work on the contrary it is necessary to employ a slow speed motor, if we wish to work the motor at its full efficiency, and when using battery power this is a *sine qua non*.

True, there are one hundred and one batteries on the market, but with the exception of the Edison-Lalande, there is only one other type, viz: the bichromate cell and its modifications, that will run a sewing machine for one hour, and the local action in this type of battery is a fatal objection to its use, coupled with the continuous increase in internal resistance and the consequent decrease of current.

The Edison-Lalande battery on the contrary will deliver a perfectly constant current throughout the whole life of battery, and as there is no waste when battery is not doing actual work, it can be used intermittently as occasion may require during a period extending over several months without needing any attention. It is, in fact, the ideal battery in which the consumption of zinc is exactly proportioned to the useful work done by cell.

As to the objection against a battery that a lady often desires to move the machine for better light, etc., and on this account, batteries must be in the same room where she works to the risk of the carpet and furniture. I think her wish to do so is simply due to the fact that there is no reason why a treadle machine should not be moved, but such an objection would not be considered by her in comparison with the advantages she would gain by having a motor machine. A lady does not continually wish to move her piano around for better light, etc.; she selects the best place for it, in her opinion, and there it remains. She would take similar action with the sewing machine if she had motor power. It is absurd to argue that a battery could not be placed in the cellar on account of difficulty in changing connections, as nothing is easier than to have long flexible leads which would reach to any part of the room if a lady insists upon moving her machine frequently. By all means, let the battery be placed in the cellar or in some out-of-the-way place and connected by heavy leads to the motor which should be enclosed. Mr. Rogers' suggestion that motor and battery be leased at a nominal rental by a company found for that purpose would hardly work satisfactorily, as the case in point is not analagous to that of the telephone.

The cost of keeping up the battery in the telephone is infinitesimal compared with that of the maintenance of central stations, poles, wires, etc.; whereas for the sewing machine, the *only* expense would be the cost of renewals of battery. It would therefore be unjust to charge a lessee who uses the machine only one hour a day the same rate as one who uses it five hours per day and it would not pay to put a meter on battery. An arrangement could easily be affected whereby batteries in private houses could be recharged by an expert at a fixed charge per renewal including the labor. This, I think would be a more satisfactory method of settling the question.

Apologizing for taking up so much of your valuable space.

JAMES W. GLADSTONE,
Edison Manufacturing Co.
Edison Building, New York.

December 26, 1891.

P. S. In your article of Dec. 19th on Edison sewing machine battery motor, you say motor is belted to sewing machines in the ratio of 1 to 8. This is incorrect as the ratio is 1.8 to 1. J. W. G.

WATER-POWER ELECTRIC PLANT.

Thompson & Banks, of Ogden, Utah, made a proposition to the Chamber of Commerce of that city, agreeing to erect and equip an electrical power plant of not less than 1,800 horse-power, to be operated by the water of Ogden River, to be completed on or before July 1, 1892, on condition that the Chamber leases and hires to the extent of 500 horse-power, for a period of five years at an annual rental of $20 per horse-power per annum, the power to be delivered at the power-house, and the Chamber of Commerce to provide the means to convey it to the point where desired and to provide motor or motors for using the current.

The proposition was unanimously indorsed and a committee of five business men appointed to arrange the details of the contract and carry out the proposition.

MEETINGS OF SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The 141st meeting of the New York Electrical Society will be held in Dr. Chandler's room, School of Mines, Columbia College, on Wednesday, December 30, at 8 P.M. Mr. A. A. Knudson will lecture on "Frauds in the Electrical Business."

The lecture will deal with the various ways in which the general belief of the public in the ability of electricity to do everything is taken advantage of by cranks and sharpers. Mr. Knudson will relate some of his experiences in exposing such frauds, and will suggest remedies for the evil.

BIOGRAPHICAL SKETCHES.

A. B. LYMAN.

The accompanying illustration shows the features of a well-known dealer in electrical specialties, especially those branches relating to telegraph and call-bell systems—A. B. Lyman, of Cleveland, Ohio. Mr. Lyman has been in the telegraph field a great many years, leaving a first-class position as a telegrapher to manufacture and sell electrical instruments. He is the inventor of a great many devices



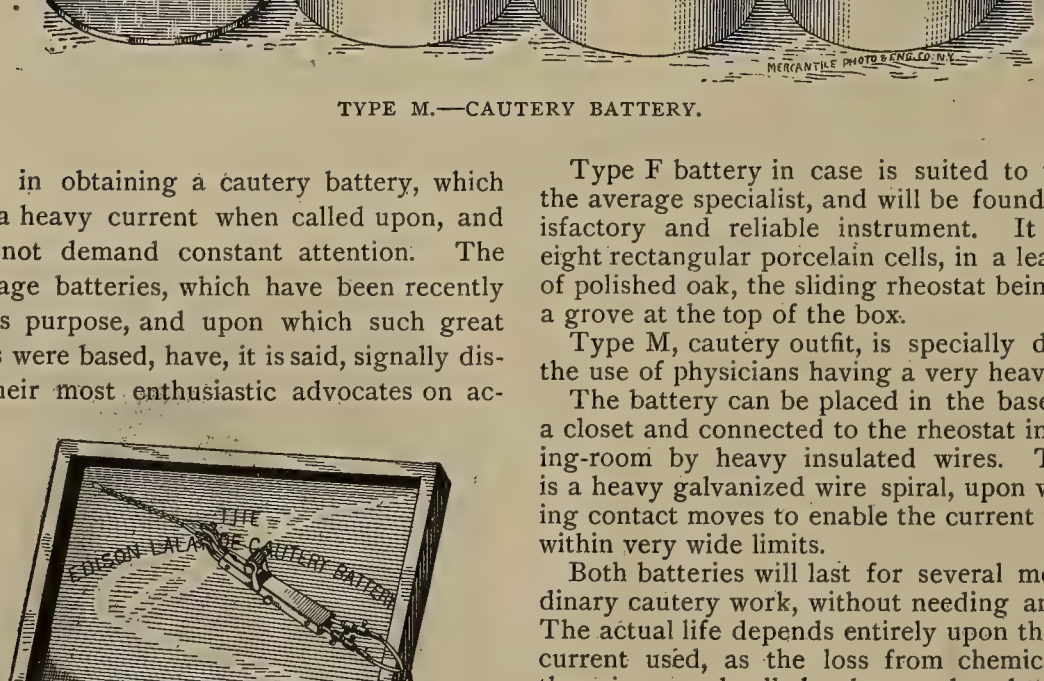
A. B. LYMAN.

in the electrical line, most of which were suggested to him by his practical experience in the telegraph office. He is always courteous and attentive to those who come in contact with him in business relations, and a friend well worth having. One could not meet a more pleasant gentleman in any walk of life.

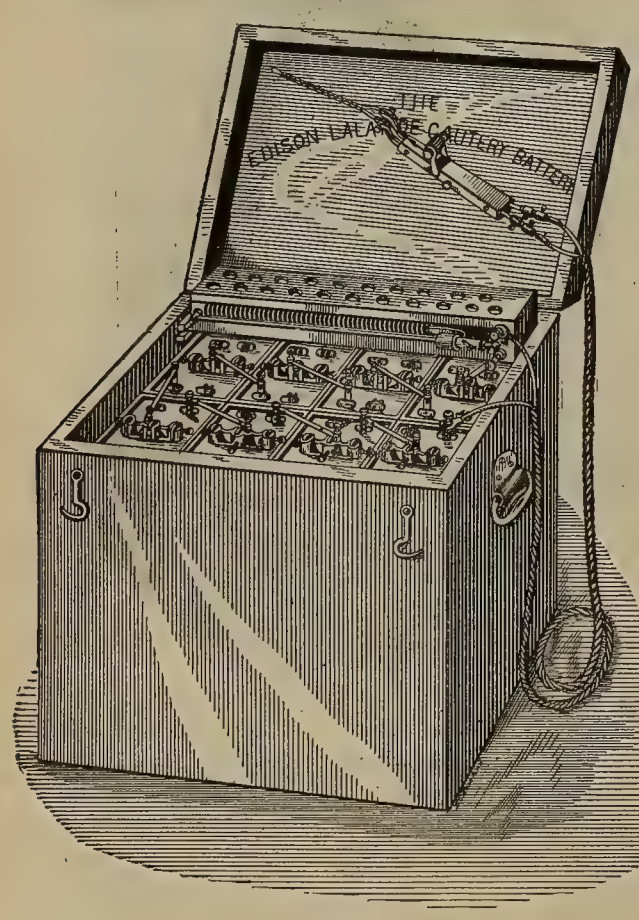
The "grip" is responsible for a little irregularity in our issue of December 19, in connection with the article on the "Elliott" Hanger, manufactured by the Revere Rubber Company, of 62 Franklin-street, Boston. The cuts illustrating the same were inadvertently placed upside down, rendering it difficult to tell whether they were hangers or pumps. This error will have to be charged to the "grip," as our regular force was disabled at the time the paper was made up.

EDISON-LALANDE CAUTERY AND FARADIC BATTERIES.

Among the various types of Edison-Lalande Batteries which the Edison Manufacturing Company has recently placed on the market, none are more worthy of special attention than the Cautery and Faradic Outfits. Hitherto, much difficulty has been experienced in obtaining a cautery battery, which would give a heavy current when called upon, and yet would not demand constant attention. The various storage batteries, which have been recently used for this purpose, and upon which such great expectations were based, have, it is said, signally disappointed their most enthusiastic advocates on account of the liability of all storage batteries to be discharged below the safety limit, and the consequent destruction of the plates from this cause, combined with the inconvenience and difficulty experienced in recharging, and the continued deterioration to which this class of batteries is subject.



TYPE M.—CAUTERY BATTERY.



TYPE F.

The two types of cautery batteries (illustrated below) are constructed by the Edison Manufacturing Company to meet this want. It will be seen on examination of the cell at the left side of the group of 8 cells (Type M. cautery battery), that in order to obtain a very low internal resistance, a double copper frame containing oxide plates is used, together with three zinc plates. Although the elements are separated by only $\frac{1}{4}$ inch, no vulcanite separators are used, as the elements are rigidly clamped to an insulating yoke on the cover.

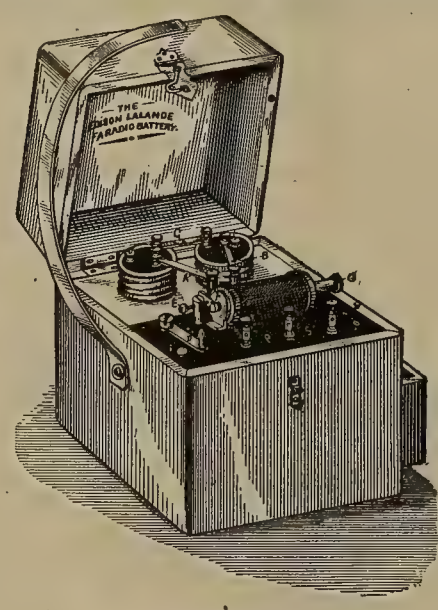
Type F battery in case is suited to the wants of the average specialist, and will be found a most satisfactory and reliable instrument. It consists of eight rectangular porcelain cells, in a lead-lined box of polished oak, the sliding rheostat being fitted into a grove at the top of the box.

Type M, cautery outfit, is specially designed for the use of physicians having a very heavy practice.

The battery can be placed in the basement, or in a closet and connected to the rheostat in the operating-room by heavy insulated wires. The rheostat is a heavy galvanized wire spiral, upon which a sliding contact moves to enable the current to be varied within very wide limits.

Both batteries will last for several months, in ordinary cautery work, without needing any attention. The actual life depends entirely upon the amount of current used, as the loss from chemical action in these improved cells has been reduced to 1 per cent per month.

The Edison Manufacturing Company also manufactures a cautery handle, suitable for both knife and snare work, and particular attention has been paid to the interior construction, so that all trouble caused by imperfect contact is eliminated. The cautery knives are specially made for use with these cautery batteries, and are thoroughly tested, and standardized before leaving the factory.



PHYSICIANS' BATTERY.

The Edison-Lalande battery, on account of its great constancy and low internal resistance, is exceptionally well suited for use with medical induction coils, and two types of faradic batteries have recently been placed on the market.

The physicians' battery consists of two air-tight cells (having a combined internal resistance of half an ohm) connected to a powerful medical induction coil, mounted on a hard rubber base, the whole outfit being enclosed in a polished walnut box. The cells will last for several months without attention, and the zincs do not require to be removed from the solution after using the battery.

The family faradic battery is of similar construction to that of the physicians' battery, excepting that only one cell is used, and the coil is mounted on a black walnut base to match the box.

The Edison Manufacturing Company has recently established its General Offices at the Edison Building, 42 Broad Street, New York, where a full line of samples of its various batteries are on exhibition.

PRESENTATION.

A complimentary lunch was tendered to Mr. Chas. D. Shain, District Manager of the Edison General Electric Company at the Hoffman (downtown) café on the afternoon of the 24th inst., at which he was presented with a very handsome present by his agents and friends. It consisted of a Louis XV. clock and a pair of candelabras made by Tiffany & Co.

Mr. Chas. T. Hughes, Assistant District Manager, made the presentation with the following appropriate remarks:

"Mr. Shain: In behalf of the agents and your friends we beg to present to you this day a token of our appreciation of the kind and courteous treatment which we have received at your hands during the past year.

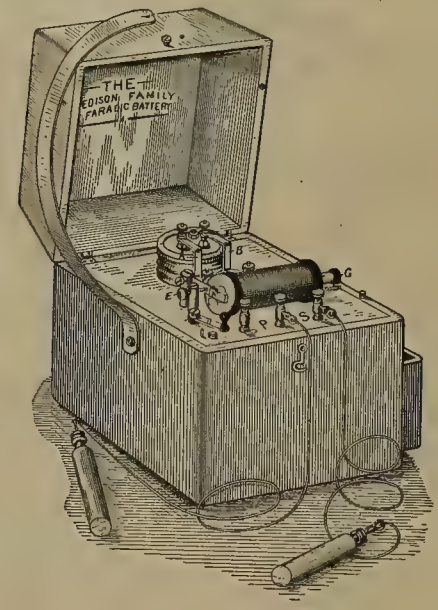
"If you remember, last Christmas we presented you with something for yourself alone, this year we feel that Mrs. Shain should be considered, and we therefore present you with this clock set, trusting that you will accept the same."

Among those present were Mr. Gilbert Wilkes, District Engineer; Mr. F. R. Chinnock, New York State Agent; Mr. Gundaker, Mr. W. F. Hunter, Mr. E. L. Draffen, Mr. Geo. H. Moseman, Mr. Theodore L. Beran, Mr. Frank Wheaten, Mr. W. H. Brown and a representative of the Electrical Age.

Needless to say that Mr. Shain was as pleased as he was surprised, and acknowledged the compliment in his own graceful way.

CLAIM FOR DAMAGES.

The raid on the electric light wires in this city two years ago was recalled on Dec. 23, in the filing of a claim by the East River Electric Light Company of this city, demanding $500,000 damages from the city for the cutting of the company's wires and poles in 1889 by order of the Mayor.



FAMILY FARADIC BATTERY.

ELECTRICAL EXECUTIONS.

The Supreme Court of the United States has affirmed the decision of the lower court in the cases of Charles McElvaine and Nicola Trezza, two murderers now confined in Sing Sing prison under sentence of death. The appeal to the Supreme Court was not on the question of the legality of the electrical execution law, but on the question of the constitutionality of the provision regarding the solitary confinement of the prisoners.

The Court ordered that no further delay occur in executing the death sentence, which will be by the electrical method.

DEVELOPMENT OF STREET RAILWAYS IN TEN YEARS.

(*Continued from page* 216, *Vol. I.*, STREET RAILWAY NEWS.)

The following table, which gives a summary of the capital stock, funded debt, dividends and interest, while it cannot be implicitly relied on as showing the condition of every road, may be accepted as being sufficiently correct and indicative for all practical purposes. The year for which the record is made is that ending July 1, 1890.

Items.	Capital stock issued and outstanding.	Dividends declared.	Rate of divid'ds declared	Funded debt issued and outstanding.	Interest accrued.	Rate of interest paid.
			per cent.			per cent.
All Motive-powers	$163,506,544.50	$11,600,334.54	7.09	$103,494,259.99	$5,870,710.72	5.67
Animal	62,415,614.50	4,390,519,54	7.03	34,361,904.99	1,997,664.92	5.81
Electric	4,034,900.00	225,697.00	5.59	3,230,300.00	187,505.00	5.80
Cable	6,437,900.00	653,587.00	10.15	4,076,000.00	218,160.00	5.35
Steam	25,917,180.00	1,561,512.00	6.03	19,326,200.00	1,181,512.00	6.11
Mixed and Inseparable	64,700,950.00	4,769,019.00	7.37	42,499,855.00	2,285,868.80	5.38

The receipts and expenditures of all the street railways has been summarized as follows:

Items.	All Motive-Powers.	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
Receipts:						
Grand total	$91,721,844.74	$38,403,748.62	$3,220,396.33	$3,798,414.36	$12,709,627.93	$33,589,657.50
From operation:						
Total	90,617,210.71	37,866,930.79	3,215,268.38	3,771,801.78	12,541,259.61	33,221,960 15
Passengers	89.711,829.39	37,536,924.08	3,125,871.49	3,718,541.80	12,464,962.10	32,865,529.92
Other sources	905,381.32	330,006.71	89,396.89	53.259.98	76,287.51	356 430.23
Rentals and miscellaneous	1,104,634.03	536 817.83	5,127.95	26,612.58	168,378.32	367,697.35
Expenditures:						
Grand total	87.388,006.65	37.066,110.78	2,994,802.27	3,476,075.55	11.700,492.06	32,150 525.99
Operating expenses	62,011,184.93	27.893,077.33	2,266,422.02	2,477,624.34	7,192,671.91	22,181,389.33
Fixed charges:						
Total	13.978,902.88	4,700,649.25	450,551.05	564,497.95	2,939,075.36	5,324,129.27
Rentals	2,561,342.50	615,232.01	19,436.55	1,525.30	288,631.00	1,636,517.64
Taxes and licenses	3,308.190.49	1,674 457 72	59,060.99	77.282.65	501,447.31	995.941.82
Interest	8,086,215.99	2,403,736.36	371,865.51	485,690.00	2,148,997.05	2,675.927.07
Miscellaneous	23,153.90	7,223.16	188.00			15,742.74
Payments from net income:						
Dividends	10,180,726.12	4 039,165.90	188 928 22	333.587.00	1,561,512.00	4,057.533.00
Miscellaneous	1,217,192.72	433 218.30	88,900.98	100,366.26	7,232.79	587,474.39
Total surplus for period	5,400,299.07	1,866,194.59	381.980.35	420.335.03	1,167,980.43	1,563,808.67
Total deficit for period	1,066,460.98	528,556.75	156,386.29	97.996.22	158,844.56	124,677.16
Net surplus for period	4,333,838.09	1,337,637.84	225,594.06	322,338.81	1,009,135.87	1,439,131.51

In conclusion, the balance-sheet of 81 per cent. of the operating roads will be found in the subjoined table:

Items.	All motive-powers.	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
ASSETS.						
Cost of road and equipment	$315,547,761.38	$121,283,492.18	$7,840,482.49	$15,353,698.21	$66,319,165.49	$104,750,922.01
Other permanent investments	46,830,823.07	5,920,962.22	357,309.23	410,646.48	21,781,166 54	18,360,738.60
Value of franchise	14,597,444.00	4,842,362.40	1,225,000.00	1,192 581.00	20,000.00	7,317,500.00
Bills and accounts receivable	7,538,199.98	1,877,493,47	46,666.67	24,453.05	3,488,918.53	2,100,668.26
Cash on hand	7,774,860.61	4,064,015.98	186,323.25	82,524.56	1,030,295.21	2,411,701.61
Supplies	2,157,292.37	801,314.45	31,724.75	73,261.64	346,130.64	904,860 89
Miscellaneous assets	10,418,987.83	1,783,546.33	870,033.43	857,035.13	2,151,117.59	4,757,255.35
Profit and loss (deficits)	3,610,082.15	2,281,954.35	116,055.94	467.358.34	345 222.91	399,490.61
Total	$408,475,451.39	$142,855,142.38	$10,673,595.76	$18,461,559.01	$95,482,016.91	$141,003,137.33
LIABILITIES.						
Capital stock	$211,277,798.08	$77,492,738.29	5,702,687.67	$8,775,854.53	$44,465,533.34	$74,840.984.25
Funded debt	151,872,289 01	49,226,234.01	3,486 200.00	5,584,500.00	44,369,000.00	49,206,355.00
Bills and accounts payable	16,325,347.08	4,926,246.03	1,163 022.84	299 653.41	1,525,841.55	8,410,583.25
Interest due	1,013,780.48	379,986.01	18,120.05	21,712.50	290,619.41	303,342.51
Dividends due	191,119.25	51,008.81	405.78	.....	45,268.90	94.435.76
Miscellaneous liabilities	12,838,218.52	2,366,366,04	156,284.27	2,754.730.59	2.674 488.79	4,886,348.83
Profit and loss (surpluses)	14,956,898.97	8,412,563.19	146,875.15	1,025,107.98	2,111,264.92	3,261,087.73
Total	$408,475,451.39	$142,855,142.38	$10,673,595.76	$18,461,559.01	$95,482,016.91	$141,003,137.33

The "81 per cent." of the street railroads referred to above is all that gave any satisfactory statement in the form of a balance-sheet, but it includes most of the important companies, and calculations to fill out the 100 per cent. can readily be made.

THE WEST END'S IMMENSE POWER HOUSE.

The immense power house of the West End Railway Co., of Boston, which has been in the course of construction in East Cambridge for several months, will probably be ready to start up by January 1. The premises were formerly occupied by the New England Glass Works. The railway company occupies the large main building, which is 100 x 125 feet in dimensions, and the boiler house, which is 140 x 50 feet. The first building has been practically rebuilt since it was abandoned by the glass company, but was reconstructed out of the same old brick. The rebuilding was made necessary by the falling in of the walls. The huge chimney, 230 feet in height, has not been disturbed. The plant consists at present of three engines, two of 100 horse-power each, which can be forced into supplying 500-horse power if necessary, and one of 500-horse power. The wheels of the big engines are nearly 29 feet in diameter and carry two belts, each five feet and three inches wide. Each of the big wheels and its shaft weigh 95 tons. They rest on brick and granite masonry, which in turn is built upon a concrete floor six feet thick, giving a most substantial foundation.

There will only be one engine ready for use Jan. 1, and that will furnish the power for operating 20 dynamos of 110 horse-power each, which will supply electricity mainly for the Cambridge division. These 20 dynamos are only temporary ones, as the Thomson-Houston Company is at work on ten of 500 horse-power, which will supplant the smaller ones just as soon as they can be constructed. This will undoubtedly take six months.

The company's property borders on a canal extending from the Charles River, which furnishes excellent shipping facilities. The canal is being dredged, and a wharf, extending twelve feet into the water, will be constructed.

ELEGANT EQUIPMENT.

President A. N. Broadhead, of the Jamestown, N. Y., Street Railway Company, has awarded contracts for eight long eight-wheel cars for use on his company's lines. There will be six open and two closed cars, the latter to run between Falconer and Lakewood. Two of the open cars will be motors. The closed motor cars are promised to be the finest street cars ever built. They will have six windows on a side besides one large bevelled plate glass in the centre. The deck will have etched and tinted cathedral glass. All trimmings will be solid bronze, there will be four handsome bevelled edge mirrors, and combination oil and electric chandeliers. The closed cars will be black and gold, the open ones white and gold. The J. G. Brill Co., of Philadelphia, has the car contract which is to be executed by February 15. The Short Electric Railway Co., of Cleveland, does the electrical work, which is to be completed by April 1. It includes two great generators. There will be two twenty-five horse-power motors to a car, guaranteed to make twenty-five miles an hour, with thirty-three-inch wheels without speed-coils.

A 200-light incandescent plant with boiler and engine will be installed in the car-barns.

A handsome mail and express car has just been received and will soon go into commission, making three in all.

SUNDRY IMPROVEMENTS ON THE WEST END LINE, BOSTON.

The second of the three double deck electric cars intended for the West End Street Railway Company, Boston, has arrived, and will be put on the Cambridge line.

The West End road is about to inaugurate a new departure in the painting of poles to designate the stopping points for electric cars. On all three-joint poles at such points, the middle joint will be painted white, and on the four-joint poles a section equal in length to that on the three jointers will be white. Under the present arrangement a narrow white band, 15 feet above the ground has been placed on poles at stopping points.

Twenty cars on the West End line have been fitted out with electric heaters, and put on the longest routes.

TWO TOWNS LINKED BY AN ELECTRIC ROAD.

The formal opening of the electric railway between East Liverpool and Wellsville, O., took place on December 17. The event was celebrated in a very enthusiastic manner, and many dwellings and places of business were decorated with stars and stripes. This road is over eight miles in length, and the construction work was begun 90 days ago. At one time over 600 men were employed on the work and the amount paid to the workmen alone will reach $80,000. The road cost over $300,000.

NEW ELECTRIC LINE IN ROVIDENCE.

The electric line between Pawtuxet and Providence, R. I., is rapidly approaching completion. Eight of the electric cars have already arrived, and are housed in the barn ready for operations as soon as the current is turned on. These cars are models of elegance and beauty. They were made by the Newburyport Car Company, of Newburyport, Mass., and are longer than the regulation horse-car.

Robinson Radial trucks will be used on the cars. The interiors are finished in hard wood, and the heavy cushions impart a sense of comfort. The cars are equipped with combination lamps for the purpose of lighting by electricity or oil as may be desired. Each car is provided with a set of self-locking iron gates, which will not be opened until the car stops, thus preventing possibility of getting on or off while the car is in motion and reducing the liability of accident.

In the overhead construction, trolley wires already extend from Pawtuxet to the Providence end of Broad street, and it is said that the first trial trip will be made very shortly.

FUSE WIRE.

The Sperry Electric Mining Machine Company, 39th street and Steward avenue, Chicago, Ill., has added a line of fuse wire to its specialties. The experience of the company in adapting electrical machinery to mining and railroad work, and in furnishing supplies for arc and incandescent lighting plants, convinced it that there was a pressing need for a more accurate system of fuse wire than that already on the market, and as the wire was directly in the line of electrical supplies and specialties, it made special efforts to secure the best and add it to its stock.

The wire is calculated for all classes of work, the smaller sizes being just the thing for ceiling rosettes and fuse boxes, and the heavier grades will insure against "burn-outs" in mining and railroad service.

The wire was carefully tested before being put upon the market, and a full and complete line is carried, which may be relied on for correctness of carrying capacity and absolute uniformity of size and alloy.

The company keeps constantly on hand fuse wire of all capacities from one ampère to two hundred ampères, and guarantees the wire to be everything claimed for it.

BROOKLYN ROADS TO ADOPT THE TROLLEY SYSTEM.

In our last issue we announced briefly the favorable report on the application of Brooklyn's four main street-railway companies for permission to adopt the trolley system on their lines.

As we were just going to press when the report reached us we were compelled to defer the publication of the details until the following issue, which we herewith give.

About two months ago the four main street-railroad companies of Brooklyn joined in an application to the City Council for permission to adopt the trolley system. These companies were the Atlantic Avenue Railroad Company, the Brooklyn City Railroad Company, the Coney Island and Brooklyn Railroad Company and the Brooklyn City and Newtown Railroad Company. The application of the companies was referred to the Railroad Committee, and on December 21 that committee submitted a report to the Council unanimously recommending that the application of the companies should be granted, and four separate resolutions, giving a franchise to each company, were presented. After a discussion the report in whole as well as the four distinct resolutions were adopted.

The reports of the committee on the application of these four roads are practically identical in their language save in the case of that on the Atlantic Avenue Railroad Company, which provides for the setting of poles in a special manner on a section of Atlantic avenue.

As these reports contain statements of extreme interest to street-railway people, and as their provisions are of such great importance and far-reaching in their effect, we give below, in full, the report on the Atlantic avenue road's application, which is practically the same as the others, except in the case of the provision referred to.

WHEREAS. The Atlantic Avenue Railroad Company, of Brooklyn, did, on the second day of June, 1890, make application to this Common Council for consent and power to run the cars of said company by electric power; and did also on the fifteenth day of December, 1890, renew said application, and did request that "authority be granted to said company to use electrical power in the operation of its cars, with the necessary appliances," and, also, on the sixth day of July, 1891, did present to the Mayor and Common Council of the city of Brooklyn a copy of the decision of the Board of Railroad Commissioners of the State of New York, in the matter of the application of the Atlantic Avenue Railroad Company of Brooklyn, for the approval by the Board of a substitution on a portion of its railroad of the electric trolley system in place of horse-power, in which decision it was provided that "all the poles shall be of iron or steel, with construction and height appropriate to the respective streets, and before erection shall be approved by the Mayor and the Common Council," and did ask the designation and said approval in the respects named, and did further, on the twenty-third day of November, 1891, in connection with certain other railroad companies of Brooklyn, petition this Common Council to grant "consent to change the motive-power from horses to the overhead single trolley system of electricity for the propulsion of their cars in the city of Brooklyn;" and,

WHEREAS, The Railroad Committee of this Board has had several public hearings on the aforesaid applications, at which the fullest opportunity was given both to the opponents and advocates of the proposed change from animal to electric power for the propulsion of street surface cars in the city of Brooklyn, and after said full and public consideration of the aforesaid application, said committee has reported in favor of granting the same; and,

WHEREAS, This Board is satisfied that the proposed system of electric motive-power is an improvement upon horse-power in the operation of street surface railways in cities, and that the interests of the travelling public in the city of Brooklyn will be promoted by the granting of said application; it is

Resolved, That the aforesaid application of the Atlantic Avenue Railroad Company, of Brooklyn, be and they hereby are granted, both as to the said company alone and in connection with the other railroad companies uniting in said last-named application and petition, such grant, however, being subject to the following conditions, restrictions and provisions:

Resolved, That we do hereby consent that the said Atlantic Avenue Railroad Company, of Brooklyn, may, and said company, its successors and assigns, is hereby permitted and authorized to substitute electric power by means of the system known as the single trolley, or otherwise, and to construct, erect and maintain all necessary constructions, poles, wires, fixtures and appliances, and all necessary span, trolley, curve and feeder wires for the transmission of electric currents, for the traction and propulsion of its cars instead of by horses or other animal power, on all of the streets and avenues and public places of the city of Brooklyn on which it has constructed or operated a railroad; and also on the tracks of other railroad companies on which it has a right to run and operate its cars, together with the right to construct, run and operate by like electric power all railroads which it now has lawful authority to construct and operate in the city of Brooklyn, and to erect and maintain all necessary constructions and other appliances as above in connection with the same; provided, however, that during any time that the operation of the cars by electric power shall be interfered with or suspended, animal power may be used for the traction of the same. This grant, permission and license and all the grants, permissions and licenses proceeding or following for the generation, use and employment and rentals of electricity and of electric currents are given only for the purpose of obtaining, supplying and using such electrical power for propulsion or traction and lighting of its cars, and for no other purpose whatever; and nothing herein contained shall warrant or permit the generation, use or employment of electric currents for the electric lighting of the streets, avenues or public places of the city, or of any public building, or of any private building, store, shop, dwellings, manufactory, or other structure in said city, save and except the cars, buildings and structures owned or rented and actually used by said grantee; and further, nothing herein contained shall warrant or permit the rent or supply of electricity for power purposes to any corporation or purpose whatever. During the reconstuction of its railroad on any street or avenue or any alterations hereby rendered necessary or desirable by the change in its motive-power, the said company is hereby authorized to place its construction material and lay any track for temporary use on such street, between its present tracks and the sidewalk; but the same shall not unnecessarily interfere with public travel on such street; and said company shall, on completing such reconstruction or alteration, restore the streets to their proper condition; and such work of restoration shall be subject to the supervision and approval of the Commissioner of City Works.

Resolved, That the poles which shall be erected by said company shall be of iron or steel, of suitable size and strength, and not less than twenty (20) feet in height above the ground, except where it is necessary to have them shorter for the purpose of operating cars under an elevated railroad; and we do hereby so designate and approve the same; and also that said poles shall be erected on the curb line of the sidewalks of the respective streets, with the exception that on Atlantic avenue, from the westerly line of Fifth avenue to the easterly line of Washington avenue, the said company is hereby authorized to widen its tracks, if it shall elect so to do, to the distance of nine (9) feet apart, and to erect and use poles in the centre between said tracks instead of on the curb line of that portion of said street; provided, also, that where the tracks of said company are located on any street or public place on which there is no curb line adjacent to its tracks, it may place the necessary poles not less than twelve (12) feet distant from the nearest rail.

Resolved, That said company is hereby authorized to connect any power station and plant which it may construct and equip by means of suitable electrical appliances, wires and connections along, under or where it is impracticable to sink or place said wires under said streets, over the streets and avenues running from such power station, with any or all of its respective lines of railroad, or any other power station or plant, for the purpose of supplying the necessary electric power for the traction and propulsion of its cars; and said company shall also have right upon terms mutually satisfactory to each company, to connect in the manner aforesaid by proper, suitable electrical connection, construction and appliances, its power station and plant with any power station and plant of its own or of any other street-railroad company in the city of Brooklyn which may have the consent of the Common Council of the city of Brooklyn; provided, also, that said company shall have the right to furnish electric power for the propulsion of the cars of any other company which may be run upon its tracks, and to receive and to use from any other company electric power for the propulsion of its own cars, which may be run on the tracks of said other company; the compensation in each case for the electric power so used to be such as may be agreed upon between the respective companies; the aforesaid work to be done by means of pipes and conduits under the surface of the streets, or, where said means are impracticable, by wires on poles along the curb line of the same; and said company is hereby authorized to make all necessary excavations and constructions therefor. But after the completion of said excavations and constructions said company shall restore the streets and the pavements thereof to as good a condition as they were in before they were opened, under the supervision and subject to the approval of the Commissioner of City Works.

Resolved, That said company is hereby authorized, with the consent of the owners thereof, to use the structure of any elevated railroad which may be over its tracks or which crosses the same, to support its electric wires for the propulsion of its cars on any street on which it operates or has the right to operate, a railroad; but nothing herein shall be held to conflict with or lessen its right to erect poles on the curb lines of any such street where the consent, as aforesaid, of the owners of any elevated railroad is not granted to the said the Atlantic Avenue Railroad Company of Brooklyn.

Resolved, That the consent of the city of Brooklyn is hereby given that said company may construct, maintain and operate its railroad by electric power as aforesaid in front of any property owned by the city of Brooklyn, upon and along any street, avenue road or highway in said city upon which said property fronts and upon which the said company has authority and right to operate a railroad.

Resolved, That in the operation of its cars by electric power said company may run them at such rate of speed as shall enable it to secure to the public the advantages of better and more speedy transit, with due and proper regard for the safety of others using the public streets, but such rate shall in no instance exceed ten miles an hour.

Resolved, That all ordinances and parts of ordinances and resolutions conflicting with these resolutions, so far as they conflict therewith, are hereby repealed, and the Commissioner of City Works is hereby authorized and directed to issue all necessary permits for the construction, reconstruction and alteration of tracks and other construction made necessary by the change of motive-power authorized by these resolutions.

Resolved, That excavations in streets, removals and replacements of pavements or sidewalks, are to be done by the said grantee, under the supervision and subject to the approval of the Department of City Works, and under such conditions as shall prevent damage to sewers, water-pipes, gas-pipes or other pipes, as may be prescribed by the said department.

Resolved, That said grantee, its successors and assigns shall execute and deliver a bond to the city of Brooklyn, in the penalty of $150,000, to be approved by the Mayor and Corporation Counsel, and said bond shall be so conditioned and so run as to save and indemnify the said city, its departments, officers and agents, from all claims and damages in any way resulting from any work done under their grant, permission and license, and from the erection and maintenance of all structures in the public streets, avenues and public places, and from all wires or cables placed under, along, above or across any public street, avenue or public place in connection with or in furtherance of such system of propulsion or traction herein consented to, and also from claims and damages resulting from the use, employment and maintenance of such electrical motive-power in said city by the said grantee, its contractors, servants, agents, successors, licensees and assigns.

Resolved, That these resolutions shall take effect immediately.

(Signed) M. J. COFFEY,
JAMES MCGARRY,
MOSES J. WAFER,
D. MCGRATH,
E. C. THOMAS,
Committee on Railroads.

It is stated that the cost to the four railroad companies concerned in making the change to the trolley system will aggregate $8,500,000, divided as follows: Brooklyn City Railroad Company $6,000,000, Atlantic Ave. Railroad Co., $1,500,000, and the other two—the Brooklyn City and Newtown and the Coney Island and Brooklyn $1,000,000.

DEFIANCE REJOICED OVER ITS ELECTRIC ROAD.

The Defiance, Ohio, electric-railway was put into practical operation a few days ago, amid joyous demonstrations on the part of the citizens, particularly the business community.

The road is to be extended to East Defiance, as soon as possible. The cars now in use were built by the Pullman Company and are elegant specimens of street-car construction. They are heated and lighted by electricity as well as driven by that means. The road-bed is said to be one of the best in the State. Manager S. L. Nelson received many congratulations on the successful operation of the system.

In referring to the road the Defiance paper says:

It is safe to say, that now that the people know what rapid transit means, that they will not be satisfied until they have roads reaching all of the most important points in the city.

NEW INCORPORATIONS.

The Neversink Light, Heat and Power Company, Reading, Pa., was incorporated December 16, with a capital stock of $50,000. Incorporators: George Brooke, R. T. Leaf and Henry T. Kendall.

The Waseca Light and Power Company, Waseca, Minn., was incorporated December 16, with a capital stock of $50,000. Incorporators: L. P. Ordway, F. L. Benjamin and Frank Benjamin, of St. Paul, Minn.

The White Bear Electric Company, White Bear, Minn., was incorporated December 17, with a capital stock of $10,000. Incorporators: H. M. Hyllesby, G. C. Duffie, W. P. Johnson, B. F. Meek, Jr., and H. C. Levis, all of St. Paul, Minn.

Everett Light and Power Company, Everett, Wash., was incorporated December 14, with a capital stock of $50,000. Incorporators: Henry Hewitt, Jr., F. H. Brownell, Tacoma, Wash.

The Electric Supply and Engineering Company, Detroit, Mich., was incorporated December 18, with a capital stock of $25,000. Incorporators: William H. Fitzgerald, William C. Clark and Frank C. Teal, all of Detroit, Mich.

The Adirondack and St. Lawrence Telegraph and Telephone Company, has been incorporated to operate in Franklin, St. Lawrence, Herkimer and Hamilton Counties, with a capital of $75,000. Incorporators: W. S. Webb, H. L. Sprague, E. M. Burns, F. G. Smith, F. Egerton Webb, John H. Prall and James Eagen.

The Akron Electric Light, Heat and Power Company, Akron, Ohio, was incorporated December 18, with a capital stock of $300,000. Incorporators: Ira M. Miller, H. H. Crowther, A. S. Hanscom, P. P. Burnett and C. H. Loomis.

The Noblesville Light and Ice Company, Noblesville, Hamilton Co., Ind, was incorporated December 18, with a capital stock of $25,000. Incorporators: J. L. Peck, S. J. Peck and George S. Christian, all of Noblesville, Ind

Sprague, Duncan & Hutchinson (L'td), (incorporated in Florida) New York City, N. Y., was incorporated December 17, with a capital stock of $50,000. Incorporators: Frank J. Sprague, Alfred Bishop Mason and Cary T. Hutchinson.

The Colchester Electric Light and Power Company, Colchester, Ill., was incorporated December 18, with a capital stock of $6,000, Incorporators: S. D. Mills, John E. Hall and M. P. Agnew.

The Nebraska Power Company, Omaha, Neb., was incorporated December 18, with a capital stock of $250,000. Incorporators: J. A. Creighton and Lewis L. Reed.

The Fairbury Electric Light and Power Company, Fairbury, Neb., was incorporated December 18, with a capital stock of $30,000. Incorporators: H. E. Chubbuck, Fred W. Allen, Frank Dugan, Samuel W. Schweitza, R. B. Howell, Fairbury, Neb.

The State Electric Light, Heat and Power Company, Jersey City, N. J., was incorporated December 15, with a capital stock of $100,000. Incorporators: H. V. Cole, Belleville, N. J.; Edward S. Frazer, Mt. Vernon, N. Y., and A. F. Crawford, Haverstraw, N. Y.

The Mexican Chemical-Electric Company, Chicago, Ill., was incorporated December 22, with a capital stock of $2,000,000. Incorporators: W. S. Baker, B. H. Ottinger and J. C. Ottinger.

The Boonville Electric Light and Power Company, Boonville, Ind., was incorporated December 22, with a capital stock of $10,000. Incorporators: L. J. Miller, S. B. Hatfield and C. M. Hammond.

ELECTRIC LIGHT NOTES.

Some prominent citizens of Livermore Falls, Me., are considering the advisability of establishing an electric-light plant in that town. Hon. R. C. Boothby is at the head of the movement.

The electric light and power house at Brunswick, Md., was destroyed by fire a few nights ago. The apparatus is a total wreck. Loss, $10,000.

Work is progressing on the new plant of the Thomson-Houston Electric Light Company, Mitchell, S. D. There has been a great increase in the demand for light this fall.

At Newport, R. I., the Edison Company is engaged in laying a cable which will serve the Goelet Mansion and Ochre Point with electric lights. Fifteen hundred incandescent lights will be required for the Goelet villa alone.

The electric light company of Ann Harbor, Mich., is putting in a 650-lamp alternating-current machine to meet the demand for light.

Guilford, Me., has recently put in an electric-light plant and the people are highly satisfied with the results.

Thompsonville, Conn., is now lighted by electricity, the plant having just been completed.

The electric light plant in Ridgefield, Conn., will probably be completed in the early spring. The Thomson-Houston incandescent system has been adopted, and for street lighting 32-candle-power lamps will be erected at a distance of 100 feet apart.

Negaunee, Mich., has effected an arrangement with the electric light company to light the street by electricity. Thirty lights are to be used to burn all night, and the cost to the city will be $10 per lamp per month.

The Dickson Electric Light Company and the Gas Company, Dickson, Ill., have consolidated and will hereafter operate as one concern.

Irwin, Pa., has contracted with the Irwin Electric Light and Power Company to light the town completely by electricity.

EXTENDING ITS WORKS.

The large and increasing business done by the Crocker-Wheeler Electric Motor Company, New York, has several times made it necessary, during the year just closing, for that company to secure more room for manufacturing purposes. The company reports that it has again taken additional space in the buildings occupied by it at 430–432 West 14th street, and will put in considerable more machinery.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Dec. 26, 1891.

MR. H. W. SELLER, the inventor and patentee of Sellers' water tube boiler, Electrical Exchange, 136 Liberty street, this city, is having made at the works of the Watertown Steam Engine Co., Watertown, N. Y., two of these boilers of 350 horse-power for the Metropolitan Museum of Art, this city. They will supply the power to operate the electric light plant in the museum building. These boilers, it is said, give more power in less space and make more steam with less fuel than any other boiler in use.

MR. HENRY G. ISSERTEL of the Railway Department of A. B. C. Co., 20 Cortland street, this city, has just returned from an extended trip through the West, and reports success.

A. B. C. Co., 20 Cortlandt street, has set apart a large portion of the store as the street railway department, which is now in full blast. The A. B. C. lamp is said to be the only lamp in use that successfully stands the strain and hard usage incident to street railway car service. The house is carrying a large line of railway appliances and line material, including insulators, bus-wires, gear-wheels, the best rails and rail-chairs, brackets, trolley-wheels, etc. The new A. B. C. double-pole switches have some excellent features. The caps and handles are of brass, and the contact points are reliable, the whole occcupying a very small space.

MR. H. C. WILLIS, of the late firm of Willis & Hunter, this city, has just returned from Puerto Cabello, Venezuela, where he installed a 105-arc light plant for that city. Mr. Willis was there 13 months.

COBB, DANBY & KNOTT, electrical engineers, have opened new offices in the Electrical Exchange building, 136 Liberty street.

THE NEW YORK INSULATED WIRE COMPANY, which has had its headquarters so long at 649 and 651 Broadway, will on January 1, 1892, remove to 13–17 Cortlandt Street, this city. The company's well known Grimshaw White Core Insulated wire and Vulca Electrical Wire Ducts continue to be staple goods on the market, and Mr. J. W. Godfrey, the general manager, reports the business outlook for the new year very encouraging.

MCLEOD, WARD & CO., electrical and mechanical engineers, 91 Liberty street, this city, do a large business as expert electrical and mechanical engineers and in the installation of electric motors for general power purposes, such as running elevators, printing presses and machinery in general. They have just closed a contract for an elevator outfit in the establishment of A. H. King & Co., 649 Broadway, which is to be operated by a special 6 H. P. Motor. The elevator was made by Reedy of this city. This installation is on the firm's own system and will be used for both passenger and freight purposes. This firm was one of the first to install elevator plants in combination with electric motors. Electric light wiring is also made a specialty by this concern, which has just closed a large contract in this city. The McLeod-Ward arrester prevents the sparks from flying from arc lamps and protects the lamps from dust, etc. It is simple in construction and very effective in operation. The arc lamp shades made by this firm are made of the best galvanized iron, and are strong and durable.

MR. D. H. BATES, of the Equitable Manufacturing and Electric Company, 44 Broadway, New York, has just returned to this city after an extended trip in Europe. Mr. Bates arrived on the City of Chester, December 21.

THE GOUBERT FEED WATER HEATER COMPANY, 30 Cortlandt street, this city, on December 21 last delivered one 2000 H. P. feed water heater to the 26th street station of the Edison Illuminating Company. This immense heater is 16 feet high and 3 feet in diameter. The Goubert company installed, about two weeks ago, a 1000 H. P. heater in the station of the Detroit Electric Light Company, Detroit, Mich.

THE ZUCKER & LEVITT CHEMICAL CO., 40 Murray street, this city, has issued a neat little catalogue descriptive of the Hercules electric motor and dynamo, manufactured by that concern. The catalogue contains several testimonial letters concerning these machines.

THE STANDARD PAINT COMPANY, 2 Liberty street, this city, is issuing a very neat pocket calendar for 1892 It consists of a tablet of celluloid in imitation of tortoise shell, on which a complete monthly calendar for the entire year, is stamped in gold. It is one of the neatest things we have seen in a long while. W. T. H.

BALL ENGINES.

The Ohio Baking Co., Cleveland, O., has just added an 80 H.P. automatic cut-off engine built by the Ball Engine Co., Erie, Pa., for electric light purposes.

The Linderoth Ceramic Co., Chicago, has just installed a 25 H.P. steam plant furnished by the Ball Engine Co., Erie, Pa., through its Chicago Office, 506 "The Rookery."

The Cleveland Hardware Co., Cleveland, O., has added a 100 H.P. automatic cut-off engine to its already large capacity. The engine is the well-known Ball engine built by the Ball Engine Co., Erie, Pa.

The Lawrence Gas and Electric Light Co., New Castle, Pa., has been increasing its capacity by the addition of a 150 H.P. Ball engine, built by the Ball Engine Co., Erie, Pa. Dravo & Black, the Pittsburg agents of the Ball Engine Co., did the installation.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	55 00
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone. N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	203 50
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	147 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	100 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	24 00
Detroit Electrical Works	1,000,000	10 00	9 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	96 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	43 50
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		66 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	20 50
Laclede Gas pref	2,500,000	100 00	61 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y.	3,500 000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	18 00
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s	1 500 000		*98
N. Y. and N. J. Telephone Stock	2,535 000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	420 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50,000		*95
North American Railway Co	39,767,200	100 00	19 00
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	38 00
Pennock Baty. E.L.& Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500 000	100 00	75 00
Public Wks. Imp. Co., Tenn, 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150 000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E L. & P. Co. 6s, Mich	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750 000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	10 00
Shaver Corporation N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00

South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	51 00
Thomson-Houston pref.	4,000,000	25 00	26 00
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co.,Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1 500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100,000	100 00	75 00
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	84 25
Westinghouse Electric Co	7,000,000	50 00	12 50
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The shareholders as well as the depositors in the banks of the country are learning a rather bitter lesson about this time. There appears to be an epidemic among them more fatal than the grip; the fortunate depositor hears of a weakness one day and finds the crape, or usual notice, on the door the next, while his neighbors run bang into the funeral without any previous notice whatever. Assuming the following dispatch, received December 21, to be correct, we must accord the principals the palm and place the name at the head of the list. It runs thus: "Woodstock, Va., Dec. 21.—Five banks controlled by Rosenberger, Shirley & Co., were closed to-day in the Shenandoah Valley. The banks are in Warrenton, Gordensville, Basic City, Waynesboro and Newmarket." That must be some new electric method of annihilating credit; opponents have about exhausted the whole list of disasters and charged it to electricity. We think this wholesale slaughter of the innocents is a good time to draw the line. Had these five institutions used their money judiciously in electrical industries, historical Shenandoah would have had pleasanter holidays this year than for the past twenty. New York must look to her laurels; even Boston and Philadelphia with all their modern wicke lness cannot show such a record.

British capital has scored another victory in competition with the American investors. This time it takes the shape of Fire Insurance. That old, well-known company, the Lancashire Fire Insurance Company, of Manchester, England, having secured the entire business of three American companies, with business aggregating $200,000,000, and a reserve fund at present over $1,000,000 cash. This is repre sented as the largest insurance negotiation ever brought to a successful conclusion in any part of the world, and will no doubt stimulate our home companies to exercise a greater amount of energy in seeking for business at more equitable rates. When those who pay the premiums glance at the solid stone assets of the great corporations it must often cause them to think that a very considerable reduction in rates would enable each to labor on with satisfactory security. There is a limit above which a company indulges in unnecessary luxuries. Salaries, commissions, adornments and other excesses may show in the accounts that the income has been carefully tabulated, that the balance-sheet is correct, but either as a reserve, surplus or rebate on future payments the cash would be of more service to those who paid it in. The insurer is apt to ask himself how many of the recipients enumerated above are on the books as his co-insurers, and as he realizes the infinitesimal sum returned to the common treasury of the gross and in too many instances extravagant outlays, he will, to put it mild, arrive at the conclusion that he is hardly doing business on business principles.

Mr. Hamilton Gann representing British capital, has just secured a charter from the Legislature of South Carolina for a bank with a capital of $5,000,000, to be known as the Union Bank of South Carolina and London, to be located in the city of Columbia, S. C. The Earl of Dunmore as its first president is a guarantee to the shareholders of a sound but liberal use of their money. This will also in many ways tend to enhance values throughout the South, although it no doubt will despoil New York of no small sum in the shape of commissions and interest. Columbia has very recently completed her grand canal, the water-power in which will make her one of the commercial cities of the country, a veritable "Niagara of the South" utilizing its force, and electric-motor force will be conveyed many miles from its banks to sister cities. As a city for investment not one in the whole South to-day offers equal advantages to limited capital.

California is struggling hard to keep up her reputation for big things, the latest being a nugget of pure gold weighing 203½ ounces and worth in Uncle Sam's greenbacks of the new $2 brand, nearly $4,000. The "chispa" is eight inches in length, five in width, and varies from two to five inches in thickness. This last specimen of gold-dust was found near Forest City, Sierra County, and was, unfortunately, overlooked by me when mining there in the early fifties.

Montana is working well up to the front and pushing for first place with a mine of precious stones more extensive than any ever before discovered. Strange as it may seem, fully three weeks ago the prospectus of this immense deposit as explained by the brilliant London promoter reached me from England in the "Investors Guardian" whose forte it is to publish the birth, life and death of all public companies, and the whole page was filled with noble and almost royal names of the first subscribers, and yet so quietly was all this carried out that within a few days the rumor has been telegraphed and published in the New York papers, fresh from Montana, that the sale was progressing favorably. There must be a short circuit of her electric signals to the snow-clad hills of our new sister State to permit us to have her local news so long in advance, *via* the ocean. We have so many good things that we MUST all get rich before 1892 is half over.

The Western Union Telegraph Co. has declared the regular quarterly dividend of one and a quarter per cent, payable Jan. 15, 1892. The statement for the quarter ending Dec. 31, 1891 (Nov. and Dec. estimated), as compared with 1890, shows an increase all along the line, as follows:

	1890.	1891.	*Increase.*
Net revenue	$2,000,000	$2,000,000	.....
Surplus, Oct. 1	10,733,832	12,269,190	$1,535,358
Interest and S. F.	242,483	242,483	.....
Balance	12,491,349	14,026,890	1,535,541
Dividend	1,077,400	1,077,400	.....
Surplus	11,413,949	12,949,485	1,535,536

This may be accounted for in a great measure by the natural growth of the population and the more economical service accompanying the scientific attainment of the art in connection with electric advancement. Although the Postmaster-General of Great Britain has decided that for the present a universal penny postal rate is commercially impossible between England and her colonies, is it not a proper time for the Western Union Company to seriously consider a reduction and a universal rate for all parts of the United States with a view to its adoption next fall? It would please the public immensely, and popularize the corporation beyond measure, beside enabling a very large and growing class or grade of the people to indulge in telegraphing who now never use it except on extra occasions.

The Western National Bank has declared a semi-annual dividend of 3 per cent., payable Jan. 2, 1892, an increase of ½ per cent., making it a 6 per cent. stock. The deposits have increased within the year to over $10,500,000 as compared with $7,000,000 when the present management took charge. The Bank's connection with the late reorganization of the Westinghouse Electric Company should, and no doubt will, serve to make it a factor in many of the larger financial operations of the great electric industrial corporations all over the land, as they come to the front. The bank which secures the majority of this particular business may laugh at the current commercial failures as reported by the registers. I am always pleased to note in this article any financial incident tending to aid the electrical public and to welcome to the fold every monetary institution connected with electric securities.

There are a few among the many figures embraced in the President's message, as reported by the Secretary of the Treasury, which are of particular interest to the taxpayers who regularly read the financial articles in the ELECTRICAL AGE. The income from all sources for the fiscal year ending June 30, 1891, was $458,544,233, and the expense for the same period $421,304,470, leaving a surplus of $37,239,762. To this must be added several reserve sums, bringing the amount up to $134,947,735.48. The 4½ per cents. have practically been replaced with 2 per cents., interest ceasing on the former on Sept. 2, 1891. The fluctuation in the value of silver bullion resulted in a loss of nearly twenty-five cents per ounce of fine metal. It began the year at $1.05, the highest price reached was on Aug. 19, 1890, $1.21 per fine ounce. The closing price on June 30, 1891, was $1.01¼, and on Nov 1 had reached $0.96. For all current purposes, so far as the people outside of the banks are concerned, the brand of the United States Government on a piece of silver or paper will make it a legal tender for its full face, and the struggle for it be continued. The population of the country today is 64,680,000, and the circulation per capital is $24.38, leaving in the Treasury $727,849,839. The gold exported early this year is being rapidly returned; the financial suffering, if any, is all on the other side of the ocean, and about $18,000,000 gold and $9,000,000 silver was used in the industrial arts during the past year. There are 3,694 national banks in operation having a capital stock of $684,755,865; bonds deposited to secure circulation, $152,113,850; with bank-notes outstanding, $171,468,948. A grand proof of the perfection of our national bank system exists in the fact that only 3½ per cent. of them have become insolvent in the whole twenty-nine years of their existence, and the average loss to creditors has been only one-twentieth of one per cent. What a glorious change, my countrymen, from the latter sixties, when we had a debt of two thousand millions staring us in the face! The very thought is electrical.

BOSTON NOTES.

NEW ENGLAND OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET,
BOSTON, Dec. 26, 1891.

AMONG the most interesting literature issued by the Railway Department of the Thomson-Houston Electric Company, Boston, are the pamphlets issued in October and April last year. The former gives a good deal of information about snow sweepers, railway supplies, etc., and gives a list of roads operated by the Thomson-Houston system. The other pamphlet gives some general information on gear-presses and an article entitled Electricity *vs.* Snow, concerning electric snow-ploughs.

THE SAMSON CORDAGE WORKS, 115 Congress street, Boston, does a large trade in sash cord, bell cord coup ings, elastic belt couplings, cord grips, etc. These cords are unexcelled for street car uses, and for many purposes in connection with the electrical trade these cords are claimed to be superior to all others. They are made of the best material and are carefully finished. They are also water-proof finished thus protecting them from the action of the atmosphere.

THE AMERICAN CIRCULAR LOOM COMPANY, manufacturer of patent woven covered insulated wires and cables, 620 Atlantic Avenue, Boston, reports a good trade among electric light, telephone and telegraph companies, and users of insulated wires and cables generally. This company is the manufacturer of a patent seamless woven covering, and claims for it added tensile strength to the wire over any other form of covering, and longer life for insulation. A non-combustible water-proof insulating compound is used, which, it is said, gives the wire the longest life, is the strongest and least susceptible to abrasion and the best fire-proof elastic covered wire in existence.

THE WASHBURN & MOEN MANUFACTURING COMPANY, Worcester, Mass., continues to keep to the front in the manufacture of wires for all electrical purposes. This company does a large business in iron, steel and copper wires for telegraph, telephone and general electrical purpo es, and its goods are the standard with all telegraph and telephone companies. The wires are made in long lengths, galvanized by the company's patented continuous process, and they fill every requisite as regards strength, uniformity in quality and conductivity. The company's pocket handbook, giving facts concerning the electrical service of the world, is full of interest to every one in the business, and a copy of it can be obtained on application. D. L. T.

GENERAL TRADE NOTES.

MR. GEORGE CUTTER, of Chicago, sends the season's greetings to his friends in the shape of a neat folder containing a tender sentiment and one of his characteristic illustrations.

THE VIADUCT ELECTRIC COMPANY, of Baltimore, Md., is extending the compliments of the season to its many friends in the shape of lead-pencils, on which the company's name is stamped in gold letters.

D. & D. ELECTRIC MANUFACTURING COMPANY, 745 and 747 Washington avenue, North, Minneapolis, Minn., has been in business about three months, and is meeting with encouraging success. It manufactures electric motors, arc and incandescent dynamos, electric elevators, etc., and deals in general electrical supplies. Mr. Gilbert Donaldson is the president and general manager.

THE CARPENTER ELECTRIC-HEATER MANUFACTURING CO., corner St. Peter and Exchange streets, St. Paul, Minn., is doing an extensive business in the manufacture of electric flat-irons, hat-irons, tailor pressing-irons, griddle-irons and heaters for buildings and street car heaters. These goods are giving excellent satisfaction through their convenience and reliability. A representative of the ELECTRICAL AGE and STREET RAILWAY NEWS called upon this enterprising concern a few days ago and was shown through the factory by Messrs. Carpenter and Swinton, the latter gentleman being the business manager,

W. T. OSBORNE, electrical engineer and contractor, Kansas City, Mo., is agent for the Eddy Electric Manufacturing Company. Mr. Osborne installed the electric plant in the new Coates House. This pl nt embraces 2,200 lights, 600 of which are in the Coates Opera House, which is situated a short distance from the hotel. Mr. Osborne has just completed the installation of a plant of 400 lights on the Eddy system in a new building, and is just fitting Oglesby & Jones' new building, corner of Missouri avenue and Walnut

street, with 800 lights, and Mr. Ridge's building, between Ninth and Tenth streets, with 500 lights.

MR. OTIS K. STUART, well known through his connection with the Germania Electric Company, of Boston, and whose removal to Philadelphia we noted a few isssues ago, has finally got settled in the City of Brotherly Love. His office is room 21, City Trust Building, 927 Chestnut street, Philadelphia, and he will deal in electrical supplies in general, particularly dynamos, transformers, lamps, sockets, shades and holders. Mr. Stuart will also act in the capacity of agent for the Germania Electric Company, of Boston, in the Southeastern District, and, as Mr. Stuart is well and favorably known in the trade, there is no doubt but what his new venture will prove a successful one. He has the best wishes of a large circle of friends.

Queen & Co., 1010 Chestnut street, Philadelphia, have recently bought the American Cardew patents for the purpose of manufacturing and selling the Cardew electrical instruments. As is well known the Cardew voltmeter depends for its action upon the expansion of a wire rendered hot by the passage of an electric current. The Wagner-Queen voltmeter, which has recently been placed upon the market by this firm, is constructed on the same principle, and it has seven characteristics, which are: portability, compactness, durability, constancy, accuracy, deadbeatness and direct reading. Queen & Co. are nicely settled in their handsome new salesrooms, which are much larger than the old ones.

SCRANTON, PA., NOTES.

MR. J. A. DALZELL, general manager, and Col. W. A. Sheldon, of the Schuyler Electric Light Company, Middletown, Conn., are in Scranton attending to some business with the Suburban Electric Light Company. Col. Sheldon has just sold a 50-arc-light plant to the city of Niles, O. This plant was started on December 15 amidst great rejoicing among the citizens.

THE WIGHTMAN ELECTRIC MANUFACTURING COMPANY, Scranton, Pa., is very conveniently located. The works are situated near a coal-mine and are within 20 minutes' ride from the heart of the city, and the distance from New York City is covered in four hours. Mr. M. J. Wightman is the electrician, and Mr. H. Bergholtz general manager of the company. The power for the factory as supplied by a 15 H. P. Thomson-Houston second-hand street-car motor, which gets its current from the circuit of the People's Street Railway Company, which runs by the door. The company is very busy on a number of street-railway motors of its own special type, and it is also engaged in constructing a large variety of railway specialties. The company does its own brass and bronze castings, but all heavy castings are done by Scranton parties.

THE SUBURBAN ELECTRIC LIGHT COMPANY, of Scranton, Pa., is now having a 500-volt Vandepoele railway generator changed into an alternating-current generator. The work is being done by Mr. M. J. Wightman, electrician of the Wightman Electric Manufacturing Company. On the first trial of the machine they got 70 lights out of three coils, with the machine running at very low speed and without an exciter. While this result was very satisfactory, some slight changes will be made, and they expect to get 1,000 lights from the same machine. An old 500-volt Vandepoele generator is now running at low speed, giving 110 volts for incandescent lighting. The company is also running one 60-arc light Vandepoele machine and three 50-arc Schuyler's. The power-plant consists of two 200 H. P. engines, made by the Dickson Manufacturing Company, of Scranton, Pa., having plain slide valves. The Suburban Company is running a total of 150 arc lights; 22 in Providence, 45 in Dunmore, and the balance in Scranton. Mr. A. H. Jones is superintendent of the company.

P. & B. INSULATING COMPOUNDS.

The following is an extract from a letter written by Mr. George P. Low, electrical inspector for the Pacific Insurance Union, San Francisco, under date of November 16, 1891, to the Paraffine Paint Company, San Francisco:

"Permit me to express appreciation of the inestimable benefit you have conferred upon the electrical industry in perfecting and bringing out your P. & B. electrical compound. I know of nothing in the way of an insulating paint for all-around work that is comparable to it."

The Paraffine Paint Company manufactures the P. & B. insulating compounds on the Pacific Coast and for the territory west of the Rocky Mountains. It is a sister concern of the well-known Standard Paint Company, of 2 Liberty street, New York.

The Pacific Insurance Union, referred to above, controls the entire insurance work on the Pacific Coast. Early this year Mr. Low, the electrical inspector, made tests of all the insulating materials offered for sale on the Pacific Coast, so as to determine on the safest insulation for the wiring of buildings. This was done for the Insurance Union, as electricity was becoming so generally used for buildings on the Coast. Severe tests of the compound were made, the P. & B. standing the tests better than anything else, and it is now compulsory that P. & B. be used in all electrical work which comes under the control of the Pacific Insurance Union.

The Pacific Postal Telegraph Company is painting its bare wires on the Pacific Coast with the P. & B., and it has been demonstrated that wires so painted have worked perfectly during the heaviest rains and the densest fog, while through the unpainted wires not a tick could be heard at such times.

INFRINGING THE "JEWEL" LAMP TRADE-MARK.

TO THE EDITOR ELECTRICAL AGE: In looking over the list of new incorporations in a recent issue of the Chicago *Evening Post* I noticed that certain parties, wholly unauthorized by me, have made application to the Secretary of State for the incorporation of a company for the manufacture of incandescent lamps—this company to be known as the "Jewel Incandescent Lamp Company."

The purpose of these parties, whoever they may be, is evidently to appropriate the name "Jewel" as applied to incandescent electric lamps and for the purpose of defrauding me of my trade-mark, which I have extensively advertised and introduced and which name has become very valuable.

The name or trade-mark "Jewel," as applied to incandescent lamps, originated with me and is my personal property. Any attempts by other parties to pirate this name is not only an injustice to me; but to users of the "Jewel" Incandescent Lamp.

WM. HOOD.
239 LA SALLE STREET, CHICAGO, Dec. 24, 1891.

NEW BABBITT METAL.

The Raymond Lead Co., of Chicago, whose advertisement appears on the front cover of this number, has recently placed upon the market a new brand of Babbitt metal which is said by those who have tried it to give very excellent results.

This company was one of the first to recognize the high value of aluminum in the arts, and more particularly as a constituent of Babbitt metals. It does not claim that any one grade of metal is suitable for all places, as do many of the manufacturers of the special brands of Babbitt metal placed upon the market, and therefore it makes two grades, one called "extra aluminum" and the other "genuine aluminum." The former is suitable for all places except those few bearings which are subject to an unusual amount of pounding or very great crushing weight. It has excellent anti-friction qualities and requires much less lubrication than do most Babbitt metals.

We think manufacturers and machinery men would do well to investigate the merits of the Raymond Lead Co.'s metal. The company also makes a full line of standard grades of Babbitt metal and does a large business in ingot brass and brass castings.

FOR SALE.

A plot of ground containing over 17,000 square feet suitable for the erection of an electrical manufacturing plant, surrounded by machine, belting and cable manufactories.

This plot of land is particularly valuable, inasmuch as it is situated within one block of the city line of Boston. Frame buildings can be erected if desired. Land fronts on three streets. Price low. About three-fifths of purchase-money can be carried on mortgage at 5 per cent. if desired. Address by letter

DANIEL L. TULLIS, 65 Oliver street, Boston, Mass.

A large lot of hard-rubber battery-cells; outside dimensions, 7¼x7¾x11¼ inches high; shells, $\frac{5}{32}$ of an inch thick; moulded cover with knob on top; several thousand in stock, Also, 60 hard-rubber cells; inside measurement, 4x15x15 inches high; thickness of shells, $\frac{3}{16}$ of an inch; without covers. All new cells. For sale at a bargain.

HARD-RUBBER CELLS, care of this office.

USED IT SEVERAL YEARS.

LEWISTON, ME., Oct. 23, 1891.

JEROME KIDDER MFG. CO.—GENTLEMEN: I now have your No. 1 apparatus; have used it several years; am well pleased with it. Yours truly,

DR. W. S. NORCROSS.

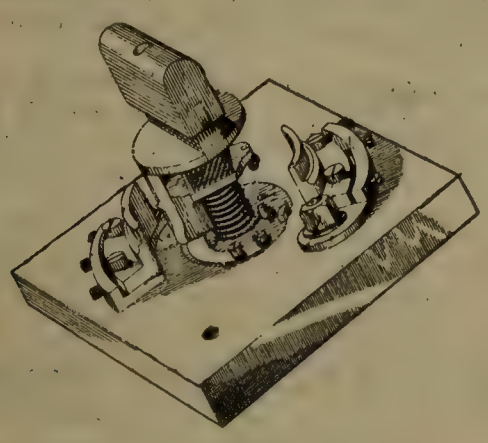
The Union City Electric Light Co., Union City, Tenn., has just received an 80 H.P. Ball engine from the Ball Engine Co., Erie, Pa.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued December 22, 1891.

465,444. Electric Switch. Henry Barton, London, England, assignor to John Abbott Iliffe, same place. Filed Dec. 15, 1890. Patented in England.

465,470. Globe-Holder for Electric-Arc Lamps. Horatio A. Foster, New York, N. Y., assignor to



465,444.—ELECTRIC SWITCH.

the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 3, 1890.

The combination, with the standards of an arc lamp, of a globe surrounding the standards, a globe-holder attached to the top of the globe, having a bearing upon its upper side, and a clamping-jaw pivoted in the bearing and furnishing means for clamping the holder to one of the standards of the lamp.

465,501. Train-Signalling Apparatus. Paul Synnestvedt, Chicago, Ill. Filed Oct, 13, 1890.

465,508. Cut-Out for Incandescent Lamps. Herbert C. Wirt, Boston, Mass. Filed March 28, 1890.

The combination, with an incandescent lamp, of a connecting device having two concentric terminals respectively connected with the terminals of the lamp, with an insulating-piece interposed between the concentric terminals, and a cut-out spring connected to one of the concentric terminals and separated from the other by a film of insulating material, one of the terminals enclosing and protecting the cut-out spring.

465,511. Electric Snap-Switch. William S. Andrews, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed May 7, 1891.

The combination, in a switch or circuit-breaker, of a base, terminals mounted on it and extending perpendicularly therefrom, a switch-arm pivoted to one of the terminals and movable in a plane at right angles to the base, a handle pivoted to the same terminal and movable independently of the switch-arm, a spiral spring connecting the handle and switch-arm, means for positively communicating motion from the handle to the switch-arm after the former has made a partial movement, and a second terminal in position to co-operate with the switch-arm.

465,512. Rheostat. William S. Andrews and Alfred K. Warren, New York, N. Y., assignors to the Edison General Electric Company, same place. Filed Aug. 25, 1891.

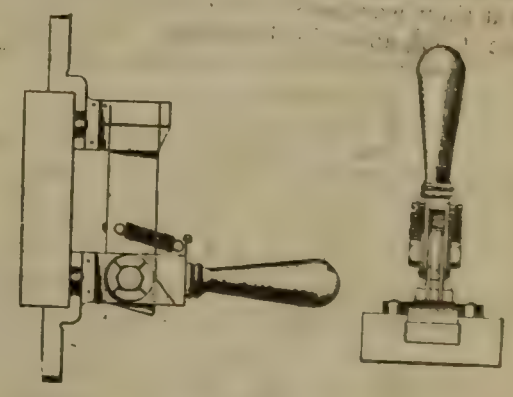
The combination of a fan-guard and a resistance-wire wound around it.

465,514. Electric-Arc Lamp. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed June 13, 1891.

The combination, with a cut-out circuit for an arc lamp having main and shunt coils, of a circuit-controller for the cut-out circuit, moved by the shunt coil or magnet, a resistance in the cut-out circuit sufficient to divert current to the main magnet to re-establish the arc when the carbons come together, a catch or lock in position to engage and hold the controller when moved by the coil or magnet, and means controlled by the main magnet for disengaging the catch or lock.

465,516. Show-Globe. Otto Berger and Hilliary Eldridge, Galveston, Texas. Filed August 4, 1891.

465,525. Electrolytic Apparatus for Treating Metals. Howard S. Hayden, Waterbury, Conn. Filed Nov. 5, 1887.



465,511.—ELECTRIC SNAP-SWITCH.

In an electrolytic bath having a number of plates unconnected electrolytically excepting through a solution in the bath and having narrow partitions extending from opposite sides of the bath adapted to hold the plates in a vertical position and out of contact with each other, stops wholly between the partitions supporting the plates above the bottom of the bath.

465,564. Conduit for Electric Wires. Henry W. Johns, New York, N. Y. Filed April 1, 1891.

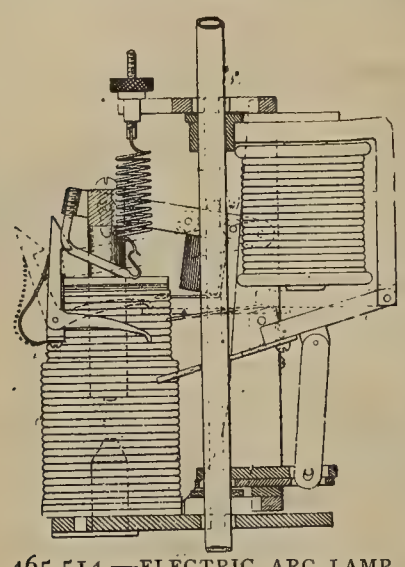
A conduit for electric wires, composed of strips of compacted asbestus-fibre wound in opposite directions, and waterproofing material and cementing material.

465,594. System of Electrical Distribution. Frederick A. La Roche, Philadelphia, Pa., assignor to the La Roche Electric Works and George H. Earle, Jr., same place. Filed Oct. 9, 1891.

A lead electrically connected to and connecting the positive poles, and a lead connected to and connecting the negative poles of the sources of electricity and following the same path as the lead connecting the positive poles, but in a reversed direction, and translating devices electrically connected between the leads at various points thereon between the points of electrical connection at the sources of electrical energy.

465,602. Electric-Circuit Closer for Burglar-Alarms. William C. Thompson, Minneapolis, Minn., assignor to the Western Electric Company, Chicago, Ill. Filed Oct. 19, 1889.

A spring mounted upon the window-frame opposite the edge of the sash, and a metallic roller provided with a metallic lateral pin, the roller being carried at the free end of the spring and projecting through a slot-opening therein, to bear against the edge of the window-sash, in combination with a hooked contact-spring which carries the roller, the hooked spring being placed in the path of the lateral pin



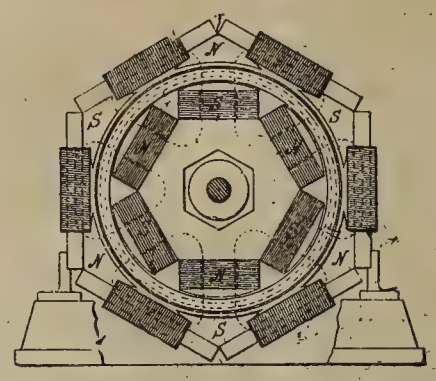
465,514.—ELECTRIC ARC LAMP.

to form contact therewith and hold the wheel from rotating after the window-sash is raised a fixed distance, whereby electrical contact is maintained between the spring carrying the roller and the hooked spring.

465,618. Electric Switch. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Filed April 16, 1891.

An electric switch comprising a base-plate, a rocking-lever supported upon an axis parallel thereto, a detent detachably engaging one end of the lever, a contact-piece carried by the opposite end thereof, but insulated therefrom, circuit terminals engaged by the contact, and spring push-buttons extending through the base-plate and engaging the lever, whereby it is adapted to be thrown into engagement with the detent of the circuit-terminals.

465,648. Combined Signal and Telephone System. Thos. W. O'Brien, Wilkes-Barre, Pa. Filed July 20, 1891.



465,808.—DYNAMO ELECTRIC MACHINE.

465,655. Independent Electric Clock. Walter J. Dudley, Somerville, Mass. Filed July 11, 1891.

465,665. Hanging Device for Arc Lamps. William K. Howard, Jr., Fredericksburg, Va. Filed Oct. 30, 1890.

465,684. Incandescent-Electric-Lamp Fixture. Gustave E. Villaret and Victor E. Rondel, Philadelphia, Pa. Filed May 23, 1891.

A fitting for an electric fixture, consisting of a plate with a central opening and raised lugs and an annulus having recesses in its inner periphery, arms connected with the annulus, and a socket on the arms, the arms being set out from the annulus, forming a chamber rearward of the socket, with spaces between the sides of the arms and opposite portion of the inner periphery of the annulus, the long diameter of the plate being less than the short diameter of the annulus.

465,685. Electric-Arc Lamp. Henry C. Waldecker, Austin, Minn., assignor to Winfield S. Pierce, same place, Samuel H. Pierce, Hudson, Wis., and Harry F. Batchelor, Miles City, Mont. Filed April 8, 1891.

In an electric-arc lamp, the combination, with the upper-carbon carrier thereof, of a fluid-containing tube, a hollow piston, fitting closely (but not fluid-tight) in the tube and provided with an upwardly-opening gravity-valve, the piston having a cap provided with one or more fluid passages or appertures, a pulley, and a cord connected to the piston and to the carbon-carrier and passing over the pulley, whereby as the carbon-carrier starts to descend any sudden movement thereof will be checked by the suction of the piston in its tube and whereby, also, the piston will be free to descend through the fluid enclosed in the tube.

465,778. Adjustable Support for Telephones. Chas. H. Gatchell, Fredericton, Canada, assignor of one-half to Albert James Gregory, same place. Filed Aug. 26, 1891.

The combination, with a telephone, of a hinged arm having its free end bifurcated, a vertically-adjustable rod adapted to hold and support a telephone-receiver, passing through apertures in the bifurcations, and a coiled spring encircling the rod, located intermediate of and bearing against the bifurcations.

465,808. Dynamo-Electric Machine. René Thury, Geneva, Switzerland. Filed Aug. 4, 1891. Patented in Switzerland.

A multipolar dynamo-electric machine or generator comprising two concentric rows of field-magnets disposed the one within the other and having the unlike poles of the magnets of the respective rows in juxtaposition, a rotable armature composed of a divided hollow, thin iron cylinder mounted between the rows of magnets and provided on the inner face with internal axially-disposed conductors and on the outer face with external axially-disposed conductors, and connections at the respective bases of the armature for coupling up the conductors from pole to pole.

465,809. Electrical Testing-Instrument. Richard Varley, Jr., Englewood, N. J. Filed Jan. 15, 1891.

A testing-instrument comprising a polarized armature supported in a magnetic field with a normal bias toward one pole, a coil for creating a bias toward the other pole, and an electro-magnet actuated by the armature when shifted under such change of bias to impel it toward its initial position, whereby a continuous vibration of the armature is maintained during the passage of the current through the coil.

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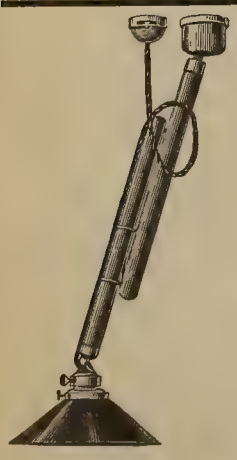
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THE ELECTRICAL AGE.

VOL. X. NEW YORK, JANUARY 9, 1892. No. 2.

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BROOKLYN'S TROLLEY RESOLUTIONS VETOED.

One of the first acts of Brooklyn's new Mayor, David A. Boody, and probably one of the most important he will ever be required to perform during his term of office, was the vetoing, on January 2, of the resolutions granting the right to Brooklyn's four great street railroad companies to substitute the trolley for horses on their lines.

These resolutions were left unacted upon by Mayor Boody's predecessor, and as a legacy for the new Mayor on which to exercise his authority. It is held that they would have become a law at midnight, January 2, had Mr. Boody taken no action on them, but as to this there exists some difference of opinion.

It is stated that the new Board of Aldermen will override Mayor Boody's veto, and counsel for the Brooklyn City Railroad Company is looking into the subject to determine if the company could proceed with the work on the trolley system under the sanction of the Common Council alone.

IMPOSTORS IN THE ELECTRICAL BUSINESS.

We print elsewhere in this issue a paper read by Mr. A. A. Knudson before the New York Electrical Society on December 30 last, which is interesting. His subject was "Frauds in the Electrical Business," and when one starts in to count such frauds it becomes apparent at once that the subject is a broad one to discuss. Mr. Knudson, however, did very well in his paper, and showed up some of the most prominent frauds in the electrical line in their true colors.

It is well known that whenever a new idea or a new industry is being developed unscrupulous persons will take advantage of the ignorance of the public concerning such new enterprises, and carry on deceitful practices under the guise of legitimate trade. Those who are unfortunate enough to fall into the net of such dishonest persons never find out that they have been victimized until they have parted with more or less money and see no returns or benefits therefrom.

The electrical trade seems to have offered a greater field for sharpers to work in than any other, probably owing to the fact that electricity in the public mind is regarded with a great deal of mystery and as past finding out, and on account of this view of the matter electrical impostors became as numerous as legitimate tradesmen. "Right is might," however, and these frauds are rapidly going out of the business. The people are becoming more familiar with electrical apparatus, and the uses and applications of electricity, and are not so easily duped. Mr. Knudson's paper should be widely read, and the daily press should give it publicity so that the eyes of the public may be opened as far as possible to these frauds.

ELECTRICITY AT THE WORLD'S FAIR.

The paper read by Prof. John P. Barrett, Chief of the Department of Electricity of the World's Columbian Fair, before the Chicago Electric Club last Monday night, is full of interest to every one connected with electrical industries. It is really the first official discussion of the plans respecting the electrical department, and Prof. Barrett's paper comes just in time to answer a great many questions concerning the electrical exhibition. Those who are contemplating an exhibition of goods will know now, after reading this paper—which is published elsewhere in this issue—with tolerable certainty what the conditions of entry will be, and they will get a clear general idea of what the electrical exhibition will amount to.

The general plan as laid down by Prof. Barrett seems to be an extremely fair one, and every facility will be given to demonstrate every feature of value of the exhibits. Nothing of a fraudulent nature will be admitted to the exhibition, and in this connection it is worthy of note the coincidence of Prof. Barrett's remarks in reference to frauds with the subject of the paper read before the New York Electrical Society, by Mr. A. A. Knudson, on December 30 last. Surely impostors in the electrical business are receiving a veritable "black eye."

Prof. Barrett's paper is as timely as it is interesting, and it will no doubt receive careful consideration.

MR. EDISON'S NEW ELECTRIC RAILWAY SYSTEM.

So much has been said about Mr. Edison's proposed system of electric railway construction, and the plain facts have been so much distorted and exaggerated that it is refreshing to find a statement that has the color of authority.

In the December number of the *Monthly Record*, which is published by the Edison General Electric Company, we find an article on the subject referred to above which presumably may be accepted as an authoritative statement. The impression that Mr. Edison's new system was to entirely supersede the present trolley system has become widespread, but, on the authority of the paper referred to, this is incorrect.

"Mr. Edison," the paper says, "has devised the new system for roads of heavy traffic, in large cities where the expense of the original installation is warranted by the traffic, and where the trolley system will not be permitted. For instance, the new system would not be applicable, in a commercial sense, to long roads operating less than fifty cars simultaneously. It must therefore be understood that, outside of the large cities, the best system that can be advocated is the trolley."

The following particulars concerning the new method are furnished by Mr. Edison with a view to creating a better understanding of the facts in the case:

"The overhead system is entirely dispensed with.

"Cars, trucks, tracks and roadbed, such as are now in use, are retained, certain changes being made in the joints and cross-ties.

"The power, furnished by 1,000-volt generators, is distributed to reducing apparatus placed in boiler plate manholes at intervals varying in accordance with the number of cars required to be operated. At these various reducing points the current is transformed from 1,000 volts to a pressure of 20 volts, and put in direct communication with the tracks. This limit of 20 volts is fixed in order to prevent horses from being affected by the current. The economy of current is about the same as with the present system of trolley.

"The car motors being wound with uninsulated-copper wires, and the pressure of current being so low, there is entire freedom from burning out of armatures, as water can be poured upon the armatures without any ill effect. The problem of producing a perfect rail joint, and the picking up of a heavy current from a mud-covered rail, has been solved in a practical manner. The experimental road at Mr. Edison's laboratory is a quarter of a mile long, with a six per cent. grade and very short curves. It is operated successfully when the rails are entirely buried in mud or in dry sand."

In this connection it is interesting to note the fact that, according to the *Monthly Record*, Mr. Edison is arranging to have the system tested on a heavy traffic road, probably in New York City, during the present year.

As a great deal of uneasiness has been caused by the exaggerated stories which have been going the rounds of the press during the past few weeks it is hoped that these tests will be made as early as possible in order to definitely demonstrate what the system is worth. Electric railway enterprises and manufacturers and supply dealers have seriously felt the disturbing influence of these alarming stories, and it will be a great relief all around to have the thing settled.

PECKHAM GEARLESS MOTOR TRUCK.

In the issue of STREET RAILWAY NEWS of October 24 last, a full description was given of the radial gear truck for electric cars, manufactured by the Peckham Motor Truck & Wheel Co., Kingston, N. Y., and in that connection was given a view of car 201 of the Coney Island and Brooklyn Electric road, which is equipped with a Peckham truck provided with this gear.

The accompanying illustration of car 209 on the same line shows a truck of new design made by the same company. This truck is constructed for the purpose of carrying the gearless motors, and it differs in construction from the radial gear truck in that the intermediate side-bars are continuous from end to end and in the inside wheel-brake.

This truck is made throughout in the most substantial manner, and is said to be giving excellent satisfaction in practical operation on this road.



PECKHAM GEARLESS MOTOR TRUCK.

There is none of the violent oscillations of the car-body so common to vehicles of this class as ordinarily equipped, and the cars run with great smoothness and steadiness.

These improvements in construction are considered to represent the highest degree of development in electric car truck construction.

WINDOW AND DOOR BURGLAR-ALARMS.

Samuel H. Hoggson & Co., St. Louis, Mo., recently placed on the market some window and door burglar-alarms that are very simple, efficient, handy and safe. Burglar-alarms are very handy things to have, but, as usually constructed, burglars find no difficulty in effecting an entrance despite all precautions. Mr. Hoggson has overcome this difficulty by constructing devices which will give an alarm on any attempt being made to enter, whether by the window or door or by destroying the burglar-alarm itself.

The alarm, as constructed for windows, has a double spring working both ways. The insulating part is of hard rubber, to which are attached German-silver cup-pointed contact-springs, that clean themselves every time either sash is moved, insuring a good connection where the windows are seldom used. Each spring is provided with a screw and a washer to securely clamp the terminal wires. It requires no mortising, and it is not necessary to remove either sash, stop-beads, inside blinds or even curtains to insert and connect it—a great saving of time and labor when fitting houses already furnished. It is accessible for adjustment or repair by simply lowering the top sash, and it can be readily tested day or night without moving either sash-cord—an excellent feature in cold or stormy weather.

The door-spring is constructed entirely of metal and has a hard-rubber insulation. The spring has a brass shield to protect the pin and prevent it from wearing a hole in the door; and it also provides means for adjustment whereby it is possible to vary the distance the door may be opened before giving an alarm. The brass shield protecting the pin makes it impossible to open the door by holding the pin in with a knife-blade or other instrument without giving the alarm. There is a positive large rubbing surface insuring good contact, and a screw-washer connection for each wire, thereby avoiding all trouble from poor connections. The alarm can be adjusted instantly to allow the door to open more or less by turning the screw in the shield.

THE TROLLEY IN PHILADELPHIA.

President P. A. B. Widener, of the Traction Company, Philadelphia, in an interview a few days ago, stated that it is the intention of his company to have the best railway system in the country, and that within five years horses will be superseded probably by electric traction. It is stated that the company now considers itself in a position to ask councils for permission to introduce the trolley system on its lines, and the recent action of the Brooklyn aldermen in granting like privileges to four companies in that city is pointed out by the Philadelphia people as likely to greatly strengthen the Traction Company's position in the matter. It is also said that the Traction Company will next spring erect trolley wires out Woodland avenue to Haddington, out Market street and in other parts of West Philadelphia, as well as out Germantown avenue to Chestnut Hill.

It is stated that the Pullman Car Company, about January 1, will place on the Market street line of the Traction Company's cable road a sample double-deck car. If this car comes up to expectations, it is likely that this style will be generally adopted.

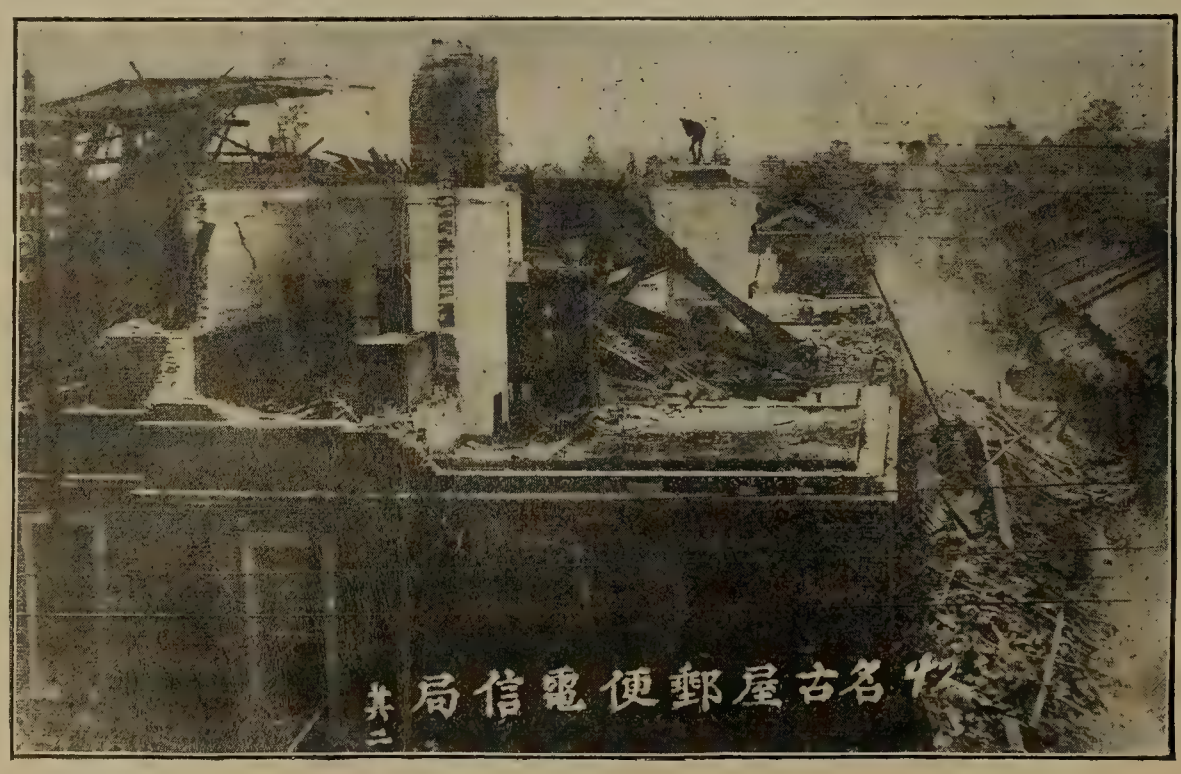
THE EARTHQUAKE IN JAPAN.

It will be remembered that on the 20th of October last a terrible earthquake took place in Japan which accomplished almost unheard-of ruin. The section affected was the fertile and populous plain extending over the central provinces of Mino and Owari. This included the towns of Nagoya, Gifu and Ogaki, with a population of 150,000, 30,000 and 20,000 respectively. Besides these cities the plains embraced numerous villages and also the most extensive pot-teries in the country. As near as can be estimated, 12,000 people perished, and at least an equal number were more or less injured. One hundred thousand houses were either wholly or partially crushed, and 300,000 persons were rendered homeless. The loss of property was, of course, enormous, and the whole face of the earth was changed, some small towns and villages being entirely wiped out of existence. The shock was distinctly felt at a distance of nearly 400 miles from the centre of the disturbance.

Nagoya, the first city above mentioned, suffered severely, and immense damage was done in every section.

Our Tokio correspondent has sent us photographs taken at the scene of devastation, one of which is herewith reproduced. Our illustration shows the ruins of the Nagoya post and telegraph office, which was almost completely demolished.

It will be noticed in the illustration that the telegraph wires remain intact, but in the building itself the work of destruction is complete. In this building, which was constructed of brick and two stories high, three clerks and one letter-carrier were killed, and three telegraph operators and three letter-carriers wounded. The building was quite new, but earthquakes make no discrimination between old and new buildings, and the terrible effect of this unusual upheaval of nature may be faintly judged by the ruin accomplished in the case of this one building, which is so clearly shown in our illustration.



RUINS OF TELEGRAPH OFFICE NAGOYA, JAPAN, AFTER THE RECENT EARTHQUAKE.

EXTENDING ITS LINES.

The Consolidated Street Railway Company, Columbus, Ohio, has just closed a contract with the Buckeye Engine Company, of Salem, Ohio, for putting in the power-house of the first-named company two engines of 1,000 horse-power each; and it is now negotiating with the Thomson-Houston Company for such additional electrical apparatus as is necessary to entirely equip the company's lines with the trolley system.

The present power-house was erected with the idea in view of its enlargement, and it is said that before the 1st of April next the improvements will be completed, and the horse cars will be things of the past.

The three engines now used in the power-house are McIntosh and Seymour centre-crank compound engines, and they are supplied with patent automatic governors. The latter improvement, as is well known, automatically opens up and lengthens the stroke of the valve when additional cars are placed upon the line, or any other circumstance occurs which requires greater power. When the load is lightened the automatic governor acts in the reverse sense, and shortens the stroke of the valve which cuts off the unnecessary steam. The speed of each of these engines is 250 revolutions a minute, and each has a capacity of 250 H. P. They supply sufficient power to drive 9 Thomson-Houston generators, which furnishes the power to run the present equipment of cars on that road. The generators are 110 H. P. each.

The two new engines contracted for are to be Buckeye tandem compound condensing engines, and will be coupled direct to each end of the main shaft from which the generators will be driven. Each engine will have four times the amount of horse-power contained in each of the present engines, and it is said will be better adapted for the additional

work which will be imposed upon the plant. Each engine will be capable of running three generators to their full capacity, and it will be possible to double the present number of cars without any undue strain on the power-house plant.

The present steam-plant consists of four Babcock and Wilcox sectional water-tube boilers, and an additional one of the same class but with larger capacity will be installed for the new engines.

The switchboard is equipped with instruments of the latest improvement. The apparatus is arranged in three tiers. There are 9 automatic circuit-breakers, one to each generator. Below these are the ampèremeters, and the third tier consists of triple-pole switches mounted on a slate base. Rheostats, one for each generator, are provided for the regulation of the voltage. Lightning arresters are placed at the back of the board, and are said to be very effective in their operation.

The generators at present in use are of the M. P. 75 type of the Thomson-Houston make, and are compound wound.

For the storage of cars a shed has been erected on High street at the northern terminus of the system. The curves and separate tracks are so arranged that a transfer table is not needed, but a large pit has been provided over which tracks are to be built on to which cars needing repairs can be run. The pit will be heated by steam for the comfort of the workmen.

The estimated cost of the tracks, curves, building and additional equipment is placed at $50,000.

LIGHTING FIXTURES FOR STREET CARS.

One of the best places for street-railway companies to select lighting fixtures for their cars is at the firm of Josephine D. Smith, successor to the late well-known firm of Willard H. Smith, 350 and 352 Pearl street, New York. This firm has been designing and manufacturing lamps for street-railway cars for such a length of time that it is the first place looked to for new wrinkles in street-car lighting.

The adoption of electricity as a motive-power on a large number of railways and the prospect of its

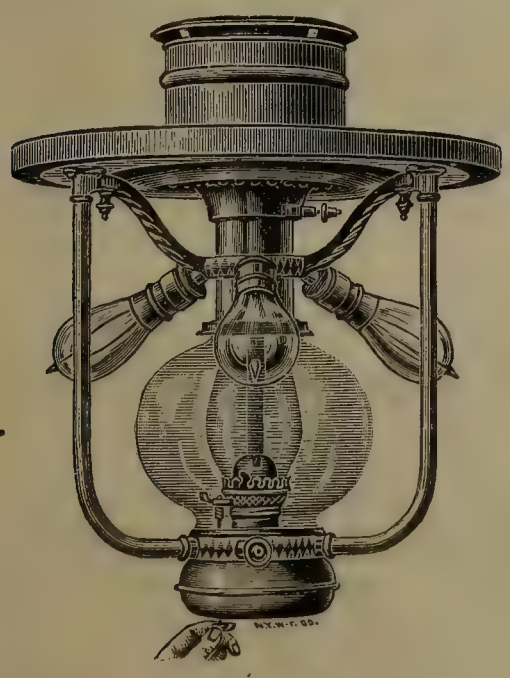


FIG. 1.—COMBINATION CAR LAMP.

increasing use in the propulsion of cars, has led those who supply it to street-car companies to seek means for utilizing the current used for the power to also illuminate the cars. This concern was among the first to manufacture devices for this purpose, and to-day its stock of electric lamps, combination oil and electric and oil lamps seems to be without limit both in number and designs.

Fig. 1 shows a combination car-lamp, which is now used to a large extent on electric street railways, upwards of 500 being used in New England alone. The lamp is a combination electric incandescent and oil fixture, and is furnished with an ornamental base, having a handsome globe over the usual chimney, and three incandescent lamps so placed that the light from them is radiated all over the car. The fixture itself is very handsome.

Fig. 2 is an illustration of an oil-lamp so generally known throughout the country that a description of it is unnecessary, and Fig. 3 a different form of the same lamp, now being introduced on a large number of roads in the country, the company now executing an order of 250 for the West End Railway Company of Boston.

This firm, with its large and well-equipped factory, is able to turn out very large orders at short notice. Nothing but first-class work leaves the shops.

"C. & C." DYNAMOS IN THE ST. NICHOLAS HOTEL, CINCINNATI, O.

The illustration shows the dynamo-room of the well-appointed St. Nicholas Hotel, Cincinnati. The two generators have a capacity of 300 lights each and are of the standard "C. & C." type. The fields of the dynamos are compound wound, and the entire machine is constructed with a view to attaining

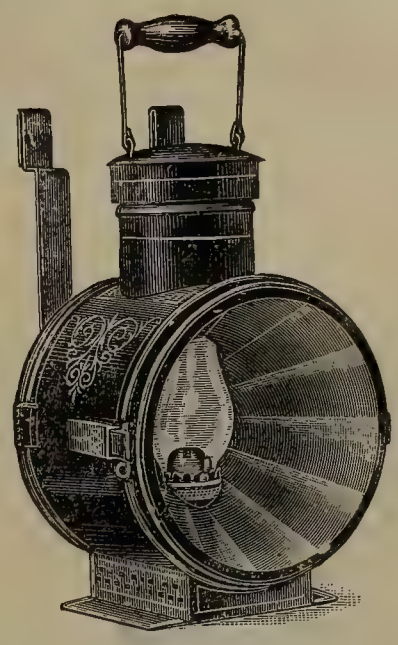


FIG. 2.—OIL LAMP FOR ELECTRIC CARS.

the highest possible efficiency. The armature shaft revolves in self-oiling bearings, and the whole machine rests upon a sliding base, which can be adjusted to tighten the belt. This installation was made by the "C. & C." Electric Motor Company, New York, about a year ago, and the dynamos have been in constant service since then. The fact that a 40 K. W. dynamo of the same type has recently been added to this plant to furnish power for an increased number of lights, gives evidence of the satisfaction which these machines have given.

THE ELECTRO-MAGNETIC PRINCIPLE.

Dr. A. W. Tipton, of Topeka, Kan., propounds the following interesting questions: The horseshoe magnet and man considered magnetically and electrically. Is not the horse-shoe magnet in equilibrium electrically considered, and every molecule of the magnet a perfect magnet electrically considered, and does not this same principle hold good in all animate and inanimate matter, is not the electro-magnetic principle in stone the life and cohesive principle of the inanimate substance, and would not the destruction of this principle in nature destroy everything animate and inanimate in part or whole in proportion to the destruction of the substance or being, and will not the horse-shoe magnet become deranged or the electro-magnetic equilibrium in a great measure be destroyed by dealing the magnet a heavy blow with a sledge-hammer or otherwise, and would not a person resort to electricity to restore the magnet to its original equilibrium as the most efficient agent? And if not, why not? Man considered electrically. When a person is in perfect health, are not the electrical conditions, positive and negative, in equilibrium or harmony in every organ and part of the body like the magnet in equilibrium electrically considered, and would not a heavy blow upon a person's head derange the polar and elec-

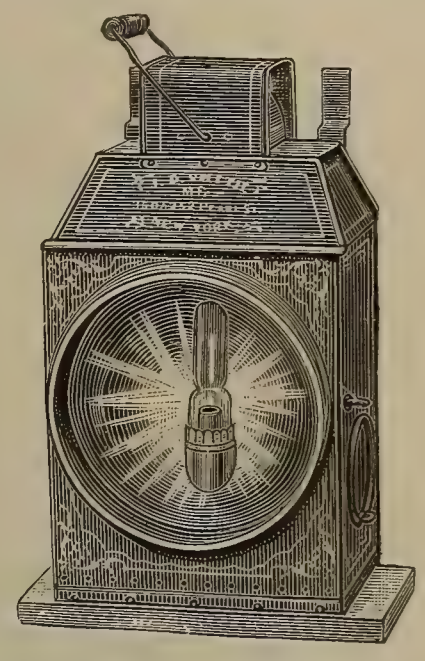


FIG. 3.—ANOTHER FORM OF OIL LAMP.

trical equilibrium of all organs and parts of the body through the nerves (motor and sentient) in proportion to the extent of the injury received by the blow or otherwise, and would not electricity properly and scientifically administered restore harmony and an equilibrium in the system as in the magnet, and why not? Can animate matter or a person live without electricity positive and negative or north and south polarities? And if the motive-power of electricity be great enough to lift a stone weighing thousands of pounds and convey it from the earth to the top of a building to the height of 200 feet or more, run cars loaded with passengers, and do many other strange and wonderful things, does not the positive and negative electricities in equilibrium generated from the air in the lungs circulate the blood, and is it not the physical life and motive-power of the body acting in harmony with spirit life, etc? If not, why not?

LIQUIDATED.

The Equitable Engineering and Construction Co., Drexel Building, Philadelphia, announces that on the 1st of January it went into liquidation.

Its business for the past year has been a profitable one, but the active members of the concern wish to get out of the construction business.



C. & C. DYNAMOS IN ST. NICHOLAS HOTEL, CINCINNATI.

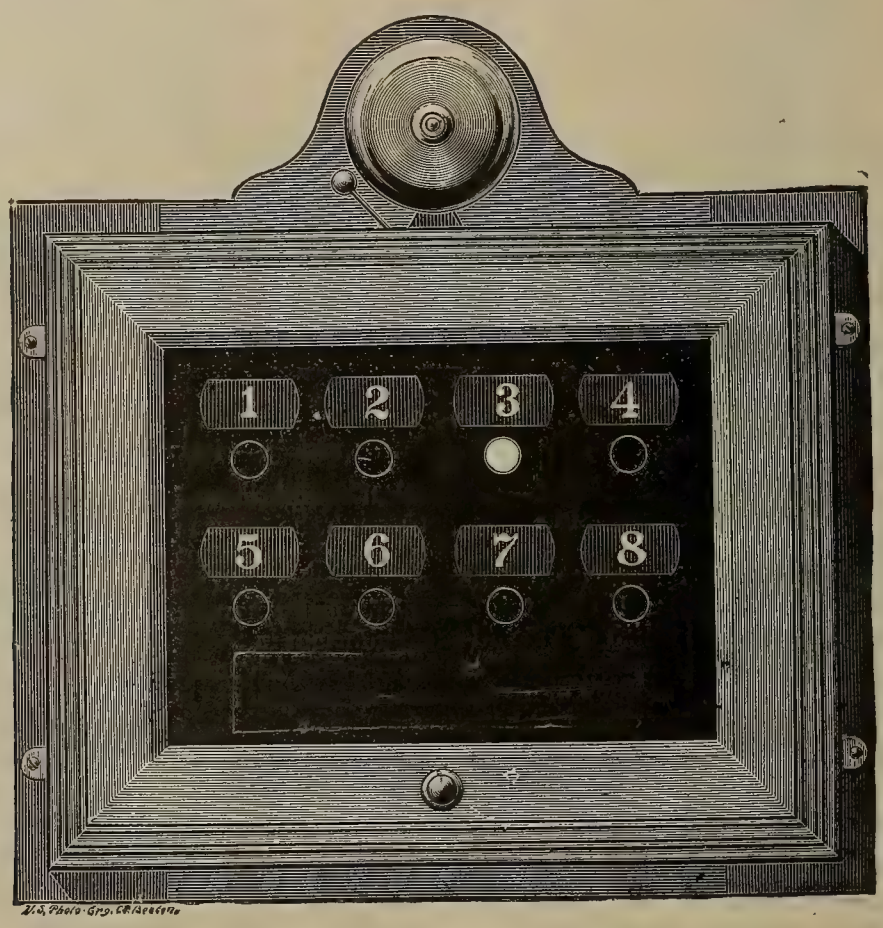
Mr. S. Ashton Hand has accepted a position as Superintendent of the Detroit Electrical Works, Detroit, Mich., and Mr. W. A. Stadelman wishes to devote his time for the present to his interests in Bristol, Tenn., which consist of the Bristol Belt Line Railway and the Bristol and East Tennessee Railroad, in both of which he owns a controlling interest.

The company retired from business with every debt paid and a good balance to be distributed as a dividend to the stockholders.

ELECTRICAL ANNUNCIATOR.

We illustrate herewith one of the neatest and simplest annunciators on the market, and one which is giving good satisfaction wherever used. Everything about this annunciator is constructed to give the best effect mechanically and electrically, and it is finished so artistically that it is an ornament anywhere. Mr. Seth W. Fuller, the manufacturer, has designed and fitted electrical apparatus of all kinds for many years, and the different styles of annunciators which he manufactures are the result of long practical experience and study.

The firm was established by Seth Fuller in 1809. He was succeeded by Seth W. Fuller, who is said to be the pioneer in the electric bell and annunciator business in this country. When Mr. Fuller commenced in this business he was obliged to import everything from Paris, including annunciators, push-buttons, wires, etc. The concern is now conducted by Mr. Frank Fuller, and it now includes everything in the electric line from bells to electric plants. This gentleman is an authorized contractor for the installation of the Edison electric light system, and plants installed by him have always proved satisfactory, the work being done in a first class manner in every respect. Everything that Mr. Fuller now uses in his business is manufactured in this country, the time for importing material from Paris having long since gone by.



FULLER'S ELECTRICAL ANNUNCIATOR.

Most of the leading hotels throughout New England contain specimens of Mr. Fuller's work, and wherever one hotel has ordered annunciators and electric-bell or speaking-tube systems from this firm it has always placed the second order, when similar goods were required, with the same company.

FRAUDS IN THE ELECTRICAL BUSINESS.*

This subject unfortunately is one of such wide scope that to cover it fully would mean the publication of a good-sized volume. For a paper of the ordinary length therefore I shall only touch upon the various branches of electricity in which impostors have left their tracks, and relate a few instances as they have come under my notice during the past few years, which will show some of their methods. We wish it understood that in speaking of impostors or fakirs in this paper we mean only those who, knowing an invention to be worthless, or of but little value, will attempt by false statements to induce people to put money into the same. Neither do we wish to include under this head those inventors who, honestly believing they have discovered something new and original, seek to interest capital, although their scheme may finally prove impracticable or previously patented.

We will now consider one or two fakir methods in the galvanic battery line which, as we all know, has proved in the past an inviting field for that class of men. The first will be the primary battery with the electric motor.

Some years ago, before the advent of the dynamo, when electric motors had to depend upon the primary battery for current, a French gentleman appeared in New York with alleged new and useful improvements in both battery and motor. He had induced a relative of mine (since deceased), who was an officer in one of the savings banks, to invest in the same, and had been given the use of an unoccupied room above the bank for the purpose of exhibiting the apparatus. I was asked to call and examine this "wonderful invention," for, according to the inventor, it was one of the greatest scientific productions of the day. The motor did not differ in principle from those already invented and published, such as that of M. Froment or of Davenport on this side of the water. In fact it was not only the same in principle as that of Froment's but nearly the same in construction.

The battery, the inventor said, was a secret, and he would not explain it. The method of demonstrating the efficiency of both motor and battery was by lifting a weight of a few pounds to the ceiling by means of a pulley and rope, the rope being wound around a drum secured to the shaft of the motor. The battery, although a secret, disclosed itself soon after the motor was started, in the strong nitric-acid fumes it gave out, and the active manner in which it boiled. When spoken to about the strong odor from the battery, which was enough to choke one, the explanation would generally be (with an attempt to smell) "You smell anything?" Our report, as you will surmise, was not favorable, and we strongly warned the banker to go no further, but he had actually become so wedded to the scheme that he would believe nothing against it and all I got for my pains was a self-satisfied smile and the remark, "Well, I can believe my own eyes when I see that weight going up to the ceiling."

You will anticipate the outcome; I left them to themselves and to their own eyes; and after several thousand dollars had been sunk in the attempt to make the scheme practical, it was finally abandoned. The banker frankly acknowledged afterwards that he believed the whole thing was gotten up with the deliberate intention to deceive. So much for that wonderful motor, and the battery that was a secret.

Another case, and this will illustrate how people will sometimes put their money into a scheme, and afterwards seek advice in regard to it, was one which came under my notice a few years ago where the primary battery played a conspicuous part (although concealed in a cellar), and was, like the one in the previous case, a secret. It had for its object the production of an electric light. The gentleman who employed me to investigate the case had, I was informed, already invested something like $20,000 in the scheme. Knowing this I certainly expected to find something at least worthy of an invention. It is a singular fact, however, and one that I have often come across, that instead of getting full and reliable advice before embarking in the venture, people will often invest their money, and then afterwards, when a sense of doubt and insecurity dawns upon them, will fly to an expert.

The object of this invention, as already stated, was the production of an electric light. It was exhibited in a room ordinarily used as a dining-room in a private house. There were three or four lights placed on the chandelier and when the current was turned on, they did make a brilliant and steady light while it was being shown.

The lamps consisted of two small carbon rods placed inside a glass tube, the point of contact between the carbons being about midway between the ends of the tube, which was about six inches long with a bulb at the centre. The wire from the battery connected with the carbons, and that was practically all there was to the invention. The inventor succeeded even before any patents were obtained, with his exceeding plausibility (and he was a remarkably good talker), to induce these gentlemen to put in this large sum of money. Why, to hear this man talk was enough to deceive the very elect if they were not posted, and to show how easy some men are induced to invest in worthless enterprises of an electrical nature when in the hands of a good talker, I will give an example of the way he talked: Edison was nowhere. For years Edison had been trying to accomplish what he had already just perfected. In Edison's system enormous capital was required in the construction of central stations, besides the cost of running expenses for fuel, labor, etc.; but in his system all of this was done away with, and for a few cents per night a whole house or store could be illuminated, and the battery would run indefinitely, and so on, *ad infinitum*. All of this time he was careful to conceal the fact that he was using in the battery in the cellar electropoin fluid by the barrel, and zinc by the square yard, in order to produce the three or four lights for comparatively short intervals of time. He told the gentlemen present and myself that there were but four cells of battery in circuit; this to me was surprising for the amount of illumination given. By a series of cross-questions we finally found out just what he had. The four cells of battery consisted of four enormous earthenware crocks, holding about twenty-five gallons each. Across the top of each jar or crock was placed a bar of wood to which was secured various plates of carbon and zinc running down the bottom of the jar, so that instead of four cells or galvanic pairs in circuit, there were actually forty of very large size, and the beautiful and brilliant electric light on the chandelier was duly accounted for. I do not suppose that the gentlemen who had invested their money in this scheme thought it worth while to even inquire about the battery. They saw the light, and like the banker in the former case, when he saw the weight go up and heard the inventor talk, they thought they could believe their own eyes. After the exposure was made, there was no more money invested in the scheme.

I could give many other instances where the impostor has manipulated the galvanic battery to his own profit; but as they would be almost repetitions of those just stated, we will pass on and look into some of the fakir's work in the electric and acoustic telephone business.

I presume there is no electrical business of late years which has been so thoroughly worked by unprincipled men as the telephone business, and in order to have a better understanding of the methods of telephone sharpers, we will give a short résumé of the telephone situation as we understood it a few years ago.

Where important lawsuits have been going on, the amount of fraud occasionally practised in the attempt of one company to secure an advantage over another would, if made known, be surprising. Bribery and false swearing have often been resorted to in some of the telephone patent suits in the past years. Witnesses, experts, lawyers and even the judge on the bench have not been entirely free from the baneful influence. I will give an instance: You may have heard of the man who was an examiner in the electrical department of the Patent Office at the time the Bell patent was issued, and who in later years, for a certain sum of money, made an affidavit in favor of the Bell Company, setting forth certain alleged facts which occurred at that time, and who not long afterward accepted a fee from another company and made another affidavit setting forth alleged facts entirely contrary to the first sworn to. It often happens in patent suits where large amounts of money are involved, the temptation is strong to mislead and deceive, wherever such deception will be of advantage. Especially was this the case in the legal telephone fight during the attempts made to overthrow the Bell patent by attempting to show that the Reis telephone would articulate. It was well known that if the telephone invented by Reis in Germany (which antedated the Bell by several years) could be proved to have talked, and to have actually produced articulate as well as musical sounds, it would mean death to the Bell patent. Or if a telephone made exactly on the principle of the Reis could be shown to articulate in court, if only for five minutes, it would in all probability upset the Bell patent, the advantages of which would thus revert to public use. Hence, there was abundant reason for the opponents of the Bell Company to prove

* Paper read by Mr. A. A. Knudson before the New York Electrical Society, December 30, 1891.

if possible, one thing or the other, and the utmost exertions were put forth. Germany was ransacked, for relatives and those who had been acquainted with Reis during his lifetime, and affidavits and witnesses were obtained by the score, attempting to prove when, where and how the Reis telephone talked. Without doubt many of these affidavits were drawn from mistaken imaginations, while others were but partial truth. On this side of the water, numbers of inventors were at work struggling for the prize in their efforts to make the thing articulate. I well remember the experience Mr. Mailloux and myself had in that direction. Night after night we worked at our homes in Brooklyn with varying success. Sometimes we would succeed in making it articulate, but our experience was, it seemed, impossible to make it stay in that condition. We finally came to the conclusion that it was possible to make a Reis telephone talk, but it could not be depended upon to stay in a talking condition from one minute to another, and so far as my knowledge extends of this subject, no telephone made exactly after a Reis pattern has ever been able to articulate for any length of time. When it did articulate, it was probably on account of either an extremely delicate adjustment which was only temporary, or the oxidation of the contact points, thus for the time creating the variable resistance which is the life of articulation. But we could not trust it to remain in that condition over night; often did we lay it carefully one side after working for hours at night, feeling that at last we had it, and in the morning find it as dumb as an oyster; finally we abandoned the attempt entirely.

There was one party, however (and this is more in line with my subject in speaking of frauds) that claimed to have produced a constant talking Reis telephone, and to the consternation of the Bell Company, actually showed it in a good talking condition; there could be no fault found with the articulation; it did talk, and talk well; and things for a time looked blue on the Bell side of the house, until one of their experts, more observing than others, discovered a carbon button concealed in the box and in the circuit, so that it was not the genuine Reis telephone that produced the articulation, but one with the necessary modern improvement.

I once had a telephone case to investigate which will show to what extent a fake scheme will sometimes go before it finally reached its end. There were but two papers furnished me to examine, one a copy of the patent (there was but one patent) and the other a copy of the prospectus. The claims of the patent were exceedingly limited, but the prospectus was broad enough to make up for any deficiency in that respect. One clause in the patent set forth that this invention was based upon the undulatory current principle, while a clause in the prospectus stated that the invention was not based upon the undulatory current theory but upon the make and break principle, a square contradiction on its face.

In point of fact it did not differ, only in construction with the Bell telephone. The parties to whom I reported did not invest in the scheme, but other parties did, and a company was started. Its method of doing business was to manufacture the telephones here in New York, sell State rights on the patent, and establish local companies in cities and towns wherever it could, and supply them with telephones. In this way it earned in course of time sufficient money to pay a dividend on the stock, and the stock advanced (a good deal of it being sold), and everything went on swimmingly. About this time I was asked by the party for whom I reported if I had not made a mistake, and they pointed to the fact that a dividend had been paid by this company. I said I thought not and advised them to wait a little longer. The Bell Company, through the slow process of the courts, finally reached them, and they were blotted out of existence.

A similar experience, as we all know, happened to a large number of other companies who attempted to compete with the Bell Company. In the acoustic telephone business it seemed at one time as though it was infested with fakirs. There seemed to be just as strong inducements in the acoustic field for this class of people even than in the electric, especially after the Bell patents had been sustained by the courts. I presume one reason was, there was no difficulty in convincing people that there was no infringement on the Bell patent as it being easy to show no electricity was used to carry the voice, and another reason was that an acoustic telephone when first put up for exhibition purposes generally worked surprisingly well. The voice could usually be heard from ten to twenty feet away from the instrument, and the promoter would not be slow to exaggerate these advantages and almost always to characterize it as fully as important and valuable as the Bell telephone. They would say nothing about the difficulty of constructing the wire and of keeping it in repair, and in most cases those investing would hardly inquire if there were any wire at all, when in point of fact the wire is the most important part of the whole business of an acoustic telephone line. The difficulty in maintaining it is well known. In this respect this case would be similar to those above mentioned where people saw a weight go up, and saw a beautiful electric light. They thought they could believe their own eyes, and when some people listened to the remarkable performance of the acoustic telephone they thought they could believe their own ears. The acoustic telephone has its place in the commercial world, and in its place is most useful and convenient; but in the past it has been badly misrepresented by being exaggerated by men whose only ambition was to sell stock in fake companies.

We will now leave the telephone business and pass on to the consideration of telegraph frauds. Some years ago a French Canadian appeared in Hartford, Conn., making a great stir about a new multiple telegraph system which he claimed to have invented. According to his story he could send and receive upwards of 40 messages over one wire. The duplex and quadruplex were but child's play in comparison, and so plausible were his other assertions concerning it that he succeeded in interesting some parties and finally obtaining from them a sum of money for an interest in the scheme.

For a complete swindle in every detail this beat all I have ever heard of in the electrical business. It was an ingenious swindle, and in order to describe it more fully I will refer to the diagram on the blackboard.

A few instruments only are shown, but they will be sufficient to illustrate the scheme. Several Morse sets of instruments were placed at each end of a room, and a wire loop was run to New Haven, in which wire the main battery was placed. From the end of this loop wires were branched to one of the binding posts of the instruments; from the other binding post ran a wire to all appearances to the ground, but it did not go there at all for it was purposely broken inside of the insulating covering and the ends pulled apart. Another very fine wire, however, was connected to the bottom of this same binding post at each instrument, carefully concealed, and led to the side of the room where it was hidden entirely from view behind the paper on the wall. These fine wires all connected with the opposite instruments in their respective pair at the other end of the room. The wire in the long loop to New Haven, as you will observe, simply acted as a return ground, or one side of a metallic circuit. Under such conditions the multiple scheme, as you would expect, worked perfectly, and with any number of instruments. After the inventor had absconded with his money, which he did shortly after he got it, the instruments were removed from the room, and in doing so the fraud was discovered, for there were the wires all carefully concealed behind the wall-paper.

Electrical frauds have visited the United States and plied their vocation from most every country on the face of the earth; but this man was from Canada, a country one would hardly expect to produce such a clever electrical swindler, and he showed a surprising nerve by going right into the heart of Yankeedom, in the State of Connecticut, where the people's reputation for shrewdness is so well known that it has been said, in order to dispose of some of their products, such as wooden nutmegs, etc., they are compelled to go outside of the State to do it.

During my sojourn in Canada for the past four years I have met but one or two who could be termed electrical fakes, and they came from the States.

Another phase of electrical frauds may be illustrated in a recent exhibition of a scheme in Boston. The inventor showed a battery of peculiar construction, to the zinc pole of which was attached a wire leading out of doors to a lightning-rod a short distance away. The wire from the other pole of the battery went somewhere, but supposedly to go to the ground.

The object of the scheme, according to the inventor, was to produce a constant and unlimited supply of electricity from the air.

To show the practicability of the scheme a motor was placed in a circuit, and it ran as though it would burst; an ordinary Morse sounder was tried, and that worked as though it would be torn to pieces. Mr. Frank L. Pope examined the scheme, but was not allowed to go into it thoroughly, and he said he couldn't tell just where the fake was, but it was there somewhere, and he advised the capitalist who was with him, and who was in the electrical business, to get some of his electricians to try and duplicate it if they could. I am sorry this scheme was not unearthed, for I believe it would prove an important addition to this paper.

As a conclusion to this list of electrical fakes, we will now consider the medical part of the business. Here we find among the so-called electrical appliances, such as belts, hair-brushes, corsets, etc., gross imposition is practised under the name of electricity upon the public, and has been for years. There is hardly a complaint in the calendar of human diseases that these things, according to flaring advertisements and circulars, will not cure. To show to what extent this imposition is practised at the present day, I will read an extract or two from a full-page advertisement taken from one of the most highly respectable magazines in this country:

"Disease is the result largely of depleted nerve force and demagnetized blood. These electro-magnetic corsets (the maker's name is here mentioned), belts, insoles and appliances have been demonstrated to be the best agency yet discovered for preventing this depletion and demagnetization as well as restoring such forces when lost. These garments are unlike any other device for electrifying the system or charging it with magnetism. As a force it is self-supplying, retaining its virtue for years and invariably benefits. These appliances so electrified can always be relied upon.

"These appliances promptly annihilate those weak and languid feelings, exterminate rheumatism from the system and promptly cure the above-named disorders. They are light and comfortable to wear and are guaranteed to imperceptibly generate a mild, continuous current of electro-magnetism, all-healing in its effect. They differ from so-called electric and galvanic belts, which are usually worthless and which create sores on the body, leading to blood-poisoning. Beware of them, and see that you get this one (our special make), with silver compass free. Ours are truly electro-magnetic, as any tyro in electric therapeutics will inform you, and are absolutely reliable."

You will note the attempt is made here to work in magnetism as a curative property. Except where steel magnets are concealed (of which I shall speak later), there is not one particle of magnetism produced by the action of a so-called electrical appliance of this class.

This is a point to which I wish to call special attention. Electricity properly controlled and applied is capable of wonderful effects in the relief and cure of a large number of diseases, and its legitimate use is increasing daily in the practice of the most enlightened and scientific practitioners of the age. In fact, hardly a practising physician of any repute can be found, who has not his medical batteries, some of them costing hundreds of dollars, with all kinds of electrodes, some of which are as ingenious in construction as they are humane in purpose.

It is just this point that the swindlers of to-day lay hold of and turn to their own purposes. They designedly confound electricity and magnetism, and by a skilful interchange of terms they encourage in the public mind the same confusion. In many cases where they claim that magnetism is generated by their appliances there is no magnetism at all; and in others where they claim that there is electricity there is magnetism. But this magnetism is not the result of any inherent virtue, it is the result of a smart piece of chicanery, in which the concealed magnet and the compass needle play the principal part. I claim therefore that in any event it is wrong and misleading to attempt to confound magnetism with the curative properties of electricity.

I have yet to learn the first case where magnetism, either strong or weak, has ever produced any effect either beneficial or detrimental upon the human system. Night after night for months I have been in the presence of the most powerful dynamos (as have thousands of men in the many electric-light stations all over the world) where magnetism of the strongest kind permeates every bone and fibre and tissue of the body, and yet so far as any effect, either good or bad, on the system goes, one would never know he had been in the magnetic field, and he would not notice it unless he found his watch stopped. To the best of my knowledge and belief there is absolutely nothing in the human anatomy that can be acted upon by a magnet. Of course, if a child swallows a mouthful of tacks or a paper of needles, there is then something inside of the child upon which magnetism will act, but not otherwise.

What physician of any reputation has ever been known to attempt magnetism, or to recommend the use of electric belts or the like? On the contrary, every reputable physician with whom I have talked on this subject has denounced them as worthless. Let us go a little further into the subject and see how some of these things will bear the light of an investigation. We will first consider the so-called electric hair-brush. I have thought best to purchase one of these brushes so that we can see just how they are made and to prove the assertion that so far as any curative property is concerned they are no better than any ordinary hair-brush. I will first read an extract or two from the directions pasted in the box in which it came:

"Cures headache in five minutes; cures neuralgia in five minutes; restores the hair, prevents baldness. The 'odic force' can always be tested by moving the brush near a compass. This power is so strong

that if the compass is placed upon a thick book or table and the brush is moved in a circle beneath the same the power will pass through the intervening table or book and cause the needle of the compass to rotate rapidly. A silver compass of considerable value accompanies each brush."

Now, this brush I have does deflect the compass-needle just as stated, but the real cause is very different from the ostensible one, and instead of any odic force (whatever that may be) or any electricity having anything to do with its deflection, the statement is false, as I shall prove. I have taken pains to dissect the back of this brush and we find just what we expected to find. Embedded in the material of which it is composed is a steel magnet. That, and that alone, is the cause of the compass-needle moving towards the brush when brought near it. When I purchased this brush I was told that the movement of the needle proved that the brush was charged with electricity, and I have no doubt everybody else is told the same thing that buys one. You will notice [showing brush] this magnet is made of a piece of steel wire in the form of a double loop and extends nearly to the end of the handle. The only electric effect possible that can be produced by the use of this brush is static, and even under favorable conditions of the atmosphere the greater part of such a very small amount of static electricity as might be generated while the brush was being used would imperceptibly pass off to the earth through the hand and arm and body of the user, leaving them no more benefited by its use than if they had used any other hair-brush.

Electric corsets is another deception. How is it possible, I ask you, for such a thing to be the slightest use electrically to the wearer when they are not even worn next the skin? The magnetizing of the steel ribs, as is often done, is of no use whatever as to any beneficial effect upon the wearer.

Another of these precious frauds is the electric garter. I have seen advertisements, as no doubt many of you have, where the use of electric garters are guaranteed to give a more shapely form to the limbs of ladies. The absurdity of such an appliance is too apparent for comment, but it is really too bad to disappoint and deceive the ladies in a case like that. What swindle under the name of electricity will not be attempted next? Why don't they get up an electrical hat-band to supply a lack of brains or furnish new ideas to those that wear them, yet would not such a thing be just as reasonable as some I have stated?

As an answer to some of the reckless statements which appear in advertisements and circulars, some of which I have mentioned, in regard to electric belts and other appliances, I will quote an authority and read some extracts from De la Rive's "Treatise on Electricity." De la Rive was at the time of writing his work a member of the Academy of Sciences, and also of Medicine, of nearly every large city of Europe, so that he is an eminently qualified authority to pass judgment on these appliances.

After explaining the construction of the electro-galvanic chains and belts of Goldberger and of Pulvermacher, he says: "We do not very well understand the effect of this arrangement by virtue of which the current is scarcely to circulate in the chain without traversing, at least in a very sensible manner, some part of the body. For not even a derived current can be obtained on account of the imperfect conductibility of the skin. Moreover, no very positive fact has proved the efficiency of this later mode of application, upon which experience has not yet decided." And again: "We do not deny that there may be a production of currents in these apparatus; even the galvanometer indicates their presence; but they are very feeble currents, and we do not see what advantage can be presented by these arrangements, which at the very basis rest on false ideas of the electricity of contact."

My wonder is that the electric journals have not been more outspoken in showing up these frauds upon the public. The public would naturally look to such a source for information of this kind, and these journals are not handicapped as others are by being paid for fat advertisements, for it is the uninformed public on electrical matters that they desire to reach, so they use the daily press and weekly and monthly publications to make known their wares. In summing up this whole matter of electrical appliances it seems singular that they have been allowed to exist so long, especially the hair-brush. One reason may be that the "public love to be humbugged," but there is a limit to all things, and I predict as electrical knowledge is being more and more disseminated by such institutions as this college, it will not be long before people will understand the truth in regard to them.

Although I have touched upon but a few frauds and deceptions as practised in the electrical business, I am aware of there being many more which would prove interesting were it not for the risk of tiring your patience. I have no doubt there are those in this audience who remember the electrical sugar-refining frauds of a few years ago. Also the motors of Paine, which for many years continued to deceive people. Also much might be said of the tapping of telegraph wires leading to race-courses, and the ingenious electrical devices and methods for supplying stock quotations to bucket-shops in Wall street. Also some of the so-called telegraph schools, where young people are induced to pay their money, with the promise of a situation as soon as competent. This class of fraud cannot be too strongly condemned. I might also call your attention to a certain individual who for years has plied his vocation as a fakir in the electrical business. I refer to the Duke of Palestine.

In concluding this paper I cannot refrain from expressing a few words as to the position of the capitalist or investor in regard to new electrical inventions. In the few instances cited I have endeavored to illustrate how easy an investor may be deceived. It may be fairly asked by some, "has the investor then no protection from the designs of the dishonest promoter, or from the mistaken though honest inventor?" I answer, he has. There are plenty of good, honest and capable engineers in this and other cities, who, for a reasonable fee, will investigate and report upon any new scheme if they are only applied to. Some of these engineers are peculiarly fitted to give advice and opinions in certain branches of this business by reason of their long experience in such branches, while others have had experience, more or less, in all of them. Besides these individuals there are now lately established in this city electrical firms composed of men of unquestionable reputation and standing, who make it their business to investigate and report upon any electrical invention; and I claim that there is now no excuse of an investor being deceived where such facilities exist for obtaining correct information upon electrical subjects. Would a man afflicted with disease undertake to cure himself if he knew nothing of the practice of medicine, or would a man having an important law suit on his hands undertake the management of his own case if he knew nothing of the practice of law? On the same principle, then, an investor takes a large risk if he depends on his own judgment while placing his money in alleged new electrical enterprises. On the other hand, the judicious investment of capital in electrical enterprises has brought large returns to a great many people and in very many cases handsome furtunes have been realized. As an evidence of this fact, we have but to point to the marvellous success of the Bell telephone, also the electric light (both arc and incandescent), also the electric railway. Besides these great industries, there are no end of less important schemes varying in value according to their commercial usefulness, and almost every day something new in the electrical line is being discovered.

In this paper I have endeavored to interest you by pointing out the methods of unprincipled people in the electrical business, and I have also attempted to make clear the importance of investors seeking good advice before placing their money in electrical schemes. If I have succeeded in these two points then the prime object of my paper is effected.

NOTES ON ELECTRICAL SOCIETIES.

ELECTRIC CLUB.

The New York Electric Club gave a very pleasant entertainment at its club-house, 17 East 22d street, on New Year's Eve. There was a good crowd present, and Mr. Joseph Howard, Jr., delivered an informal address entitled "A Few Plain Words on Journalism." Mr. Howard, in his characteristic happy manner, entertained his audience for some time, after which Dr. Theodore Wangemann rendered some excellent music.

THE NEW ENGLAND ELECTRIC CLUB.

Boston is unquestionably the city of clubs. The electrical industries of the city have for some time felt the need of a social organization that would afford amusement to its members and give them at the same time the opportunity which only club privileges can give, that of enlarging their acquaintance among the people who are interested in the same line of trade. Feeling the necessity of an organization of this kind a movement a few weeks ago was started and the trade well canvassed. The result of this preliminary work was most satisfactory. Every electrician in the city at once saw the benefits to be derived, and the names were added rapidly to the list soliciting membership. In less than two weeks over one hundred names had been added to the list. So spontaneous was the response that a meeting was called to talk over the affair and organize if the feeling shown was strong enough to warrant going ahead with the enterprise. This meeting was held in the parlors of the Tremont House, and over fifty people were in attendance. It was shown at this meeting that there was no further necessity for delay, and the meeting at once organized and proceeded to the election of officers. This resulted as follows: President, Mr. Ferdinand A. Wyman; Vice-President, Mr. E. A. Record; Treasurer, Mr. A. O. Smith; Secretary, Mr. L. M. Hays. Steps were taken to secure a suitable club-house and also to incorporate the organization. This work is at present under way and it is anticipated that but a few weeks will elapse before everything will have been completed.

The club has been given the name of the New England Electric Club, and membership can be secured by any one interested in electrical science or trade in the New England States. Applications will be received by the secretary. Address in care of Boston *Daily Globe*.

ELECTRICAL EXHIBITS AT THE COLUMBIAN EXPOSITION.*

Electricity, as an adjunct to industrial procedure, has ceased to be empirical. Its practicability, economy and the conveniences of its employment are settled and incontrovertible facts. Its conduct under fixed conditions is no longer problematical. The laws which rule its action are as inviolable as those of the exact sciences, as constant as those of nature, of which they are a part.

In making plans, therefore, for an exposition of electrical development the practical side of the question must be ever uppermost. The chief aim must be to demonstrate beyond cavil that as a factor in the affairs of this workaday age electricity cannot but be taken into great account. This, the chief feature, however, would fail of its force were we to neglect to demonstrate at the same time the immense strides that have been made since electricity emerged from a state of mystery and became one of the essentials of civilization and progress.

Following out this preliminary reasoning, I think it necessary to treat practical electricity in classes according to the importance and relationship of its application.

The question of railway and other processes for transporting passengers and freight is the most vital economical issue of the present day. Steam, either by locomotive or cable, has been the only feasible motive-power up to within a short time. The manifold objections to it, however, have increased the activity of inventors and the possibilities of rich reward have been a stimulus to the energy of electrical workers. Electricity in some branches of this service is already a success, and is fast displacing other motive-power. The next few years—possibly the next few months—will probably see the whole question finally settled by some new element or the further development of one or other of the existing electrical systems. It will be part of our duty, therefore, to give every facility to exhibitors to make displays of new systems and to exploit old, along new lines and under new circumstances. In order to do this it is contemplated to set aside a parcel of ground at some point of the exposition, on which to build trial tracks which may be equipped for the different systems. We should make it possible for every system to be demonstrated so that not only the electrical people may judge of their respective merits, but that visiting capitalists and possible customers may have ready facilities for becoming interested in the subject itself or in any of the various inventions or systems on exposition. It is to be hoped that in this class of work the electrical people will submit something which should decide the question of transportation wholly in favor of electricity, as it is already in part done, whether it be by means of overhead, conduit or accumulator systems. I have only to say that the public at large and those who are interested in the question from a financial standpoint have high anticipations in this direction, and there is a disposition to wait for developments.

Electric lighting, arc and incandescent, has already arrived at a point of practical success. For illumination purposes electricity is accepted and stands without competition. The developments in this direction will be as thoroughly demonstrated at the Columbian Exposition as it is possible to conceive of. All the various systems of lighting, and of the transmission of power, will be placed in practical operation for service. Nearly if not quite 25,000 horse-power will be applied to electrical transmission at various parts of the grounds and buildings. It is contemplated to engage each company undertaking work to wire and equip the *locale* of its distribution,

* Paper read before the Chicago Electric Club, January 4, 1892, by Prof. John P. Barrett, Chief of the Department of Electricity of the World's Columbian Exposition.

furnish its own lamps, material and supplies, so that each company's system of construction and operation will stand entirely alone, to show its especial merit or to receive condemnation for failure. In this work it is contemplated to bring into friendly but brisk business competition the companies and systems of this country and Europe. The questions of the saving of energy by the perfection of machinery and insulation will be closely calculated, and the various systems will be thoroughly tested by the efficient juries on awards, of which more hereafter. Artistic lighting of theatres, hotels, residences and streets will be given an impetus, placed as these features will be in competition with art in every other conceivable dress. The brisk, practical business methods of the electrical people of this country have left little time to art and æstheticism up to the present time, while the people of Europe have on the contrary led art and electricity hand in hand. The Columbian Exposition may have some surprises in store for visitors in this behalf, and will undoubtedly be a source of much pleasure and instruction.

The transmission of power from sources at points along available water-courses, or in the immediate vicinity of fuel for steam, and remote from the desired point of application, has been given much attention of late, and much newspaper comment has been made upon alleged successful inventions. This has seemed to me surprising, coming from electrical journals at least, since all of us in this country ought to be aware of the fact that long-distance transmission has long been an accepted application of electricity in the mines of the West and Southwest, and has done much toward revolutionizing the processes of mining. At many points in the West far removed from fuel for steam, and at long distances from water-power, mines are being successfully operated that could not have been so where fuel was to be delivered at the mine instead of the developed power ready for application. Some new things have come into practice in this field of electrical work in Europe of late, and at the Columbian Exposition we will see an increased interest in this work of transmission, and there is in contemplation a project to make a most instructive object-lesson by placing in practical operation a water-wheel motor with wiring and terminals for application at an artificial mine some distance away. The many applications of the electrical current, of various quantities and qualities, in mining and milling work, will come under this head, and I am assured of some new and valuable contributions in the way of machinery.

In the whole field of electrical invention, moreover, there are promised models of invention setting out new principles, and numberless contrivances will be a part of the exhibit to testify to the large measure of usefulness of electricity in the various directions of its application. It is hoped also that the exhibits accepted will be object-lessons to the general public which will inculcate a clear judgment to appreciate the fact that there are legitimate uses of electricity and that on the other hand there are applications of the current which closely border upon the fraudulent, and which are mere catch-pennys and brought forward wholly because of the mystery and hocus-pocus that surround them. I feel it a part of the duty of the Department of Electricity to unreservedly oppose the presence of these things, and by discountenancing them have an effect in a degree to rob them of their harmful influence. People must come to understand that electricity is not a mysterious force, uncertain in its operation and liable to all sorts of eccentric deviation from the desired course. Until this understanding has been arrived at with the public the electrical people will suffer more or less from frauds practised by the unscrupulous, and will meet with obstructions in the shape of legal injunctions to prevent the laying of electric roads and lines of wire for transmission, and the actual dangers of electricity will be magnified many fold by those interested in restricting its use.

The remaining feature of the electrical exhibit, but not by any means the least for being mentioned last, is that part which will create object-lessons on electrical progress—the historical exhibit. It would be impossible to fully appreciate the greatness of the progress made and the magnitude of the work of making commercial electricity what it is to-day, without the presence of any exposition of the first crude machinery, the initial appliances by which the electrical current was made a useful force. It is contemplated to have some of the original models, and where this is found impossible, to have reproductions of the models of the apparatus of Morse, Franklin, Vail, Henry and many others of our own country, and those of Ohm, Ampère, Gauss, Siemens and many others of Europe. The Department is in correspondence at the present time with those people or governments that have control of museums or institutions of learning where any of this historical apparatus may be, and we earnestly hope to have a full exhibit of these priceless treasures.

It is not contemplated by the National authorities of the Columbian Exposition to offer awards which would have so great an intrinsic value as to attract exhibitors, but it is contemplated to make the standard of excellence so high that the bare acceptance of an exhibit by a department will be a lasting and distinguished honor. In the Electrical Department the space available for exposition purposes will be so small, as compared with the demand, that the greatest judgment will have to be brought into play to decide what exhibits are worthy of a place and what will have to give way. It will be impossible to accept all. Therefore, the presence of an exhibit in the Electrical Building will be a testimonial of its unusual merit. The awarding committees have determined to have full and exhaustive tests made of all machinery in competitive exhibition, by the juries of the different departments, and to publish these tests and the jury findings at the close of the Exposition, under the authority of the National Commission.

I regret that it is impossible at this time to present figures and definite information as to the prospects and scope of the department. It is yet sixteen months before the opening of the Exposition, and while an amount of space in the department building has already been applied for in excess of the total amount available, yet we have heard from fewer than one-half of the probable applicants for space. A delicate task is before the Department, therefore, and it will not be advisable to discuss the question in detail for some months to come, when I hope to have heard from all the electrical people. I will then be in position to discuss the matter more fully and more in detail in a paper which I shall ask to present.

ADAPTING THE TELEPHONE TO THE POSTAL SERVICE.

Postmaster-General Wanamaker recommends this year, in his annual report, the adaptation of the telephone, as well as the telegraph, to the postal system, showing that it is not only the constitutional privilege, but the duty of Congress, to utilize all the means of modern science for quickening the transmission of intelligence. He says upon these two points:

"A year from next March the telephone patent expires, and unless Congress acts promptly to authorize its adoption for communication among the people, it requires no stretch of the imagination to believe that in the next two years one immense syndicate will unite and control all the hundreds of telephone plants of the country as the telegraph is now controlled, or the two will be united, and then for the next twenty years the most astute attorneys will be legitimately earning large salaries in indignantly opposing the so-called attacks of future Postmasters-General upon defenceless vested rights.

"One-cent letter postage, 3-cent telephone messages, and 10-cent telegraph messages are all near possibilities under an enlightened and compact postal system, using the newest telegraphic inventions. The advantage of tying the rural post-office by a telephone wire requiring no operator to the railroad station must be obvious. The benefits arising from telephonic connections with the post-offices will easily suggest themselves in a hundred ways to those who want the entire people to share in common privileges. The rural population would be the greatest gainer. A telephone message from the post-office to the railroad station miles away to ascertain if expected freight had come would save the farmer many a needless wagon trip over bad roads; news of approaching frosts could be promptly spread over country districts and fruit-growing regions, and many a valuable crop saved.

"The day's market prices for cattle and grain and wool and produce may be obtained by the farmers direct by inquiry from others than the buyer who drives up to the farm in his buggy. All these may seem homely purposes to dwellers in cities, but country life would lose some of its drawbacks by the extension of such facilities to those who bear their full share of the burdens of the government, and receive, in postal respects at least, less than their share of its benefits."

ELECTRICITY IN INDIANAPOLIS.

It is reported that the Broad Ripple Street Railroad Company, Indianapolis, Ind., will soon be reorganized and re-officered, and will probably begin the construction of the line from Broad Ripple to the city limits. Since Thursday evening $35,000 have been subscribed for the completion of the suburban portion of the line, and the land-owners who have put up the money say the road will be built. The company will ask for a renewal of its franchise inside the city limits upon the same terms as agreed to by the board several months ago. As an evidence of good faith, the company will, it is reported, deposit with the board a certified check, to be forfeited in case the road is not built from the city limits to Broad Ripple.

The company already has a right-of-way part of the distance from the city limits to Broad Ripple. The road, if it is built, will come down Washington boulevard on the extension of Alabama street, and will cross Fall creek over a new bridge to be built early in the spring, or else will go east on Twenty-second street, and cross the creek over the new bridge recently built on that street.

The members of the Broad Ripple Company say this building of their road will not be dependent upon what the Citizens' company does in reference to building to the new State Fair site. They believe that there will be plenty of patronage for two companies. It is thought the Citizens' line to the new site will be out Central avenue. If both companies do attempt to reach the Fair grounds with electric lines, there may be a fight before the county commissioners for a right-of-way on the cross streets leading to the grounds. It is expected that applications for right-of-ways to the grounds will be filed with the board this week by both companies.

JOSEPH T. MURRAY'S INVENTIONS.

Mr. Joseph T. Murray, Room 30, No. 15 Cortlandt street, New York, a well-known electrician and inventor, has recently brought out a new and valuable invention. It is an indestructible lamp-wick, which is composed of clay, the oil being carried up to the flame by capillary attraction. The clay is prepared by a special process, and made porous by artificial means in order to enhance the capillary action. In practice this wick gives excellent satisfaction.

Mr. Murray is also the inventor of the Union Fire-Alarm system, which is well known throughout the country. He was associated with Mr. Thomas A. Edison in the early days of telegraphy, and the two jointly invented and patented the old automatic telegraph system and stock printers used by the American Telegraph Company.

Mr. Murray has recently invented and patented a self-lubricating journal, the lubricant being embodied in the journal, and he has also patented a lubricant specially valuable for dynamos and motors and light machinery.

BACK TAXES.

The Allegheny sub-auditing committee met December 28, and heard a report of experts on the street railway companies' indebtedness to the city. The experts drew attention to methods employed by the Pleasant Valley Company, to evade the payment of taxes. The entire amount claimed by the auditors as due to the city is $226,379.27, divided as follows: Pittsburg, Allegheny and Manchester Traction Company, $158,073.73; Pleasant Valley Railway Company, $68,305.54. This includes revenues from all sources. In the account of the Pittsburg, Allegheny and Manchester Traction Company, $140,000 of the $158,073.73 is the 5 per cent. tax due from the stock division, or rather from the division of $2,800,000 Pittsburg, Allegheny and Manchester Traction Company stock among the shareholders of the Pittsburg, Allegheny and Manchester Passenger Railway Company, which went out of existence all but nominally upon the incorporation of the company now operating under its franchises, and from which the city is claiming the $140,000, the amount of the stock dividend tax.

It is questionable in the opinion of leading lawyers whether this tax can be collected, as it differs materially from a regular division of profits. Even several members of the auditing committee seriously doubt the feasibility of forcing the company to pay this money into the courts.

In referring to the methods of officers of the Pleasant Valley Company the auditors say the California avenue division of the system is operated under an ordinance which levies a tax on dividends and cars materially less than on the other branches. The report was referred to the general committee, and a resolution recommended to councils requiring the City Controller to submit itemized bills to the railway companies of the amounts claimed as due by the experts.

AN INTERESTING PAPER FROM MR. WIMAN.

We are in receipt from Secretary George F. Porter, of the National Electric Light Association, of a copy of a letter which Mr. Erastus Wiman is sending to Central Station men for the purpose of obtaining certain information and facts which that gentleman desires to incorporate in a paper on "The Financial Side of Electric Lighting," to be read at the next Convention of the National Electric Light Association, which will be held in Buffalo, February 23, 24 and 25 next. The following is a copy of this letter:

DEAR SIR: Having had the honor of being specially designated by Mr. C. R. Huntley, President of the National Electric Light Association, to address the next Convention at Buffalo, on the special subject of the financial side of electric lighting, I am desirous of all the help I can get to make a careful and strong presentation of the merits of this class of property. There is believed to be in the public mind, and especially in financial circles, a growing prejudice adverse to securities based on electrical properties. It would seem important at this juncture that as clear a view as possible should be had of the real facts of the case. Hence, it would be very desirable if I could be placed in possession of instances of successful companies, with particulars of the amounts of their stock, the length of time before dividends were paid, and the amounts regularly realized, cost of maintenance, and such other facts as can readily be got together. Some special instances of very successful concerns are particularly wished for, and the history of companies which have not at first been successful, but which have since been rescued from insolvency by good management, also any facts relating to combinations between gas and electric light companies, and how best it can be promoted.

If you happen to have anything of that kind and can send it for me to Mr. George F. Porter, 136 Liberty st., N. Y., I shall be much indebted, and am

Respectfully yours,

ERASTUS WIMAN.

NEW BOOKS.

THE GALVANIC CIRCUIT INVESTIGATED MATHEMATICALLY. By Dr. G. S. Ohm. Translated by William Francis, student in Philosophy in the University of Berlin. D. Van Nostrand Company, New York. 269 pages. 50 cents.

Those who have studied the laws of electricity will be gratified to be able to read the famous work of Dr. G. S. Ohm, printed in 1827. The translation just placed on the market has been very carefully edited by Thomas D. Lockwood, and we think after a careful perusal that the original could have been no better. Before the time of Ohm, practically nothing was known of the electric current and the relation of the circuit to the source of the current; nothing but vague ideas prevailed of "intensity," "quantity" and such terms, and even then each individual had a different definition for the term used. We may say Dr. Ohm gave the first definitions of electromotive force, current strength and resistance, and the wonderful structure built upon those definitions shows that they were made with mathematical precision. Ohm's famous law has been the basis of all electrical science; everything in this branch of physics to-day being built upon $C=\frac{E}{R}$. Mr. Lockwood ably expresses the ability of the man, the position he occupies in electrical science and the scope of his work in the following words, taken from his editorial preface to this new edition of the book: "Ohm's work stands alone, and, reading it at the present time, one is filled with wonder at his prescience, respect for his patience and prophetic soul, and admiration at the immensity and variety of ground covered by his little book, which is indeed his best monument."

THE JOHNSTOWN ELECTRIC LIGHT CO., Johnstown, Pa., is making considerable additions to its plant, and has purchased a 200 H. P. single-cylinder engine from the Ball Engine Co., Erie, Pa.

THE CLAREMONT ELECTRIC LIGHT CO., Claremont, N. H., has just installed an 80 H. P. Ball engine built by the Ball Engine Co., Erie, Pa.

NEW INCORPORATIONS.

The DuLaney Clock Company, Chicago, Ill., was incorporated December 24, with a capital stock of $300,000, to manufacture and sell electrical clocks and general electrical appliances. Incorporators: James W. DuLaney, Charles S. Perry and Charles F. DuLaney.

The A. C. Robertson Company, Princeton, N. J., was incorporated December 22, with a capital stock of $50,000, to manufacture electrical supplies. Incorporators: A. C. Robertson, Wilkesbarre, Pa.; A. C. Carpenter, E. W. Carpenter, Princeton, N. J.

The Royal Electric Shield Company, Portland, Me., was incorporated December 22, with a capital stock of $200,000, to manufacture general electrical appliances. Incorporators: Alfred E. Hill, Somerville, Mass.; Nelson E. Hollace, Boston, Mass.; and J. W. Philpot, Lynn, Mass.

The Municipal Fire and Police Telegraph Company, Kittery, Me., was incorporated December 21, with a capital stock of $250,000. Incorporators: John Q. A. Brackett, Arlington, Mass.; Moses G. Crane, Newton, Mass.; and W. M. Chapman, Needham, Mass.

The Clemons Electrical Manufacturing Company, Attleboro, Mass., was incorporated December 19, with a capital stock of $25,000. Incorporators: George Demarest, H. G. Bacon, Plainfield; Maynard E. Clemons, M. B. Short, Philip E. Brady, Attleboro; Chas. T. Guild, North Attleboro, Mass.

The North River Electric Light and Power Company, New York City, N. Y., was incorporated December 29, with a capital stock of $200,000. Incorporators: Henry D. Fuller, Bayonne, N. J.; Robert Maitland, Brooklyn, N. Y., and Henry C. Adams, Jersey City, N. J.

The Dolgeville Electric Light and Power Company, Dolgeville, N. Y., was incorporated December 29, with a capital stock of $25,000. Incorporators: Alfred Dolge, Otto Voigt, Dolgeville, N. Y., and Edmund R. Wanckel, New York, N. Y.

The Breckenridge Electric Company, Denver and Breckenridge, Col., was incorporated December 26, with a capital stock of $20,000. Incorporators: Horace M. Hale, Hal Sayer and Irving Hale.

The Crown Point Electric Illuminating, Heating and Power Company, Crown Point, Lake Co., Ind., was incorporated December 29, with a capital stock of $60,000. Incorporators: Edwin L. Jeffrey, Chicago, Ill.; George A. Bell, Cobden, Ill.; and Walter H. Tompkins, Crown Point, Ind.

The National Railway Exposition, Chicago, Ill., was incorporated December 30, with a capital stock of $10,000, to exhibit railway, electrical and other mechanical appliances and inventions, and to manufacture and sell the same. Incorporators: Henry Schofield, Richard A. Morrison and Albert Brodie Stone.

PERSONAL.

Mr. Robert George Brown, of this city, was on December 29 last married in Washington, his wife being Dr. Lucy M. Hall. Mr. Brown is well known among electricians throughout the country, having patented some telephone improvements. He organized the first telephone exchange in America, and invented and developed a system of synchronous multiple telegraphy. Mr. Brown was at one time chief-engineer of the General Telephone Society of Paris, and is a member of various scientific bodies in Europe and in this country.

CATALOGUE.—The Electric Gas Lighting Co. of 195 Devonshire street, Boston, has just issued its catalogue for 1892. It is a work of art, and shows that the goods dealt in by the company are of the very best and of the greatest variety. The company is manufacturer, importer and wholesale dealer in electrical house, hotel, church, theatre and office furnishings of every kind, and is the sole manufacturer of the celebrated "Samson" battery. It also deals in supplies for all electrical purposes.

ELECTRIC ROAD IN GEORGIA.

On December 23 last the North Highlands Electric Street Car Company, Columbus, Ga., formally opened its line to traffic amid considerable ceremony. Two cars filled with invited guests and officers of the road went over the line and inspected the work, after which the party returned to the power-house and enjoyed a fine collation which was spread for their benefit. Appropriate remarks were made.

The electric cars are complete in every respect and are lighted by electricity. The officers of the company are: S. A. Carter, President; Rhodes Browne, Secretary and Treasurer. The inauguration of the line was a complete success.

TROLLEY LINE IN UPPER NEW YORK.

A new double-track electric street railroad is to be run from the Mott Haven railroad station to Kingsbridge in Westchester County, N. Y. It will connect with the New York Central and Hudson River and the New York and Northern Railroad. From this point it will run along Broadway to the Yonkers line. The capital stock of the company is $300,000, and work on the road will soon begin. The officers of the company are: Charles E. Runk, President; William Forster, Treasurer; George P. McVay, Secretary.

REBELLION AGAINST THE SERVICE.

The citizens of the South Side, Pittsburg, Pa., are discontented with the car service now being offered by the leading street-car lines of the two cities. At the present time it is said that none of the roads run cars enough to provide seats for the majority of the passengers during the busy times of the day, and a demand for greater seating capacity is raised on all sides. There is talk of making an effort to secure the passage of a law similar to one now in force in London, where only enough passengers are admitted to the cars to fill the seats.

The citizens of the South Side held a meeting a few nights ago and decided to petition the Birmingham Traction Company to pay more attention to the comforts of its passengers by putting on more cars. The following is a copy of a communication sent to Superintendent Elliott of the company.

"At a meeting of citizens of the South Side and patrons of your road, we were instructed to communicate with you in regard to the matter of placing more cars in service at certain hours of the day, when the heavy travel makes riding extremely uncomfortable. We believe in comfort and convenience, as well as rapid transit, but of late the crowded condition of your cars in the mornings and evenings has made both an impossibility. It is in the interest of thousands of your patrons that this request is made and we trust you will give it the consideration it deserves."

In referring to the overcrowded condition of the cars one of the Pittsburg papers says it is a common thing to see 75 or 80 people jammed into a car with a seating capacity of not more than 25 or 30, and suggests that the Mayor can bring the matter before the attention of the Councils with a view to the proper regulation of traffic and a remedy of the difficulty complained of.

THROUGH the kindness of M. P. Handy, Chief of the Department of Electricity of the World's Columbian Exposition, and J. Allan Hornsby, Secretary, we have received a beautifully colored lithograph, showing the Exposition grounds and buildings. The lithograph adorns the walls of our office, and is a beautiful piece of work.

CALIFORNIA ELECTRIC LIGHT CO., San Francisco, Cal., having just installed a 300 H. P. Ball engine, built by the Ball Engine Co., Erie, Pa., is so well satisfied with its operation, that the company has ordered an additional engine of the same size from the Ball Engine Co.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Jan. 2, 1892.

THE UNITED STATES MINERAL WOOL CO., 2 Cortlandt street, this city, was burned out on December 24 last.

ENGLEWOOD, N. J., a town of 8,000 inhabitants, is desirous of establishing an electric-light plant. This town is at present without electric light. Perry Chamberlain is at the head of the movement with this object in view.

A. B. C., 20 Cortlandt street, this city, with their customary enterprise, came out at the new year with an artistically and humorously illustrated New Year's greeting. The front and back covers are works of art.

MR. HORACE IRONMONGER, a well-known electrician connected with several electrical and kindred concerns in this city and vicinity, a biographical sketch of whom appeared in our issue of December 12 last, died very suddenly a few days ago of pneumonia.

THE INTERNATIONAL ELECTRIC SUPPLY CO., Times Building, this city, of which Mr. W. H. Fleming is general manager, is developing a large trade in Spanish-American countries. The company has just issued a circular in Spanish for distribution in those countries giving general directions for the purchase of American electrical apparatus of every description. The company was organized with the object of extending and facilitating trade in electrical apparatus between the United States and South American countries.

W. H. GORDON, 115 Broadway, states that the indications point to a live future business in Bryant electrical specialties, sockets, switches, etc., and Sunbeam lamps, in which goods, as well as many others, he deals. The increasing sales and demand for the goods above mentioned are a practical demonstration of their superior excellence. There is a steady increase in the business, and Mr. Gordon is satisfied that the handling of the very best high-grade goods is good business policy. Mr. Gordon has won for himself an enviable reputation for promptly filling orders.

THE W. S. HILL ELECTRIC COMPANY, the well-known firm which has been so long established at 54 Devonshire street, Boston, kept open house at its New York quarters, Room 518, Electrical Exchange Building, 136 Liberty street, this city, on January 4. Messrs. W. S. Hill, president, George H. Poor, general manager, and Ernest A. Des Marets, manager of the New York office, had everything, including an elegant repast, elaborately arranged for the reception of guests. Large numbers of the company's friends both from New York and the New England States called during the day, many of the electricians bringing their wives with them. Arranged at one end of the room was a supply of the company's specialties, including a large variety of switches, fuse blocks, cut-outs, etc., and a motor recently placed on the market by the company. A close examination showed the latter to be a very superior machine, light in weight, low speed, non-heating and non-sparking. There are several features about it which make it worth the trouble of the electrical engineer to investigate. The brushes are of a very novel construction, the weight being placed where most needed—where it presses on the commutator bars. The rest of the brush is of a very light construction, enabling the brush to respond to slight variations in the wear of the commutator quicker than the ordinary brush. A little catch attached to it enables the withdrawing of the brush to clear the commutator when desired. A motor recently tested, which weighed complete 855 lbs., showed a speed of 1,063 revolutions with no load and 1,057 with 6 horse-power of work. The size of the pu'ley was eight inches in diameter with a four-inch face. The various switches displayed were mounted on a handsome slate switchboard, and arranged so as to produce a very neat effect. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	55 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	202 50
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light.	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	148 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	104 00
Cons. Gas & E. Co., Batavia, 6s.	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	93 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120.000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	44 00
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		60 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	20 25
Laclede Gas pref	2,500,000	100 00	61 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co.	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500.000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Mount Morris 5s, N. Y	2.300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I.	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	18 75
New England Butt Co	100.000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s.	1,500.000		*98
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50.000		*95
North American Railway Co	39,767,200	100 00	18 00
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	38 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	51 00
Thomson-Houston pref	4,000,000	25 00	26 50
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	†50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100,000	100 00	75 00
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	83 50
Westinghouse Electric Co	7,000.000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		18 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The already prodigious proportions of the various first mortgage bonds representing the assets of the electric light, heat and power industries of the American continents are not only increasing very rapidly in amounts and number, but are becoming a decided factor in the current business of the trust companies of this commercial metropolis, and it is of the utmost importance that a corporation desirous of impressing capital favorably should identify itself by securing a well-known New York conservative trustee and fiscal agent, which necessitates a statement as shown by the mortgage, franchise, real and personal estate carefully and intelligently examined which is to an investor a reliable guide of the most unfailing character, requiring the least personal attention. Take for instance the Holland Trust Co., and among its managers will be found financiers who for several generations have negotiated the bonds by means of which it was made possible to people and enjoy this great country. From father to son the information necessary and the *clientelle* requisite have kept pace with the pecuniary demands of the ever-growing, ever-changing conditions of advancement and science. The financial, legal and mechanical routes from mule to electric motor, from pine knot to arc lamps change simply in quantity and by comparison with other financial investments, statutory laws and skilled application; commercial success and value being the key to the problem. To secure the services of this trustee, with all its knowledge of public companies' securities, and their monetary value; capable at all times of explaining intelligently to bond and stockholders existing conditions, with creditable offices at the financial centre of the country will cost less with a $500,000 capital per annum than the salary paid to an ordinary skilled clerk. Eighteen hundred and ninety two is to be a very busy year in electrical industry, and there is no time to spare in arranging the finances. The January thaw is nearly due and construction must not be delayed. There is a public demand for electric light and electric car service all over the land. Steam locomotion ashore and possibly at sea will be replaced gradually; that is a matter for the next generation. Money for the cause is the financial agent's present theme. New York has not even time to clothe herself in electric light or permit electric transit to her own citizens until the bonds now ready for the purchasers are negotiated and the rest of the country supplied with their necessities. When this has sufficiently advanced we will take a breathing spell, look in the glass and view our own appearance, perchance even ride at times in properly lighted electric vehicles through brilliantly illuminated streets.

One of the grandest financial and engineering enterprises of the past year was the commencement of the Hudson River Bridge by the breaking of the ground at the spot where the towers on each side of the river will for centuries to come sustain the enormous structure. One tower for the present will be in New Jersey, the other in New York, but both in the near future will owe allegiance and pay revenue to Greater New York. With the experience gained in building the Brooklyn Bridge this one should be completed in five years, and will earn dividends from the day it is opened to the public. Property values will increase beyond present conception over many square miles at the western terminus; thousands of manufacturing establishments will locate there, conceding to Manhattan Island the more profitable marketing of their products; capital will demand this and advance the requisite expense required to make delivery of the goods and return the cash for them. The investor has by this magnificent structure a large number of securities created for and placed before him in their virgin condition. First,

there is the bridge company itself, fully organized, offering long bonds of the safest description, a portion of which the exigencies arising during construction from internal or external causes may be secured at most remunerative rates; second, the real estate contiguous to either end; and, third, the factories and foundries, the second and third being capable of division into a great many interests. Residences will increase in the outlying towns, the bright healthy Palisades throughout their entire length being utilized for labor. The most important factor entering into the colossal span is electricity. To what extent it will be employed in the actual construction we are too well versed in the science to venture an opinion, feeling sure it would fall so far short of current fact that we should look back on it with considerable derision. I venture one assertion, however, and that is that there will be no necessity for a steam-engine ever to cross it with a train of cars; by the time it is completed electric motors will be speeding all over the country, and who, whose opinion carries value, dares to-day draw the line of distance or weight at which electrical economy ceases as compared with vapor. The transmission and application of electric power belongs to other departments of the ELECTRICAL AGE, but to render possible its attainment the financial requirements must first be positively assured. The Patent Office is crowded with monuments "sacred to the memory of unassembled ghostly pasts," which, had money been procurable, would have combined and proven profitable to the inventor, investor and the human race. It is about time some eccentric gentleman provided in his will a fund for electrical inventors; they are all hard workers and simply fail on raw material and fees. The birth of a wonder such as this noble aërial work makes one think kindly of those who could aid in its development as well as chronicle the opportunity of increasing the one talent to ten or more for the benefit of the good and faithful.

CALENDARS FOR 1892.

THE BUBIER PUBLISHING COMPANY, publisher of electrical and scientific books, 20 City Hall square, Lynn, Mass., is sending out a neat calendar for 1892.

THE PETTINGELL, ANDREWS COMPANY, dealer in electric light and electric railway supplies, Boston, is distributing a calendar for 1892.

THE COMMERCIAL CABLE CO., of New York, of which Mr. George G. Ward is the general manager, has got out a calendar for the new year, which will be found very useful.

THE DIRECT UNITED STATES CABLE CO., Limited, is presenting its patrons with a memorandum calendar for 1892. There is a leaf for each day in the year, with space thereon for memoranda.

The Carpenter Electric Light and Power Company, Catlettsburg, Ky., is installing a complete new plant. The company is operating 70 arc lamps and 15,000 incandescent lamps on the Thomson-Houston, Westinghouse and Continental systems. Buckeye engines aggregating 225 horse-power are used.

EASTERN NOTES.

NEW ENGLAND OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET,
BOSTON, Jan. 2, 1892.

THE ELECTRICAL SPECIALTY COMPANY, Pawtucket, R. I., was awarded a gold medal at the Southern Electrical Exhibition just closed at Augusta, Ga., for the best arc light cut-out. The company also received medals for carbon brushes and transformers.

THE next section of the West End system to be equipped with electricity will be that from Bartlett street to the East Boston and Chelsea ferries. Twenty-three cars will be required for this service. The Bartlett street car-house for the storing of electric cars is approaching completion. In the meantime the Norfolk House car-house will be used for the storing of cars. The street-car service from Bartlett street to Rowe's Wharf is to be extended to the Fitchburg depot.

THE BERNSTEIN ELECTRIC COMPANY, 620 Atlantic avenue, Boston, is preparing for an extra large trade during this year. This company's lamps are so well known that any description of them is superfluous. They have been in use for several years and have established the reputation of being superior to all others for economy of power, long life and brilliancy. These lamps, as is well known, are incandescent and burn in series. Their high efficiency, which varies with the type of lamp from 2.9 to 3.2 watts per candle-power, is not obtained at the expense of durability. They are especially designed for use on arc circuits, and are particularly adapted for street and store lighting. The company also manufactures multiple lamps of the standard candle-power for any voltage, and capped for any socket. Fixtures of all kinds are also dealt in by the company, which gives particular attention to instruments and special work.

D. L. T.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
CHICAGO, Jan. 2, 1892.

THE INDIANAPOLIS FROG AND SWITCH COMPANY, 73 West Maryland street, Indianapolis, made all the crossings, cross-overs and intersections for the Broadway and Seventh avenue cable road, New York City. It is now making crossings, cross-overs, turn-outs, etc., for the Baltimore Street Railway Company's lines, which will be nearly 29 miles in length. J. E. McGettigan is president and F. A. Lapham is secretary of the company.

ANY one happening into the store of the Electric Appliance Company, Chicago, during the last week of December would have wondered at the unusually lively appearance of the place, which at no time since the new firm started has been anything but busy. If you had stopped to inquire the cause you would have been informed that the president of the company, Mr. Willard W. Low, had just returned from a business trip, and any one familiar with the *personnel* of the Electric Appliance Company knows what that means. Mr. Low filled the Electric Appliance Christmas stocking with orders that made holiday week a very restless one for the employés of the company and a merry one for the firm.

N. D. W.

DRAVO & BLACK, Pittsburg, Pa., are installing at the Pittsburg Plate Glass Co., Ford City, Pa., two 150 H. P. tandem compound engines built by the Ball Engine Co., Erie, Pa.

SAUQUOIT SILK MFG. CO., Scranton, Pa., has just started a 35 H. P. single-cylinder engine sold to it by J. W. Parker & Co., Philadelphia, representatives of the Ball Engine Co., Erie, Pa.

BUSINESS NOTES.

The following letters to the American Electrical Mfg. Co., St. Louis, are self-explanatory:

ST. LOUIS, Dec. 4, 1891.

Replying to your favor of the 2d inst., wherein you inquire as to the experience we have had with your lamps, we would say that we have used 850 of them on arches placed on the poles of the Lindell Railway, on Washington ave., during the recent fall illumination.

The test we gave them was the severest that could possibly be given, as they were exposed to all kinds of weather for forty days, and to a vibrating caused by passing cars, besides which, although the lamps were intended for 96-volt current, they were subjected to a current of from 104 to 108 volts; yet with all this, we lost only 15 lamps out of the 850, which we consider a very low percentage under any circumstances.

These facts, together with our experience with your lamps in other places where we have used them, have satisfied us as to their merits, and we willingly and cheerfully give you this evidence of our opinion, that the American lamps excel any other that we have used.

Very truly,
PEARSON & MASSON, Electricians.

In reply to your letter of the 2d inst., asking our opinion of the "American" Lamp.

We have been using them for some time, and are better satisfied with them than any lamp we have ever used. They are very efficient and long-lived and do not blacken nearly so quickly as other lamps.

Yours truly,
ST. LOUIS ELECTRIC POWER CO.

CLEVELAND, O., Dec. 5, 1891.

GENTLEMEN: We have your lamps in use almost entirely on our line at the present time, and they are giving perfect satisfaction. Yours very truly,
THE BROOKLYN STREET RAILROAD CO.

We have used your "American" Lamps for the last six months and are very much pleased with them. Indeed, we think them the most economical lamp that a Street Railway Co. can use. Yours very truly,
SOUTHERN RAILWAY CO.
Joe S. Minary, Sec'y.

ST. LOUIS, Dec. 9, 1891.

After using your lamps for three months we find in them more than you represented, as to their life and efficiency. In proof of their efficiency we would say, we are easily carrying 276 of your 16 candle-power lamps on our dynamo, Edison pattern, while the estimated capacity of same is only 225 16 candle-power lamps at 101 volts. We are also pleased to say that, notwithstanding the overload, we are not troubled with heating of commutator or bearings, which we know to have been the case before your lamps were used on this dynamo. We will soon place another order with you. Yours truly,
ST. LOUIS REFRIGERATOR AND WOODEN GUTTER CO.

In reply to your favor of 2d inst. will say we are pleased to have an opportunity to recommend your lamp for any and all uses. We have sold quite a number of them, and they have given satisfaction without any exceptions. We consider it among the first lamps in the market for long life and efficiency, and, furthermore, will say they do not drop in candle-power to any perceptible degree.

Yours very truly,
WESTERN ELECT. SUPPLY CO., ST. LOUIS.

VENICE, ILL., Dec. 4, 1891.

Replying to your favor of the 2d inst., we beg to say that we have been using your lamps for several months, and so far we have not lost one of them by burning out. They are giving a most beautiful as well as an entirely satisfactory light. VENICE ELECT. LIGHT AND POWER CO.

Your favor of the 2d received. We are glad to be able to say that we have been using the American Incandescent Lamps for several months past, at places where we are particular about preserving our trade, and have never had occasion to regret taking your lamp. We have never, as yet, had any kicking or complaints from our customers. We therefore can truly say that we think we have struck the right lamp at last. Yours truly,
SOUTHERN ELECT. SUPPLY CO.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued December 29, 1891.

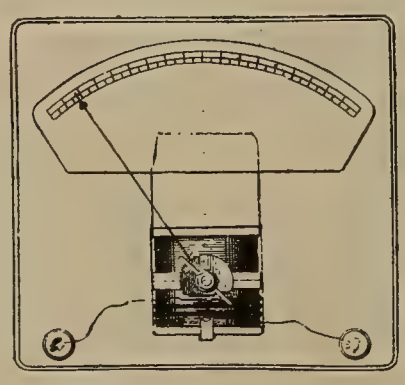
465,829. Fire or Other Alarm. Hugh M. Browne, Washington, D. C. Filed Dec. 24, 1890.

465,832. System of Synchronism for Telegraphy. Gilbert A. Cassagnes, Paris, France. Filed June 26, 1891. Patented in France.

The combination, in a system of synchronous telegraphy in which a single line-wire is used, of two vibrating tuning-forks governing an electromotor, a current-distributer, a trailing finger on the distributer and connected with the line-wire, and electrical pitch-varying means at the receiving-station and controlled from the transmitting-station, whereby the vibrations of the forks may be made equal or unequal at will.

465,844. Electric Railway. Julius Emmner, Jr., Washington, D. C., assignor, by direct and mesne assignments, to Philip T. Dodge, trustee, same place. Filed Oct. 30, 1890.

The combination of a tunnel or conduit having a longitudinal opening, an external car, a contact-arm connected to the car and extending into the tunnel to contact with the conductor, and a wheeled support for the contact device, the support constructed to admit of a tipping movement of the arm on a horizontal axis.



466,087.—TEMPERATURE-REGULATING DEVICE FOR ELECTRICAL CIRCUITS.

465,853. Electric Machine. Thomas H. Hicks, Detroit Mich., assignor of two-thirds to George F. Case and E. D. Richmond, same place. Filed May 9, 1890.

465,854. System of Electric Distribution. Thomas H. Hicks, Detroit, Mich., assignor of one-half to George F. Case, same place. Filed Dec. 26, 1890.

465,855. Alternating Current Dynamo. Thomas H. Hicks, Detroit, Mich., assignor of one-half to H. L. Obetz, same place. Filed Jan. 3, 1891.

465,866. Sliding Clamp for Electric Welding Appaatus. Hermann Lemp, Lynn, Mass., assignor to the Thompson Electric Welding Company, of Maine. Filed Jan. 19, 1891.

The combination of an electric conducting-slide, a stationary conducting part connected to a source of electric energy, and an interposed yielding or adjustable contact block or blocks having double contact-faces, one making connection with the slide or a part moving therewith and adapted to preserve connection as the slide moves over the stationary conducting part and the other making connection with the fixed part and adapted to preserve connection therewith on movement of the slide in a direction away from the fixed part.

465,886. Electric Railway. Henry S. Pruyn, Hoosic Falls, N. Y. Filed June 25, 1890.

In a railroad-track, the combination, with the rail, of two supporting-girders therefor, bolts or rivets for uniting the girders, the bolts or rivets having enlarged central portion for spacing the girders.

465,888. Covered Electric Conductor. Thomas L. Reed, Providence, R. I. Filed Nov. 18, 1890.

A wire for electrical purposes having a covering composed of braided strands and straight wire-strands not braided inclosed between the two sets of braided strands.

465,909. Door-Bell. Frank M. Winters, Chicago, Ill., assignor of one-half to Albert H. Baldwin, same place. Filed June 1, 1891.

The combination, with clock-work for ringing the bell and having a cam-wheel, of an electro-magnet, a catch operated by the armature of the magnet, a weighted bell-crank lever, bell-crank stop-lever and stop-pin.

465,949. Electric Cane. Alfred W. Roovers and Alexander H. Roovers, Brooklyn, N. Y. Filed March 13, 1891.

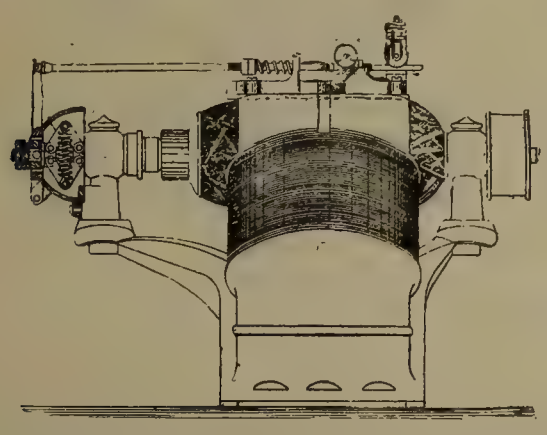
The combination, with a cane having a tubular upper part containing conductor, and induction-coil, a battery, a spring for holding the battery in contact with the core of the induction-coil, and electrical connections.

465,958. Lightning-Arrester. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 5, 1891.

The combination, with an alternating-current electric generator, of two discharge-plates, one constantly moving with reference to the other, the plates being so located with reference to each other that they will pass at the moment of a neutral point in the wave phase of the electro-motive force.

465,961. Insulator. Giuseppe S. Albanese, Orange, N. J. Filed April 3, 1891.

The combination, with an insulator having an annular groove or neck, of a fastening device composed of a neck-band, a locking-lever pivoted to the neck-band, and a bail connected pivotally to the locking-lever and provided with



466,028.—GOVERNING DEVICE FOR ELECTRIC MOTORS.

a bent-up or hook-shaped portion for engaging the line-wire and applying it to the neck of the insulator when the lever is moved into locked position on the same.

465,970. Armature Connection for Motors or Generators. Thomas A. Edison, Llewellyn Park, N. J. Filed March 26, 1891.

The combination of an armature-coil, a commutator having commutator-segments in sections separated from each other, but connected through resistance-conductors, and conductors connecting the armature-coil with the first section of each segment, whereby as the commutator moves relatively to the commutator-brushes the resistances between the sections are thrown into circuit in series one after another.

465,971. Means for Transmitting Signals Electrically. Thomas A. Edison, Menlo Park, N. J. Filed May 23, 1885.

Means for signalling between stations separated from each other, consisting of an elevated condensing surface or body at each station, a transmitter operatively connected to one of the condensing-surfaces for varying its electrical tension in conformity to the signal to be transmitted, and thereby correspondingly varying the tension of the other condensing-surface, and a signal-receiver operatively connected to the other condensing-surface.

465,972. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 18, 1889.

In a phonograph, the combination, with a diaphragm, of a recording-point and a separate reproducing-point connected therewith and adapted to be brought alternately into operative relation with the same surface.

465,973. Armature for Dynamos or Motors. Thomas A. Edison, Llewellyn Park, N. J. Filed March 23, 1891.

An armature for dynamos or motors, having a winding of two wires of different specific resistances, in combination with the commutator, conductors connecting the commutator with the wire of higher resistance, and connections between the wires at intervals.

465,981. Electrical Pyrotechnics. Pierre C. E. Champion, Paris, France. Filed May 15, 1891.

The combination of series of electric lamps with a key-board and a commutator and with a conductor from a series of lamps to the key-board, and with conductors from each of the lamps of one series to the commutator, corresponding lamps of the different series connecting with like contacts of the commutator.

465,983. Cut-Out. Henry W. Fisher, Pittsburg, Pa. Filed March 2, 1891.

In a cut-out mechanism, the combination of an automatically-movable bar adapted when in normal position to form electrical connection between two terminals, needles adjustably connected to the conductors of the main circuit, and a filament for controlling the movement of the movable bar and passing between the adjacent points of the needles.

465,989. Signal-Transmitting Apparatus and System. Henry A. Chase, Boston, Mass., assignor to Albert Watte, same place. Filed May 4, 1891.

465,990. Signal-Transmitting Mechanism. Henry, A. Chase, Boston, Mass., assignor to Albert Watte, same place. Filed July 10, 1891.

465,991. Electric Signalling Apparatus. Frederick W. Cole, Newton, Mass. Filed Jan. 6, 1890.

465,994. Alternating-Current Dynamo. Thomas H. Hicks, Detroit, Mich., assignor of one-half to H. L. Obetz, same place. Filed March 9, 1891.

465,997. Electrical Switch. George B. Martratt. Troy, assignor of one-half to Charles E. Martratt, Albany, N. Y. Filed Dec. 6, 1890.

465,999. Brake for Electric Motors. Alton J. Shaw, Muskegon, Mich. Filed Sept. 21, 1891.

In combination with an electric motor having a field magnet or magnets and an armature, one adapted and arranged to rotate and the other free to move or oscillate a limited distance, and a brake connected with and controlled by the part having a limited play or movement.

466,011 Electric Pendulum Clock. Henry Phillips, New York, N. Y. Filed March 11, 1891.

In an electric pendulum clock, the combination, with the pendulum, of a sliding and vertically-swinging switch actuated thereby and having an electric contact-piece, and a vibrating brush also actuated by the pendulum, the switch having a pivot-support near one end and intermediate support on the vibrating brush, and thereby having electrical contact with the brush in the movements of the pendulum in one direction only and avoiding the contact in the movements in the reverse direction.

466,028. Governing Device for Electric Motors, William Baxter, Jr., Baltimore, Md. Filed April 14, 1891.

In a governing device for electric motors, the combination, with a rod reciprocated by a governor, of a pivoted roller carried by the rod and a series of inclined spring-contacts having the line of their bases parallel with the movement of the rod and their points projected in the path of a roller which traverses over the springs longitudinally.

466,037. Electrically-Operated Elevator. Frank E. Herdman, Indianapolis, Ind. Filed Feb. 24, 1891.

In an elevator, in combination, a worm, a lever, connection between the lever and worm, whereby the lever is adapted to move with the worm, a tension device connected to the lever, and intermediate connection between the lever and the source of power, whereby when the movement of the worm exceeds the tension device the lever moves and shuts off the power.

466,052. Electric Plug Circuit-Closer. James L. Kimball, Boston, Mass. Filed Jan. 22, 1891.

The combination, with a socket adapted to be connected to a source of electricity and provided with two circuit-terminals, of a removable plug or attachment for an electric translating device composed of two members, one of which is movable with relation to the other, and a circuit terminal on each member adapted to co-operate with the two circuit-terminals in the socket, and thereby establish electrical connection, and conducting-cords leading to the translating device connected to the stationary member and electrically connected with the circuit-terminals on the separate members of the plug.

466,053. Electric Signalling Apparatus. Bernice J. Noyes, Boston, Mass. Filed Nov. 4, 1890.

A multiple signal-transmitting apparatus comprising a train, a let-off, a removable signal-wheel and means controlled by the signal-wheel for moving the let-off, and a switch controlled and operated by the removable signal-wheel.

466,058. Electric Game-Register for Pool-Tables. Carl A. Erikson, New Britain, Conn. Filed August 24, 1891.

466,063. Electric Annunciator. Frank C. Colville, Oakland, Cal. Filed March 26, 1891.

A base-plate having a forwardly-inclined bridge for the magnet-spool, ears or lugs and side brackets.

466,086. Mechanical Telephone. Henry B. Thompson, Pittsburg, Pa. Filed June 13, 1891.

In an acoustic telephone, the combination of a primary disc having radial extensions formed at its periphery and a supporting-frame having radial spokes or arms to which such extensions of the primary disc are connected.

466,087. Temperature-Regulating Device for Electrical Circuits. Edward Weston, Newark, N. J. Filed June 4, 1891.

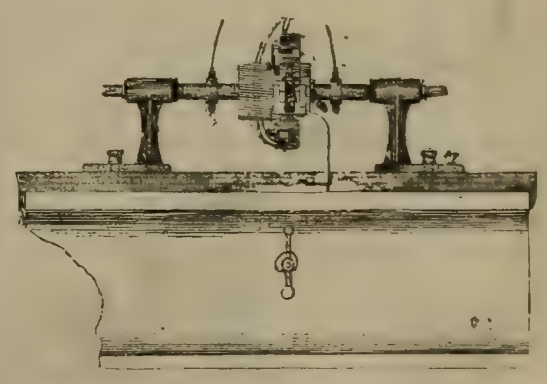
An electrical circuit composed of a conductor the electrical resistance of which increases with augmented temperature and a conductor the resistance of which decreases with augmented temperature, the conductors being disposed in such proximity that heat received from the first conductor may augment the temperature of the second.

466,101. Electric-Railway Switch. Max Kerstein, Boston, Mass., assignor of two-thirds to Henry Cramer and Robert Fabery, same place. Filed May 16, 1891.

In an electric street-railway switch, the combination, with the movable switch member, of an armature-carrying arm or stud projecting downwardly from the same, an armature thereon, electro-magnets on opposite sides of the armature adapted when energized to attract the armature and thus move the movable switch member, the trolley-wire, trolley-arm, contact-levers supported by the trolley-wire and adapted to be electrically connected therewith, the contact-levers being electrically connected with the electro-magnets, and movable arms on the trolley-arm to move the contact-levers to close the circuit and energize one or the other of the electro-magnets.

466,131. Art of and Apparatus for Heating Metal Articles by Electricity. Edwin E. Angell, Somerville, Mass., assignor to the Electrical Forging Company, of Maine. Filed March 16, 1891.

In an electric heater, the combination of two electrodes disposed in position for contact with opposite ends of the article to be heated, and an electrode or electrodes disposed in position for contact with the sides of the article.



466,131.—ART OF AND APPARATUS FOR HEATING METAL ARTICLES BY ELECTRICITY.

466,132. Electric Forge. Edwin E. Angell, Somerville, Mass., assignor to the Electrical Forging Company, of Maine. Filed March 18, 1891.

In an electric forge, the combination of two electrode-levers pivoted at opposite points and inclined rearwardly toward each other, the inner ends of the levers being adapted to receive between them a bar to be heated.

466,133. Electric Forge. Edwin E. Angell, Somerville, Mass., assignor to the Electrical Forging Company, of Maine. Filed March 23, 1891.

In an electric forge, the combination of a work-holder having clamping-electrodes connected with one pole and provided with notches of different shapes for different tools, and an adjustable electrode connected with the other pole.

466,138. Secondary-Battery Plate. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa. Filed July 5, 1890.

A compound of sulphide of lead and a binder from which is formed the spongy-lead active material of a secondary battery plate.

466,159. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Filed July 10, 1891.

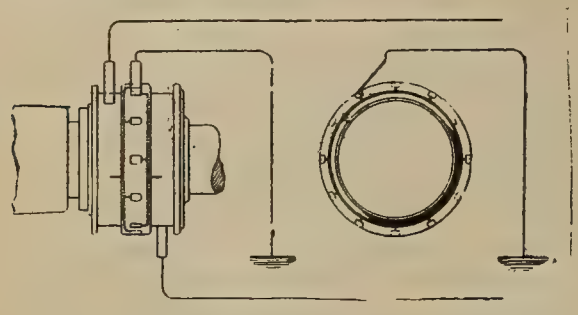
The combination, with the speaking-tube and the electric bell, of a drop-leaf arranged at the mouth of the tube and forming one terminal of the bell-circuit, a yielding contact arranged adjacent to the drop-leaf and forming the other terminal of the bell-circuit, and a projection on the leaf adapted to strike and pass the yielding contact when the leaf is dropped.

466,177. Galvanic Battery. Samuel Miller, Buxton, England, assignor to Evelyn Glover, same place. Filed Oct. 16, 1891. Patented in England, France and Austria-Hungary.

A primary battery comprising in combination the following elements: a case or vessel, a carbon element in the form of a cylinder or box embedded in pitch or similar substance and containing a depolarizing-liquid, a porous pot inclosed by the carbon box and containing an acid solution, and a zinc element in porous pot.

466,180. Electrically-Driven Locomotive. Everard H. Morgan, Dover, England. Filed March 9, 1891.

The combination, with the ordinary frame and drive-wheels of a locomotive, of a storage-battery and dynamo arranged in the space usually occupied by the boiler and engine, a pinion on the axis of the dynamo, a transverse shaft provided with a pair of cranks and a gear-wheel engaging the pinion of the axis of the dynamo, cranks on the axle of the driving wheels, and connecting-rods between the cranks on the transverse gear-wheel shaft and the cranks on the axle of the driving-wheels.



465,958.—LIGHTNING ARRESTER.

466,196. Electric-Railway Trolley and Support. Wilbur A. Stevens, Kansas City, Mo. Filed Sept. 22, 1890.

The combination of a post with a bracket secured to it, an arm secured to the bracket, the arm having a portion extending in a horizontal plane, and a portion extending in an oblique plane, a line-wire being suitably secured to the outer end of the oblique portion.

466,212. Electric Car-Brake. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Company, East St. Louis, Ill. Filed Jan. 10 1891.

In an electric car brake, the combination of brake shoes, a track-brake, an electric motor, a pivoted stem, a suitable connection between one of the brakes and the stem, a relatively longer connection between the other brake and the stem, and a train-of-gear connection between the motor and the stem whereby the stem may be moved a greater or less degree and the respective brakes applied successively.

466,244. Electric Switch. William J. Kelly, Boston, Mass., assignor to John P. Cushing, same place. Filed June 29, 1891.

In a circuit-controlling device or switch, the combination, with circuit-terminals separated from each other, of a horizontally-sliding contact-carrier provided with a contact member extended from the opposite sides of the carrier and co-operating with the terminals, guides in which the carrier slides, a vertical shaft, and a connecting-rod joining the sliding carrier and shaft to produce straight-line reciprocations of the carrier.

466,245. Controlling Apparatus for Incandescent Lights. William J. Kelly, Boston, Mass., assignor to John P. Cushing, same place. Filed August 7, 1891.

The combination, with a main-supply circuit and an adjustable current-regulator included therein, of a plurality of loops connected to the regulator and provided with one or more translating devices, a switch in each loop to connect and disconnect the loops from the current-regulator, and an auxiliary loop for each of the loops connected directly to the main-supply circuit, and a switch in each of the auxiliary loops.

466,250. Electric Conductor. Joseph W. Marsh, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed Sept. 30, 1891.

The combination of an open frame formed of non-conducting material, wires arranged on opposite sides of the frame, and a perforated strip of fibrous material surrounding the frame and wires and binding the latter in position on the frame.

466,266. Electric Heating-Tool. George W. Blanchard, Waterville, Me., assignor to the Electrical Forging Company, of Maine. Filed April 3, 1891.

An electric heating device consisting of tongs, in combination with two electrodes, one secured to each jaw of the tongs and electric conductors secured to the electrodes.

466,268. Electric Cable. William A. Conner and Joseph W. Marsh, Pittsburg, Pa., assignors to the Standard Underground Cable Company, same place. Filed Feb 10, 1890.

An electric cable having a series of conductors adapted to be used in pairs for metallic circuits, the two wires of a pair or circuit being separated from each other a greater distance than the adjacent wires of adjoining circuits.

466,288. Lamp-Socket. Jesse L. Hinds, Syracuse, N. Y., assignor to the Electric Engineering and Supply Company, same place. Filed July 23, 1891.

In combination a base-plate, a bracket secured to the base-plate and formed with an arm adapted to carry one of the socket-terminals, a double U-shaped spring having one end fixed and formed with an arm extending at outside of the bracket-arm, a laterally-extending arm extending outwardly from the first-mentioned arm and an engaging end extending downwardly from the latter arm, a cam for engaging the spring-arm and forcing its engaging end into contact with the corresponding lamp-terminal and a spindle loosely connected to the cam for operating it.

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THE ELECTRICAL AGE.

VOL. X. NEW YORK, JANUARY 16, 1892. No. 3.

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ELECTRICAL EXECUTIONS.

Acting on the suggestions contained in our article on electrical executions in the issue of December 26 last, Governor Flower in his message to the Legislature recommends amendment of the law so as to remove the feature of secrecy which is now compulsory. Secrecy in the administration of law in this country is a gross inconsistency with republican spirit, and with commendable promptness Governor Flower realized the truth and wisdom contained in the article referred to.

On another page we print the portion of Governor Flower's message which refers to electrical executions. The language used is plain and to the point, and there is no question that the Governor is the correct exponent of public sentiment on this subject.

While Mr. Flower does not suggest specifically any action in the matter of the appointment of a committee of responsible persons, as suggested in the ELECTRICAL AGE article, there is every reason to believe that he is in favor of such a procedure. Indeed, a bill is to be introduced in the Senate during the present week with this very object in view, as well as to amend the law so that there will be no undue secrecy exercised in the execution of criminals by electricity.

This method of execution is practically an experiment, and, as we pointed out in our article of December 26, other States and countries are watching the experiment and "making notes" of New York's experience. They cannot gain much information so long as secrecy is enjoined on the handful of legal witnesses.

Remove the bond of secrecy and let electrical and medical experts determine whether the method is the best and a success or not, then there will be no question on these points. As the matter stands now the very fact that secrecy is enjoined naturally gives rise to misgivings and doubts in the public mind concerning the success of the electrical method of execution; so long as secrecy is enforced so long will the people regard the operation of the law with suspicion.

Governor Flower is to be congratulated on his prompt action in the matter, and there is no question that he is seconded unanimously by the entire people in his effort to correct the obnoxious law.

The bill which it is intended to introduce in the Senate provides that there shall be twelve witnesses present at an execution, of whom at least six shall be representatives of newspapers in the State of New York. It also strikes out the clause which makes it a misdemeanor for newspapers to publish accounts of the details of such executions.

ICE HARVESTING BY ELECTRIC POWER.

An interesting application of electric power is described on another page of this issue, namely, in the harvesting of ice. The apparatus is so simple and its operation so effective that one is apt to ask why it was not thought of before.

The machine is called the electric ice-harvester and ice-cleaner, and Mr. F. E. Kinsman, the inventor, applied his ingenuity to excellent advantage when he produced this valuable invention.

By the use of this electric ice-harvester ice can be harvested where it could not be under the old method. For instance, ice of moderate thickness, which ordinarily would not sustain the weight of a horse, can, with this new apparatus, be harvested with little difficulty. The machine, which is a cleaner and cutter combined, is operated entirely by an electric motor which constitutes a part of the apparatus itself. All snow and other undesirable substances can be removed from the surface of the ice before it is cut, so that pure, solid blocks are obtained. The ice cutters or groovers are driven directly by the armature shaft upon which they are mounted in gangs, and are adjustable, so that cuts may be made of any depth desired, according to the thickness of the ice.

The current is supplied to the motor through a flexible insulated cable, the source of the current, of course, being at some convenient place on shore.

The inventor claims that by the use of this machine there need be no fear of an ice famine in the ordinary sense of the word. Usually ice harvesting is carried on only when the ice is of sufficient thickness to bear the weight of horses, which are used to haul the ploughs or markers; then the ice has to be cut afterwards by hand. By the electric method comparatively thin ice can be taken, thus avoiding the necessity of having to wait until the ice has attained considerable thickness.

There are many valuable features which the new method possesses over the old, one of which is absolute cleanliness in connection with the work of gathering the ice, and in view of the great importance of the ice industry and the uncertainty of an abundant supply heretofore, it would seem that this new apparatus is just what is needed by those engaged in ice harvesting.

THE LAST OF THE POLES.

The exciting times attending the vigorous crusade against telegraph, telephone and electric-light poles in this city two years ago was recalled a few days ago by the issuing of orders to the Board of Electrical Control to remove the remaining poles within certain described limits down-town. This work is now being carried on and will soon be finished, much to the relief of everybody concerned.

It will greatly add to the appearance of Broadway to have the poles out of the way. It cannot be said that the remaining ones on that thoroughfare are things of beauty. They never were attractive in appearance, and since the war began, those poles which survived the onslaught have been sadly neglected. Some of them were attractive through their ugliness and complexity of wires and cross-arms, and no one will be sorry to see them removed.

NEW YORK SUBWAYS.

Mayor Grant, in his annual message to the Board of Aldermen, refers specifically to the marked decrease in the number of fatal accidents in this city due to coming into personal contact with heavily charged electric wires. He ascribes this happy result mainly to the wisdom of the authorities in having the wires placed underground, despite the great increase in the electrical business.

There can be no question that heavily charged wires are safer when buried underneath the surface of the ground than they are when strung overhead; that is, they are less accessible than overhead wires, and consequently not so liable to cause damage or injury. But we think that the fact that there were no accidental deaths during the past year is due as much to the extra care exercised in handling heavily charged wires as to any other cause.

According to the Mayor's report the Board of Electrical Control caused to be removed from the streets 5,224 poles and 7,152¼ miles of wire, while 114 miles of subway were constructed. The fact that so many poles and so much wire were removed from the streets without a word being said about it in public is remarkable, and it shows how quietly things move along when the first excitement attending the inauguration of such movements subsides.

When the crusade was begun the excitement ran high; now the matter is almost forgotten by the public.

One thousand four hundred and twenty miles is the length of subways so far constructed. In these are 29,666 miles of telegraph and telephone wires.

"The reports are conclusive," says the Mayor, "that from an electrical standpoint the operation of the subways is a success."

THE POWER SYSTEM OF THE BALDWIN LOCOMOTIVE WORKS.

The distinction between the real and apparent relative economies of steam plants is seldom observed, yet conditions may very easily be such that one is the exact reverse of the other. In other words, it is perfectly possible to make a change in a steam plant that, according to most experiences, would seem to favor an increased economy, while, as a matter of fact, the net results might prove a considerable loss. An expensive economical device may be imposed upon a system with the effect of actually lowering the efficiency of the combination in that particular case. For instance, a vacuum is almost certain to raise the economy of an engine under almost any condition, but if the circulating pump uses more steam in that particular case than is saved by the engine a mistake has been made. The quality of an oil usually improves as the price increases, but it would be a positive error to use an oil whose increased useful effect would be insufficient to justify the greater cost. On the other hand, it would be just as false economy to use an oil of half the cost if it required more than twice the quantity to produce the same effect. If the saving caused by an expensive attachment will not pay for the interest on the investment, cost of maintenance and operation, etc., then the plant is better off without it. An improvement is not an improvement if the increased production will not pay for it, and it is poor engineering that lets a dollar pass to save a cent. At the same time, it is an unnecessary expense to continue with an inefficient machine when a change can be shown to be a considerable benefit.

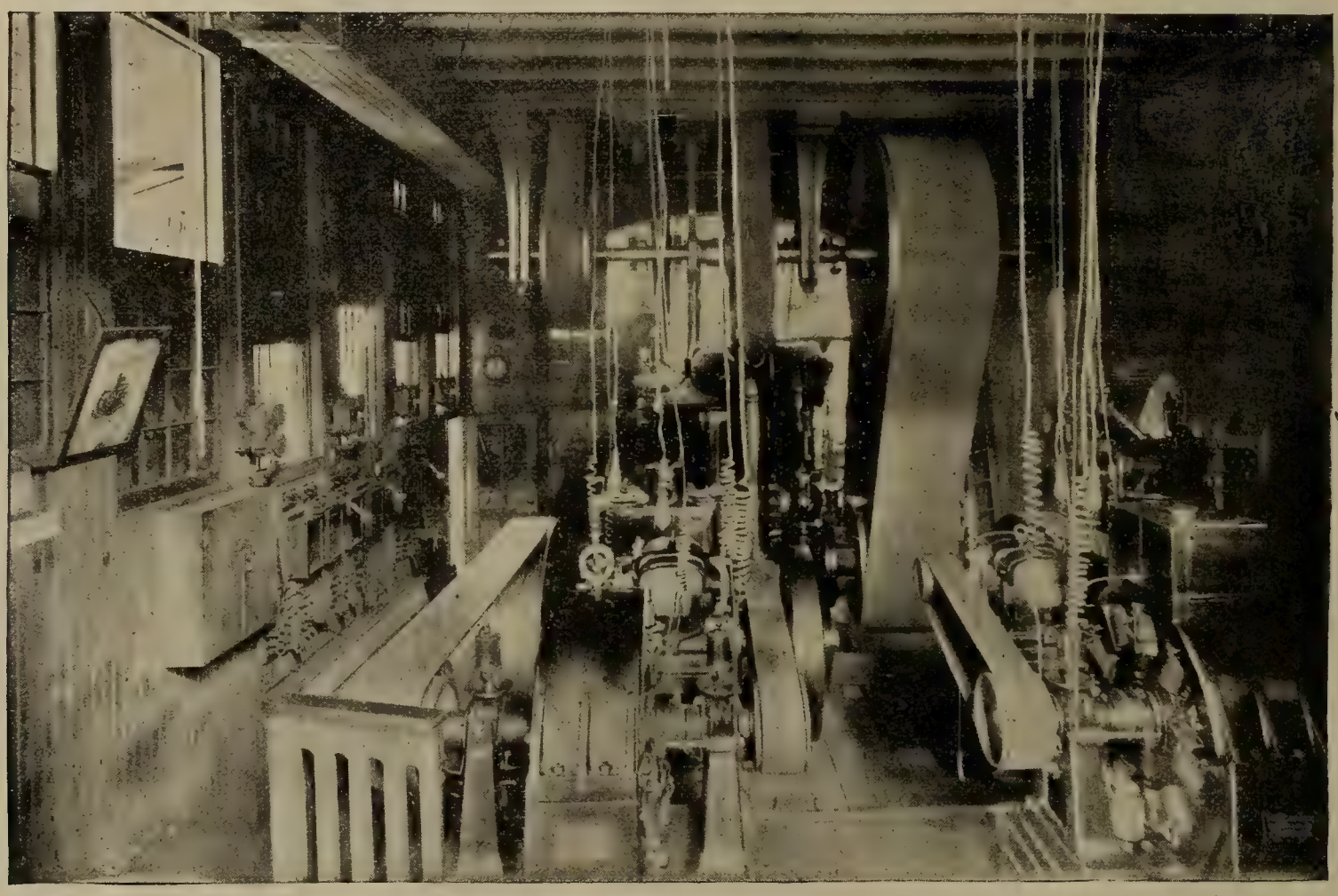
The Baldwin Locomotive Works, of Philadelphia, realizes all this most thoroughly, and shows its appreciation of it in a very practical way.

Years ago the company used engines to drive its works whose indicated water rate would probably be in the neighborhood of 28 pounds, but on substituting Westinghouse Standard Automatic Engines, with an indicated water rate of about 32, the apparent loss became nearly 15 per cent. Practically, however, by splitting up the power and distributing it around wherever needed, the saving by the consequent loss of friction amounted to considerably more than this, so that the net fuel consumption was less by the amount of this difference.

It had hardly finished substituting these high-speed engines for those formerly used when the Westinghouse Machine Company put on the market its high-duty compound, and a comparative test at the Baldwin Locomotive Works showed that this new engine would, under the same conditions, save about 30 per cent. of the fuel consumed by the single-expansion engine of the same type. It was rather disheartening, considering that the company had barely finished replacing one lot of engines, but it set to work, and now has nearly all Westinghouse high-speed compounds in place of the standards. The Baldwin Company says it pays, and it should know, inasmuch as it is a builder of locomotive steam-engines, and is regarded as in the very front rank of the steam engineering and mechanical profession. When the firm pays for the change, and is more than satisfied with the result, it is pretty good evidence that it has made no mistake.

We illustrate from a photograph an interior view of one of its engine-rooms which, while it exhibits nothing of particular interest, yet is a fair type of what may be met with in works of such magnitude. These engines are used in driving various electrical generators for light and power.

Engines are here regarded as simply a means to an end. They are the laborers of the plant, and are housed accordingly. At the present time the Baldwin Locomotive Works has eighteen Westinghouse engines in use.



ELECTRIC PLANT AT BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA.

EXECUTIONS BY ELECTRICITY.

The subject of electrical executions receives marked attention in the message of Governor Flower to the New York Legislature.

The Governor says :

"During the past year and a half there have been several executions of convicts sentenced to death in the State prisons, under the provisions of what is popularly known as the 'Electrical Execution' act, passed in 1888. The results of those executions have been regarded by expert witnesses as a satisfactory vindication of the new method of inflicting the death penalty, furnishing, it is said, a speedy and painless death, and being less revolting in its operation than was the old method of hanging.

"There is one feature of the law, however, which is of doubtful constitutionality and of questionable propriety. I refer to that provision which prohibits the newspaper publication of an account of the details of the execution. The exact reading of the law upon this point is as follows :

"'No account of the details of any such execution, beyond the statement of the fact that such convict was on the day in question duly executed according to law, at the prison, shall be published in any newspaper. Any person who shall violate or omit to comply with any provision of this section shall be guilty of a misdemeanor.'

"This provision of law has been generally disregarded by the newspaper press. In my opinion, it was unwisely made a part of the statute. The adoption of so novel a method for inflicting the death penalty as electricity naturally excited world-wide attention and aroused both popular and scientific interest. There was in the beginning some question of its success. The public curiosity to know the actual results of the experiment was intense. It did not spring from morbidity, but from wholesome interest. The feeling was general that so radical and important a departure from existing methods should be carefully studied and the facts relating thereto truthfully stated. There is a popular aversion to secret methods of performing public duties.

"In response to this sentiment the newspapers at the time of the various executions contained long and graphic accounts of what purported to be accurate descriptions of the details of the executions. If the descriptions were accurate the law was deliberately violated. If they were inaccurate the public was grossly imposed upon. In any case this provision of the law is not sustained by public sentiment and is practically a dead letter.

"I therefore recommend its repeal. I have no sympathy with that morbid taste which yearns for revolting details of human suffering and misfortune and would make heroes out of criminals, but I recognize a legitimate public interest in the adoption and trial of this new method of execution, and I would not shut out from the people the opportunity, under proper restrictions, of securing the most unbiased information regarding its operation.

"Other legislation has also been suggested to facilitate the operation of the statute providing for electrical executions. The infliction of death by electricity requires expert supervision and perfect appliances. These, it has been thought, are not always easily attained in the State prisons. Besides, the cost of establishing and maintaining the necessary apparatus in each prison is considerable, and should be avoided if practicable. I would respectfully invite your attention, therefore, to the recommendation of the Superintendent of Prisons, that the statute be amended so as to provide for but one plant, in a building especially constructed for the purpose and containing the necessary rooms and apparatus, under the charge of a competent and trustworthy electrician. My own opinion is that, should it be deemed advisable to adopt this suggestion, the plant should be connected with one of the largest and most accessible prisons, rather than established separately. This would be more practicable and more economical."

SUBWAY WORK IN NEW YORK.

Mayor Grant, of New York City, in his annual message to the Board of Aldermen, gives the following interesting information respecting the placing of wires underground:

"The decrease in fatal accidents resulting from overhead wires, despite the great increase of electrical business, is an evidence of the wisdom of the efforts made by this administration to place the wires underground. One fatal accident, in which death was caused by a fall from a telegraph pole, is the record of the year. In 1889 five deaths from actual electric shock were reported. There has also been a noticeable improvement, especially in the lighting service, from the use of the subways. The year's work under the Board of Electrical Control comprises the removal of 5,224 poles and 7,152¼ miles of wire and the construction of 114 miles of subways. The capacity of this subway work is as follows: 47 miles for electric light service, 721 miles for telephone and telegraph service, and 121 miles for Edison light service. There are now in use in the city 1,420 miles of subways, divided as follows:

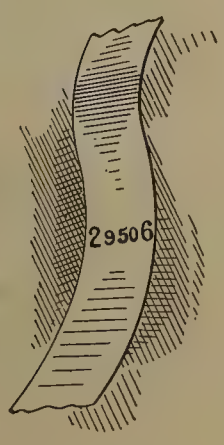
Electric light subways 578 miles, telephone and telegraph subways 721 miles, and Edison subways 121 miles. There are at present 59 alternating and 84 arc circuits, making a total of 143 high-tension circuits in use in the subways, with 528 miles of electric light conductors. There are 29,666 miles of telegraph and telephone wires and 383 miles of Edison conductors. The reports are conclusive that from an electrical standpoint the operation of the subways is a success."

ELECTRIC SYSTEM AND WATCHMAN'S REGISTER.*

The necessity for an efficient system of automatic safety signals for use in factories, warehouses and other large buildings, has stimulated the genius of inventors and led to many inventions with this object in view. In this class of apparatus, as in all others, many of the inventions are more or less



REGISTER.



RECORD ON TAPE.

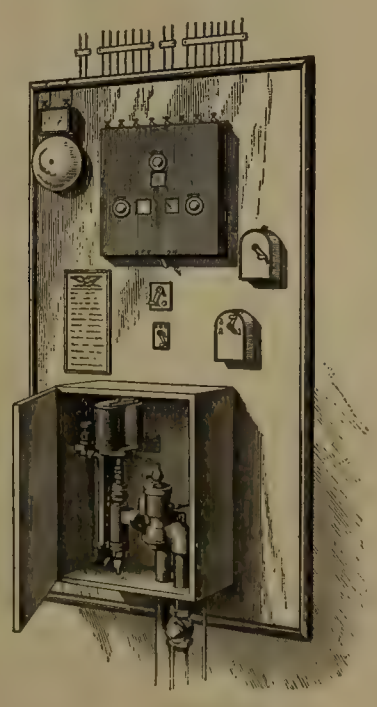
deficient in many important respects. A system to be complete should provide means by which the movements of the night watchman, in the performance of his duties, are immediately recorded in print. It should provide means by which an alarm can be promptly sounded in case of fire, and in establishments where machinery is used, in case of accident, enable the engine to be immediately stopped, from any distant point, independent of the engineer.

All of these important features are fully covered by the system described and illustrated below.

The Register (Fig. 1) on which all records are made prints upon a strip of paper, one inch wide, the time at which a watchman, on his rounds, reaches any particular station, noting as well the number of such station. For example: If the station be No. 26 and the hour 9.50, the strip will read as shown in Fig 2—the two outside figures representing the



STATION.



RECORDER.

number of the station and the three central figures the time.

In the event of the clock mechanism becoming deranged from some unusual cause and it should stop, or become in any way affected, registration would not be entirely prevented. In such case the *time* would be omitted from the record on the slip, but the station number or numbers would be printed as usual. From these registrations it could be discovered at once if the watchman had failed in his duty. This is a valuable feature of the system, and it is said to be the only system making complete provision for such circumstances.

The Register can be used without special arrangement for from 1 to 90 stations, and any number of watchmen may record upon the same register. These instruments are extremely simple in their mechanical construction and consequently not liable to easy derangement. Any meddling with the working of the system at any point is recorded on the strip on the Register; hence such tampering cannot remain undetected. The Register besides prints the number of the station where any interference takes place; in this way not only is the fact recorded that tampering has been done, but the location of such meddling is also recorded, so that the fault or responsibility for it can be at once located and the proper remedy applied.

The clock movement of the Register requires winding but once a week, and is of the finest workmanship.

It may be said that this apparatus contains really two instruments in one, of which either alone does more than any other device for the purpose; but when all its parts are working in unison, it then achieves a most wonderful and accurate result, printing, as it does, in clear and distinct figures the station, the hour and the minute at which the signal is made.

The next important part of the system is the station. Sometimes, in addition to such as are visited by the watchman at night, there exist places where there is liability to conflagration or danger to employés from machinery by day. Sometimes machinery in swift motion becomes disarranged, causing serious damage; rapidly revolving wheels may break, belts may catch, etc. It is very important for these reasons to be able to instantly stop the engine from such places in a building independently of the engineer.

At such localities are placed stations, which are small iron dust-proof boxes from which project handles. When at rest these handles are at 0, but they may be readily turned to numbers, 1, 2, 3 and 4.

Should it be needful at any time to stop the engine from any of these stations, however distant, it is only necessary to place the handle over the figure 4 and then release it. Before the handle will have returned to its normal position—about ten seconds—the engine, with all attached machinery, will have quickly and silently stopped, independently of any action on the part of the engineer, and more smoothly than if the engineer were standing with his hand on the throttle at the instant the signal was given.

This part of the system is accomplished by a simple hydraulic valve, placed at any distance desired from the engine, being piped to a cylinder connected with the throttle valve, and which does not interfere with the engine's usual working, whatever its size or style.

This electric valve is automatic in its action, requires no resetting when its work is accomplished, and can be instantly and repeatedly used as may be required. It works with water pressure taken from house tank, main or other supply, steam pressure being substituted if desired. At the same time the engine is stopped a special instrument (called a Recorder) indicates the number of the station in the two lower squares, also in the upper square the number of times it is repeated; at the same time the alarm bell on the top of the Recorder is set ringing, and continues to ring until the engineer or other person in charge replaces the numbers to zero by the use of the handle at the base of the instrument; in this way no mistake can be made. This is repeated four times, while the register in the office prints the number of station, the hour and the minute four distinct times.

The figures 1 and 2 are used to signal to the engineer to start his engine—thus: 1, *Start Slow;* 2 *Full Speed.*

The figure 1 is used at night by the watchman to register his movements. The figure 3 is to be used either by night or day for fire or burglar alarm, or for one watchman to call a comrade or patrolman to his assistance from a distance.

If by day the figure 3 is used for fire-alarm, and there be a lack of water pressure in the building, so that a steam-pump is required, *an extra valve* may be arranged, so that when the handle is placed at the figure 3, and at the same moment a button is pressed in the bottom of the box, the steam-pump will start, and the Recorder in the engine-room will repeat the number of stations three times, all of which will be as usual recorded by the Register.

When the handle is placed on the figure 3 at night for the above cause, a continuous automatic signal begins, which cannot be stopped by the person giving it, and which allows him to leave the station for any purpose, while continuing to sound the alarm. The station from which this is given is as usual noted on the register, thus saving time in determining where the watchman can be found.

In order to insure the perfect working of all the stations, apparatus, etc., and to be able to test it daily, the building is wired in such a manner that the wires begin in the engine-room and from thence run to all the various stations without loops or branches from the main line, returning again to the engine-room, at which point there is a station from which the engineer may, twice a day, or oftener if he chooses, stop his engine by using the system. By so doing he completely tests every circuit; and should any of the wires, batteries or appliances fail to be in perfect working order, he will be at once cognizant of the fact. This constant use is a perfect check on the unimpaired accuracy of this system.

The electric power with which all this is accomplished is derived from 12 cells of open-circuit battery.

The wiring for this system is conducted in the best and safest manner possible and nothing but the best of materials is used.

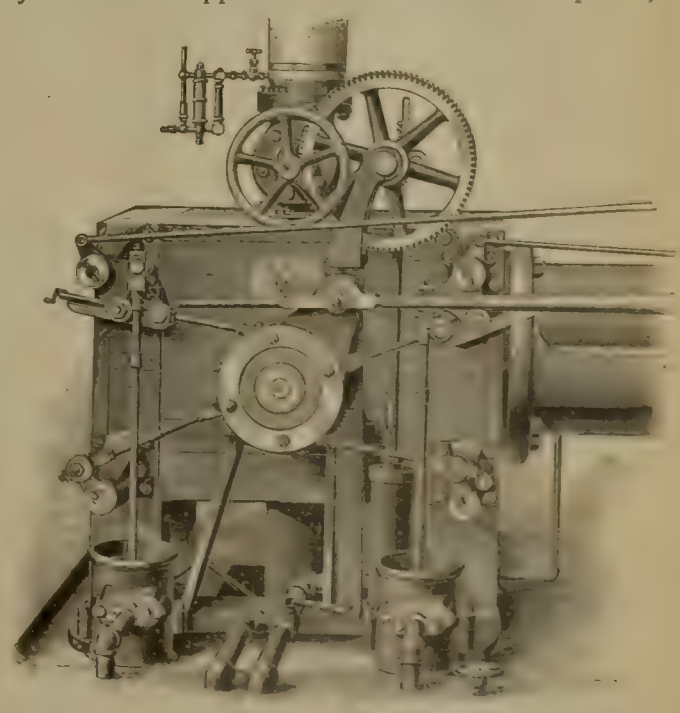
The company has organized an Inspection Department, which will examine (subject to a reasonable yearly payment) the system wherever used, keeping it in perfect working order, re-charging batteries, cleaning, adjusting or repairing where it may be necessary, thus relieving the owner of all responsibility and assuring perfect service without attention from himself or his employés.

Another very important application of this system is in the automatic sounding of an alarm in case of a leak in a sprinkler. Attachments are placed upon the sprinklers and in electrical connection with the alarm, so that in case a leak should develop the alarm would be sounded and a record made of the same. By this means the attendant can at once locate the leak and give it proper attention. Three drops of water will cause the alarm to sound.

In a similar manner thermostats are placed in electrical connection with the system and communication is established through them with the fire department. In this way the breaking out of a fire is automatically made known at the fire department quarters without delay.

This system is patented in the United States, Great Britain, France, Belgium, Germany, Switzerland, Sweden, Austria, Italy and Australia, and in this country it has been approved by the New York Board of Fire Underwriters, the New England Insurance Exchange, of Boston, Mass.; the Fire Underwriters, Association, of Philadelphia, Pa., and the Southeastern Tariff Association, of Atlanta, Ga. It is a fact worthy of mention that wherever this system is used the insurance on the property so protected is reduced enough to cover the cost of the installation.

A bill has been recently introduced in the Massachusetts Legislature directing the introduction in all factories of some apparatus by which the machinery can be stopped at once from distant points,



ELECTRIC HYDRAULIC VALVE FOR AUTOMATICALLY STOPPING ENGINE.

directly without signalling the engineer. The system described herewith is designed to meet this want, and the company believes a very large sale of its devices can be secured from this source without similar legislation in other States.

A still farther field of use for this invention is on steam vessels of all kinds. By its use the engine can be rendered subject to direct and instant control from the bridge or any other part of the ship. The

*The Ongley Electric Co., 1 Broadway, New York.

register may be found useful in various ways other than those for which it was primarily designed; for example, as a general recording instrument. By use of this register a single word or figure can be substituted where now various signs and signals are used.

The Associated Mutual Insurance Company, of Boston, has accorded the privilege of having this system placed in its rooms. The importance of this will be recognized when it is known that Associated Mutual Companies insure the greatest part of fire risks in the large manufacturing districts throughout New England.

The uses of the system can be divided. For example, if there is no machinery to be controlled, as in the case of hotels, warehouses, stores, etc., and only a watchman is employed, then the register can be used separately. Again, if only the engine-stopping device or fire-alarm is desired this can be furnished without the other portions. In short, divisions of or additions to the apparatus can be made to suit the requirements of the case.

The company's factory is in Jersey City, and is equipped with the finest machinery that could be made.

THE KINSMAN ICE-HARVESTER.

Notwithstanding the fact that the lack of an unfailing source of the natural ice supply has induced the carrying on of the manufacture of artificial ice to a large extent, the majority of people prefer the natural to the artificial on account of the possible impurities in manufactured ice. A thoughtful and careful man would be likely to consider many things before using artificial ice, among which would probably be the source of the manufacturer's water supply, the make and material of the freezing-boxes, the danger from uncleanliness, neglect or unhealthiness of the employés entrusted with the manufacturing process and the fact that any impurity or refuse due to oxidation, carelessness or other causes, must of necessity become a part of the artificial cake, owing to the fact that it cannot as in the case of natural ice settle to the bottom or be given off in the atmosphere through natural processes, as the entire contents of the freezing box become a part of the cake.

The main trouble in harvesting natural ice is the difficulty with which the cakes are cut and trimmed for storing, the plough now in use cutting the ice very irregularly, necessitating a large amount of trimming before the ice is ready to store away for use. As ice harvesting is now conducted it is necessary that the ice must be of a certain thickness before it can be touched, and with changing weather and the accumulation of snow on the surface, the supply is very far from being an unfailing one, but the electric ice-harvester and ice-cleaner recently devised by Mr. F. E. Kinsman, manager of the American Manufacturing and Engineering Company, 15 Cortlandt street, New York, seems destined to work a revolution in the gathering of natural ice, as it is possible to harvest ice that is much thinner than it is possible to obtain in the usual way, with horses. The water under the ice is at a temperature of from 6 to 8 degrees higher than the ice, and if the ice is covered with a warm blanket of snow, it is evident that the formation of ice will be much slower, unless the weather is extremely cold, than it would be if the ice was clean, permitting the cold air to be in immediate contact with its surface. If the first snows could be economically removed as soon as they fell the ice would be exposed to the lowest possible temperature, and Mr. Kinsman has devised an electrical self-propelling snow planer and carrier for this purpose.

This planing and carrying machine is equipped with a scoop and chamber, which can be dumped when once filled or upon approaching the shore limit of the ice field, while the planer being adjustable can be raised or lowered sufficiently to remove all "snow ice" or unevenness of the surface. The planer and chamber are detachable at will.

The electric ice-cutting machine designed by Mr. Kinsman is so plainly shown in our illustrations that a detailed explanation is unnecessary. The cutters or groovers are so constructed as to admit of the easy adjustment of the knives for cutting any thickness of ice, and when desired the shaft upon which the knives are mounted in gangs, are supplied with corrugators for corrugating the upper surface of the ice as it is cut. This corrugating upon the field is a decided improvement over doing the same work at the ice-house, as all the refuse ice made or produced by corrugating is floated off on the water when the cakes are split from the main body and become submerged. On account of the greater depths to which the grooves are cut, a shorter splitting surface is left, and consequently there is a likelihood of less divergence from a true line, when the ice is barred off.

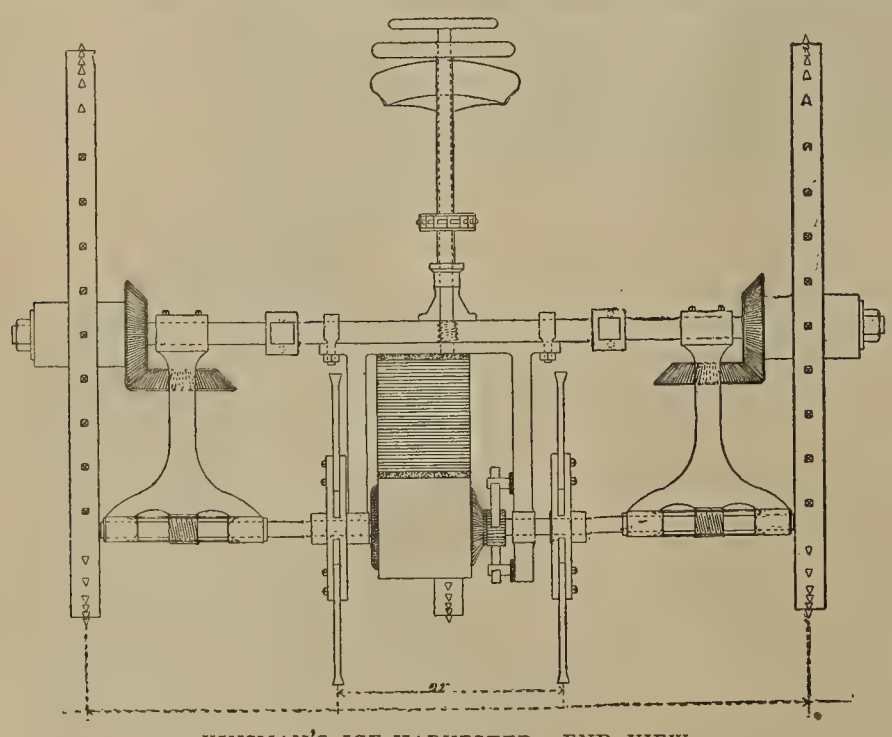
The cutters are driven direct by the armature of an electric motor which has an elongated shaft upon which the cutters are mounted; this obviates the necessity of using belting or gearing. The depth of the groove to be cut can be regulated by a hand-wheel under the control of the attendant, the cutters being raised by a worm-and-tooth segment. The same shaft that carries the cutters is provided with two worms, which acting through the shaft and bevel gears propel the wheels upon which the machine is mounted; by this means the exact ratio is obtained between the travel of the machine and the speed of the cutters. The direction of the machine is controlled by the hand-wheel and sprocket chain fastened around the pivot of the rear wheel, but the machine may also be guided by a special "guide" run in the groove last cut.

The current is transmitted from the generator to the motor on the ice-cutter through a flexible waterproof cable.

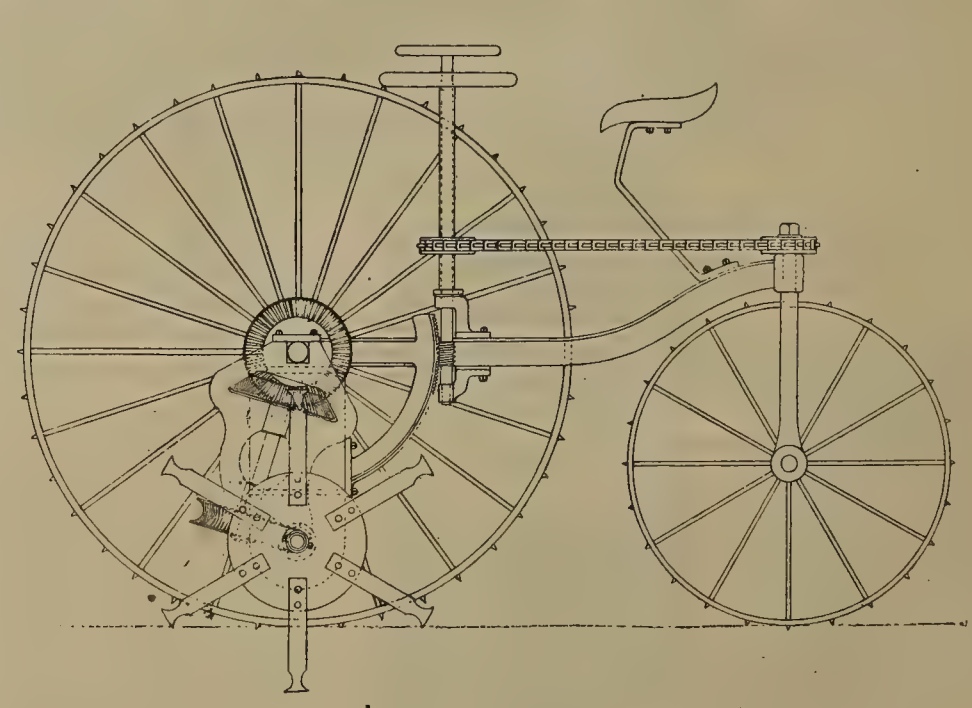
With the "Kinsman Cutter" it is possible to groove ordinary ice almost through to the water, as the machine produces no shock or jar upon the ice, while its width and length is sufficient to give it the advantages of a broad bearing surface. The weight of a No. 2 machine does not exceed that of a fair-sized horse; a No. 4 machine carrying a gang of four cutters is somewhat heavier, but not enough to prevent its use on "thin ice."

Another feature of great importance in localities where comparatively small quantities of ice are cut by one party, or where it is necessary to go to remote places for a supply, as is frequently the case in "warm" or "short seasons," is a portable plant made by this company. It has been especially designed for transportation from field to field. This portable equipment is expected to exert a potent influence upon the ice industry in and about country towns, as a person owning one can contract with the owners of numerous small houses to cut their ice much upon the same plan as the owner of a threshing-machine plant now goes about the country in harvest-time, with this advantage, that it gives profitable employment during a season of the year when most farmers are idle.

This improvement in ice harvesting, if owned by any one of the larger ice companies, would enable that company to practically control the natural ice business, since it is estimated that a saving of from 30% to 50% can be made by its use and enable it to compete with producers of natural ice.



KINSMAN'S ICE-HARVESTER—END VIEW.



KINSMAN'S ICE-HARVESTER—SIDE VIEW.

MUNICIPAL TELEGRAPH EXCHANGE.

Mayor Grant of this city, in his annual message, recommends the establishment of a municipal telegraph exchange to connect the departments and other points between which communication is necessary and desirable. This service is now performed by several independent and inadequate systems, each department having its own, without uniformity of plan or of efficiency. "All the departments," he says, "should be connected by wire with a central station controlled by the city government in which the city's operator could connect any two wires called for, as in the switch plans of the telephone exchanges. Each office should be provided with either a dial telegraph, a ticker, or other instrument, which would transmit the messages as rapidly as written. The expense would be very light, as the city owns privileges in the use of the subways.

"The advantages of a single system," he continues, "by which any official could reach any point would greatly facilitate the transaction of the business of the city and add to the efficiency of those departments whose duties involve the protection of life and property. The points to be connected might well include the Police and Fire Department buildings, the public offices, and the hospitals. It might be found desirable to throw open these facilities to the public to the extent of permitting theatres and othes places of public resort to be connected with Police and Fire Headquarters at a charge which would pay the expense of the service and yet be much lower than similar service now costs."

THE WORLD'S FAIR.

The special rules of the machinery department of the World's Columbian Exposition are given below. These will be of interest to those who intend to have electrical exhibits at the Fair for the reason that the electrical generating plant will be located in that department, and not in the electricity building, as may be supposed. The rules are as follows:

A limited quantity of steam and water power will be furnished for the purpose of exhibiting machinery in operation, the quantity of each to be definitely settled at the time of allotment of space. Any excess will be charged for at a fixed price. Demands for such excess must also be settled at the time of allotment of space.

Exhibitors must be manufacturers of machinery and not dealers only.

Exhibitors must provide show-cases, shelving, counters, fittings, countershafts, pulleys, beltings, etc., at their own expense.

Exhibitors are required to furnish the following information, and a drawing to the scale of one-fourth inch to a foot of the plans and distribution of the objects they wish to exhibit: If machinery, actual horse-power required; cubic feet of steam used an hour, at a pressure of 150 pounds; diameter of steam and water pipes; diameter of discharge or drain pipes (the main shafts will make 120 and 240 revolutions a minute); dimensions of space required must be given in feet and inches, without including any allowance for passage-ways; what per cent. of

labor performed by females in the production of articles exhibited; whether the applicant is a producer or manufacturer.

By special arrangements the installation of heavy articles requiring foundation should begin while the building is under construction.

The floor of Machinery Hall will support 250 pounds per square foot. The heaviest single piece received must not weigh more than 30,000 pounds, as facilities will not be provided for handling heavier weights.

The steam-pressure supplied will be 150 pounds to the square inch. Those wishing to secure lower pressure may do so by using a reducing valve. Water pressure will be that due to a head of 225 feet, or a pressure of 98 pounds to the square inch, and a head of 40 feet, or a pressure of 175 pounds to the square inch. The line-shafting will be 16 feet from the centre of the shaft to the floor. Driving-pulleys are limited to 36 inches in diameter.

Exhibitors of steam and other machinery who desire to offer their exhibits for use by the Exposition Company should send their applications as soon as possible. Such exhibitors may select their own men to operate this machinery. Their wages will be fixed and paid by the Exposition Company. The Exposition Company will defray the necessary expenses of exhibitors, loaning them machines, tools, etc., for use beyond that which they would have incurred as exhibitors simply, wear and tear excepted. Fire-engines entered for exhibit offered and accepted for use will be properly cared for and furnished with fuel free of expense.

All exhibits of machinery in motion must be inclosed by a railing 2 feet 6 inches in height, to come inside the space. No signs will be allowed to extend over the passage-way and no signs will be allowed made of muslin, linen, canvas or paper. No fire will be allowed in machinery hall except by special permission. Not more than a day's supply of oils or other inflammable substances will be permitted in machinery hall, but a suitable place for the storage of these materials will be provided.

Exhibitors not desiring to employ attendants or watchmen may leave their exhibits in the care of the department, which will assume the responsibility of their cleanliness.

POINTS ON THE TROLLEY.

BY A. A. KNUDSON.

The proposed substitution of electricity for horses on the street railways of Brooklyn, Philadelphia and other cities, and the system commonly known as the "Trolley," being lately widely discussed as to its merits, demerits, etc., I have felt prompted to state a few points as they occur to me from an electrical standpoint. I have read several communications in the local papers in Brooklyn of late, several of them showing they were written by parties not correctly informed on the subject, or were intended to create a wrong impression in the minds of the public, by parties whose personal interests lay in the direction of defeating the project.

I propose in this article to state my experience during an investigation made on behalf of a street railway company, and to give my views regarding the objections now urged against the system.

1st. As to the danger to human life. One of the several cities I visited was Scranton, Pa. While there, during a stormy evening, one of the trolley wires broke for some reason and the end nearest the station hung down near the ground, seemingly in an inviting position for a social handshake with any one foolish enough to take hold of it.

Among the onlookers was an individual who, before he could be cautioned, deliberately took hold of the bare end of the hanging wire. *Now* was the opportunity for the trolley to make for itself a lasting reputation as a fool-killer, for every favorable condition was present for that result. The ground was soaked with water caused by the storm; the man's boots were wet, and even the wire was wet. If the affair had been purposely prearranged the conditions could hardly have been more perfect for throwing the entire current through the man's body. But the result was only to cause some lively dancing in his efforts to get loose; and, when he did so, he went home with no other damage than having his fingers burned. Besides the above incident, engineers and others about the power stations have informed me that they have often taken the full force of the current with no great inconvenience, and when we add to this the fact that there is no case where a man has ever been killed through contact with the trolley circuit or a circuit of 500 volts, such as used on the trolley lines, this should certainly settle the question of fatality.

2d. The unsightly looks of poles and wires in the streets has been urged as an objection, and no doubt there is some reason in this; but when we consider the advantages gained to a city as a whole in furnishing a much quicker and more comfortable means of transit, besides the improvement in the sanitary condition of the streets, these considerations have, in the cities and towns I have visited, far outweighed in the minds of the public the objection made by some that poles and wires were unsightly. A case in point will illustrate this. While the trolley system was being introduced in Bangor, Me., some opposition was had from a prominent gentleman, whose residence was on the line of the road, on the ground of unsightliness, etc. — a case very similar to the one now existing in Brooklyn in which Mr. David M. Stone, a gentleman who is highly esteemed by all classes of citizens, is the opponent. After the electric cars had been in use in Bangor for a short time, the gentleman referred to soon saw the advantages gained by the city at large, and the next time he saw the president of the road he frankly told him he was very sorry he had opposed his enterprise and congratulated him on giving the city such excellent transit service. Possibly Mr. Stone will view the case in a similar light if the trolley should finally be adopted and its benefits to the people as a whole be established. There is hardly any important improvement but carries with it something that will be considered by some as objectionable. Take, for instance, the elevated railroads; certainly there are far more objections to them than can be urged against the trolley, and yet how could we do without them?

Further than this the improvements which have been made in pole and wire construction during the past two years in large cities, such as Boston and others, in the placing of neat iron poles and the attaching of wires in such manner that they will look as unobtrusive as possible, take away very largely the objection made to unsightliness.

3d. The question of killing horses by their coming in contact with a broken trolley wire or a wire lying across a trolley wire, has been also raised as an objection, and some people who do not understand the case naturally think if the trolley current will kill a horse it will a man; but this is not the case, for, singular as it may seem, a current of electricity that will make a man feel uncomfortable only, will kill a horse in an instant. This has occurred in Brooklyn on the Jamaica road, but, while such a thing is unfortunate, I claim there is no comparison where one or two horses on the average per year are instantly killed to the slow death which scores of horses are put to in dragging about loaded street cars, and making passengers with any humanity about them feel that they are individually contributing to a case of cruelty to animals nearly every time they enter a horse car.

While in Boston, last winter, I saw a sight which clearly illustrates this point. An electric car was going up the Tremont street grade loaded down to the steps; there was snow on the ground, and this car, being equipped with snow-flanges, had them down, clearing off the rails as it went along, besides carrying its heavy load with apparent ease. A short distance behind this car was a horse car, also full of passengers, attached to which were *four* steaming, jaded beasts, who, under the lash of the driver's whip, were straining every nerve in their efforts to pull the car up the hill. What a contrast, and what an argument is here furnished for the various societies of cruelty to animals throughout the country in favor of electricity over horses!

4th. In some of the objections urged against the trolley it has been stated that there may yet be invented some underground system which will finally be practical, and thus avoid the placing of wires through the streets. While such a thing is possible, it is hardly probable that any underground system can be so put down as to give such reliable service to the travelling public as is now being given by the trolley lines in over 200 cities and towns in this country. Very large amounts of money have been sunk in the attempts made in Boston, New York and other places to establish an electric system with underground conductors, but all have failed, and of all methods that have been tried the trolley has steadily come to the front, and will in all probability remain at the front for years to come.

5th. During my investigation of trolley systems I made it a point to ascertain the public feeling in such cities as had made the change from horses to electricity. This was obtained by inquiry among local editors of papers, hotel proprietors and the people themselves as far as possible, and without a single exception the verdict was emphatically in favor of electricity.

In view of the above, and of much more that could be said in favor of making the change from horses to electricity, I should, as a Brooklyn resident of several years having the interests of the city at heart, recommend the change to be made by all means, and thereby not only secure an elegant and rapid means of transit, but increase the healthfulness of the community by having a large number of horses removed from the streets.

PELTON WHEELS AND ELECTRIC POWER.

The first practical demonstration of electric transmission of power for mining purposes in California was inaugurated by an English company known as the American River Syndicate in El Dorado County. The power station is located on Rock Creek, some 1,500 feet below the mine and mill and two miles distant in a straight line.

The plant consists of an 8-foot Pelton Wheel, which, running under a head of 110 feet at 100 revolutions with a 5½-inch nozzle, has a maximum capacity of 130 horse-power. To this wheel is connected a 100 horse-power Brush generator, speeded at 900 revolutions, the current from which is carried to the mill through a single insulated copper wire, No. 3, B. & S. gauge, the return being made by a wire of the same size, making a four-mile circuit. The power from the generator is communicated to the counter-shaft of the mill by a 70 horse-power Brush motor running at 950 revolutions.

The machinery operated consists of three centrifugal roller mills, a ten-stamp battery and a rock-breaker. The Pelton Wheel under these conditions shows an efficiency of 86 per cent., while about 75 per cent. of the power thus generated is available for duty at the mill. Sufficient power is taken from the main circuit to run sixty incandescent lamps for lighting the entire works.

ELECTRO-MAGNETS FOR ALTERNATE CURRENTS.

In constructing electro-magnets for use in apparatus intended for alternating currents it is of the greatest importance that the cores should be built up of thin sheets of the metal used, and the sheets, or laminæ, must be insulated from each other. The object of lamination of cores is to prevent the circulation within the mass of the iron constituting the cores of induced eddy currents.

There are several methods of lamination, but in one respect the construction of all such electro-magnets is alike—at least should be alike—that is, the iron core must be divided in directions at right angles to that in which the eddy currents would be set up. The tendency of these currents is to circulate parallel to the coils that surround the cores, that is transversly to the length; therefore it follows that the laminations must be longitudinal to the cores.

For the cores of straight electro-magnets a common mode of construction is to take annealed iron wires, of 1 to 2 mm. in diameter, in sufficient numbers to make up the cores of the desired size. Such wires should be separately varnished, then secured together in bundles by lightly binding them with thread or tape, which is afterward served with varnish. Metallic binding wire should not be used.

For larger electro-magnets, and for those of horse-shoe pattern, thin sheets of iron are preferred. There are two modes of constructing laminated cores from iron sheets. In the first of these, a number of square-cornered U-shaped stampings are assembled together in sufficient numbers. In the second the iron sheets are bent over a mould, one outside the other. In either case the separate layers of iron should be protected from metallic contact by the interposition of layers of varnished paper, or even a thin mica, though the latter is too costly for common use. Some constructors simply japan or enamel the iron to prevent contact. It is important that the edges of the stampings should be trimmed from any burr which would produce contacts from lamina to lamina. To secure the parts mechanically together, bolts may be passed through the stampings, but such bolts should be insulated from contact by a surrounding tube of vulcanized fibre or of ebonite, and by washers of fibre or ebonite placed underneath the heads and nuts of the bolts. In cases where paper well varnished with shellac varnish has been interposed, it is well to consolidate the whole core into one substantial mass by serving the whole with varnish after putting it together; and then heat it in a stove to a temperature sufficient to soften the shellac, the core being then compressed until it is cold.

The cores that are to be used as plungers in coil-and-plunger mechanisms must also be laminated if they are to be used with alternate currents.

A NEW APPLICATION OF ELECTRICITY.

"Slowly, step by step, electricity is forcing steam into the background" in the applicatian of power directly to the work to be done. It has gone from isolated applications, when treated as a subtle, mysterious and dangerous something more to be feared than trusted, to be finally recognized as one of the best of human aids—one of man's best friends when rightly understood. It has gone over the whole field from a laboratory experiment to its practical application as a marketable product; from the pith-ball and sealing-wax and the small magnet used to pick up small articles to the enormous dynamos and motors which furnish light and power all over the country. Who can say where it will end? Every day we see the application of electric power becoming more common; street-cars, mining machinery, elevators, and even the machinery of the mechanic are giving way to this power, and now our wheat is to be ground by means of the same force. Believing this movement to use electricity in establishments requiring a large amount of power is one that is of general interest, we reproduce an article on this new application which appeared in a St. Paul paper of recent date:

"The manufacture of flour is on the eve of being revolutionized. This is a most important announcement to the citizens of St. Paul and Minneapolis, in which cities are located the largest milling establishments in the country. The Pillsbury mills, the Washburn mills and the St. Paul mills are known throughout the world for the high-class character of their flour. The pioneer in the work of revolutionizing the milling industry is a St. Paul man—Kingsland Smith, head of the firm of Kingsland Smith & Co., successor to the St. Paul Roller Mill company. The St. Paul roller mill, situated on West Third street, was burned to the ground a little over two years ago. The mill has remained in ruins up till to-day, but there is every probability that it will be restored at an early date. The mere fact of the rebuilding of the mill is of small importance compared to the innovations Mr. Smith proposes to introduce.

"Mr. Smith is something of a reformer. When he built the old roller mill it was something of a novelty. Old millers, like William Lindeke, declared that the millstones could not be supplanted by rolls, but events proved that the rolls were far superior to stones. It will thus be seen that Mr. Smith is no 'theorist,' but a practical and successful miller. The latest thing to which Mr. Smith has turned his attention is in experiments in electricity as a motive-power. These experiments have covered a period of over a year, and Mr. Smith says: 'I have become thoroughly convinced of its cheapness and its entire practicability.' There is not, so far as has been reported in the columns of the electrical press, a mill in existence run by electric power, and its introduction into mills will be a step in advance as far as was the introduction of rolls in 1880. Mr. Smith is now engaged organizing a new company. This company will rebuild the roller mill, and the intention is that it will be operated by electricity. Mr. Smith says: 'I have not definitely decided on how and where I shall get this power, but am figuring on a plan which, if it is carried out, as I think it can be, will revolutionize the question of cheap power in St. Paul.'"

We are informed that Messrs. Kingsland Smith & Co. will require about 80 horse-power at the start.

DISAPPEARANCE OF THE POLES.

Representatives of the various electric-light companies in this city and the Mayor had a conference on January 6 in reference to the poles and wires which the Board of Electrical Control ordered to be taken down within ninety days from October 12. The result of the talk was that the representatives agreed to have all the poles now standing down before the middle of this month at their own expense

The poles which are to be removed are on the following-named streets: Warren, Walker, Exchange Place, Grand, University Place, Park Row, 29th, Bowling Green, and Broadway from the Battery to Houston street.

CONTRACTS AWARDED.

The Gas Commission of this city. on January 4, awarded the contracts for lighting the city during the present year. Among the contracts awarded were several to electric light companies for electric lighting, the average price being about 40 cents a night a lamp. These prices are the same as paid for the same service last year.

The contracts awarded for gas lighting range in price for each lamp a year from $12 to $28.

NEW INCORPORATIONS.

The Edison Sault Electric Company, Sault Ste. Marie, Mich., was incorporated January 4, with a capital stock of $57,000. Incorporators: Harris T. Dunbar, William Chandler, Minnie C. Dunbar, Sault Ste. Marie, Mich.

The Hart & Hegeman Manufacturing Company, Hartford Conn., was incorporated December 21, with a capital stock of $21,000, to manufacture electrical machinery. Incorporators: George S. Hegeman, Windsor, Conn., and Alfred H. Pease, Hartford, Conn.

The S. D. Warfield Company, Baltimore, Md., was incorporated December 30, with a capital stock of $100,000, to manufacture electrical apparatus. Incorporators: S. D. Warfield, C. S. Shriver and C. Jenkins.

The Neutral Storage Battery Company, Newark, N. J., was incorporated December 30, with a capital stock of $300,000. Incorporators: G. W. Harris, G. Huerstel, H. L. School, E. Hall, A. Fogal, New York, N. Y.; E. C. Harris, Newark, N. J.; M. H. Chase, Hilton, N. J.; B. G. Field, Rahway, N. J.; P. A. Harris, Paterson, N. J.

The Electric Power Transmission Company (incorporated in W. Va.), Boston, Mass., was incorporated January 2, with a capital stock of $500,000. Incorporators: F. C. Todd, Charles S. Knowles and Arthur L. Woodman, of Boston, Mass.

The Charleston Electric Light Company, Charleston, Mo., has been incorporated with a capital stock of $6,000. Incorporators: S. Alexander, A. H. Danforth, A. Orr, all of Charleston, Mo.

The B. B. Electric Supply and Construction Company, New Whatcom, Wash., was incorporated December 29, with a capital stock of $1,000. Incorporators: O. E. Berg, Lewis Stenger, D. R. Myers, New Whatcom, Wash.

The Duquesne Heat, Light and Power Company, Duquesne, Allegheny Co., Pa., was incorporated December 30, with a capital stock of $20,000. Incorporators: Wm. B. Rath, M. G. Conlin, C. W. Allbrand, H. T. Black.

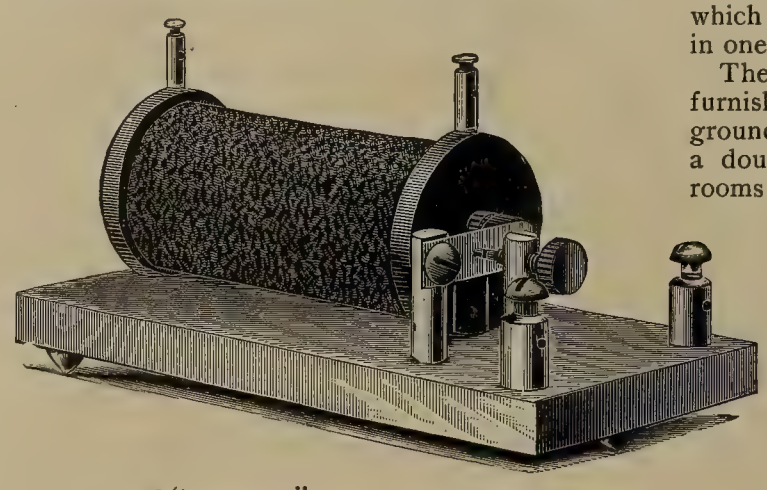
The National Storage Battery Company, Troy, N. Y., was incorporated January 4, with a capital stock of $5,000. Incorporators: William H. Hollister, E. G. Bernard, W. D. Weaver, all of Troy, N. Y.

Edison Electric Illuminating Company of Coney Island, Gravesend and Unionville, N. Y., was incorporated January 4, with a capital stock of $50,000. Incorporators: Manuel A. Plaisantin and Josephine V. Cook, Brooklyn, N. Y.

The Cortland and Homer Electric Company, Cortland and Homer, N. Y., was incorporated January 4, with a capital stock of $50,000. Incorporators, C. B. Hitchcock, Tallapoosa, Ga.; F. B. Hitchcock, H. Wells, both of Cortland, N. Y.

THE "TERROR" INDUCTION COIL.

The Blakeney Electric Company, 431 Broadway, Brooklyn, N. Y., has devised a neat little laboratory outfit for inductive experiments by amateurs and those who wish to make experiments in this line without the usual expense involved in the purchase of the ordinary apparatus. The induction coil while



"TERROR" INDUCTOIN COIL.

cheaper in price is not cheaply made, and will give all the effects of coils now on the market costing so much as to be beyond the reach of amateurs. The coil gives a one-quarter-inch spark, and is constructed on the most approved scientific principles of materials best suited to secure the highest degree of efficiency. The primary coil has a resistance of 0 7 ohm, the secondary, which consists of many thousand turns of No. 35 wire, has a resistance of about 1,100 ohms. The insulation throughout is carefully attended to, so that the coils will stand a very high electrical pressure without injury. The automatic break is substantially constructed and the condenser is made of such size as is found by experience to give the best results.

The coil has nicely polished hard-rubber ends and is mounted on a polished base of the same material. All metal parts are fully nickel plated. The Blakeney Company supplies a number of accessories with the coil for different classes of experiments, and we think that no progressive student of electricity can afford to be without the outfit, as its low price places it within the reach of all.

Our illustration gives but a faint idea of the beauty of the induction coil, which has been given the suggestive name "Terror."

ELECTRICAL SOCIETIES.

THE PITTSBURG ELECTRIC CLUB.

Electrically speaking, the year 1892 has opened very auspiciously in the city of Pittsburg, Pa., inasmuch as the local Electric Club threw open the door of its own home and invited its friends to a grand reception.

The Pittsburg Electric Club has been in an embryotic state of existence for years, but owing to the fact that nobody seemed to care much to act as sponsor, nurse and godfather to this yet indefinite being, the scheme only lived in the imagination of a few enthusiasts. But fortunately things changed, men changed and minds changed, and it is owing to this combination of changes, resulting in better times, better men and more energetic minds, that Pittsburg has now the nucleus of what is probably destined to be one of the finest clubs in the country; an organization of which the electrical fraternity may be justly proud; an association of men well fitted for working untold benefits to the electrical industry itself, and who, by their reputation and standing in the profession, will also be able to infuse their fellow members of the club with fresh energy and a more ardent love for their work.

At the first regular meeting of the club after it had been organized with seventy-one charter members, the officers were elected as follows: Morris W. Mead, chief of the Electrical Bureau of Pittsburg, President; Eugene Ingold, of the Fort Wayne Electric Co., Vice-President; James A. Rutherford, of the Railway Dept., Westinghouse Electric and Mfg. Co., Treasurer; J. E. Hall, of the Fort Wayne Electric Co., Secretary; H. McL. Harding and Ph. Lange, of the Westinghouse Co., E. B. Gawthrop and D. W. Dunne, of the T. H. Co.; Isaac A. Silverman and E. B. Kettle, of the Edison Co., and W. N. Dillon, of the Brush Co., were elected a board of directors.

Immediately afterward the president appointed a committee to secure permanent quarters for the location of the club. This committee had a very arduous task for the reason that it is a very difficult thing to find a house at once centrally located and without an exorbitant rental. However, these men have succeeded beyond the most sanguine expectations of anybody, and too much credit cannot be given them for their zeal, ardor and unwavering perseverance.

The club-house is situated at 802 Penn avenue, a location in the very heart of the down-town portion of the city. It is equi-distant from all the railroad depots, and can be easily reached from any hotel, and cars pass in the front of the club building by which one may take a continuous ride of eight miles in one straight line.

The building itself is three stories high, and it is furnished throughout with antique oak. On the ground floor are two reception-rooms connected by a double folding door. In the rear of these two rooms are the buffet, the dining-room and the steward's quarters. On the second floor are the billiard-room, card-room and reading-room, while on the third floor are three bedrooms. The place is throughout fitted up with all the modern conveniences of a first-class club-house.

The reception of the 1st of January was a very great treat. It was attended by about five hundred people, who were all exuberant with praise and flattery for the club and the committee of arrangements, a fact which alone stamped the undertaking an unqualified success at the very start. The club had arranged a very seductive bill of fare for its guests, and it is safe to assert that nobody came and went without being able to do full homage to the hospitality of the Pittsburg Electric Club.

The most attractive feature in the menu was "An Electrical Punch," and its electrical effects were generally compared with those of the nectar of the Olympian gods.

DEPARTMENT OF ELECTRICITY, BROOKLYN INSTITUTE.

On January 8 Mr. Osborn P. Loomis gave an illustrated lecture on "Practical Experiences in Dynamo Designing" in the large lecture-room of the Institute.

Dr. A. D. Rockwell, of New York, will, on January 22 next, deliver a lecture before this Department on "The Use of Electricity in the Treatment of the Human Body." The lecture will take place at 8 o'clock P.M. in the large lecture-room, 502 Fulton street.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 63d meeting of the American Institute of Electrical Engineers, will be held at 12 West 31st Street, New York, Tuesday evening, January 19. A paper will be read by Mr. Chas. P. Steinmetz, of Yonkers, N. Y., on the "Law of Hysteresis."

RAPID TRANSIT IN NEW YORK.

In his annual message to the City Council, Mayor Grant, of New York, refers in the following interesting manner to the subject of Rapid Transit for the city :

"Acting under the provisions of chapter 606 of the Laws of 1875, in the month of December, 1890, I appointed William Steinway, John H. Starin, Samuel Spencer, John H. Inman and Eugene L. Bushe as Commissioners of Rapid Transit.

"Experience had demonstrated the fact that the provisions of the act of 1875 were not of such a character as to permit the construction of any permanent system of rapid transit in this city. The municipal authorities had presented to the Legislature, at its session in the year 1890, an act giving additional powers to those conferred by the act of 1875, under which a proper system of rapid transit could have been laid out, but the Republican Legislature refused to pass such bill, and the solution of this important matter was thereby delayed for another year.

"The same Legislature, however, recognized the propriety of such a bill by causing to be introduced and attempting to pass a bill conferring substantially the same powers, but which latter bill violated the principle of home rule by taking the appointment of the Commissioners and the management of the work out of the hands of the people of this city.

"The Legislature having thus committed itself to the general features of the bill promoted by the municipal authorities, they, at the opening of the session of 1891, caused to be introduced a bill adopting the essential features of the one thus approved at the previous session, and making the Commissioners that had been appointed by me in December, 1890, Commissioners under the provisions of such act.

"The act thus introduced was passed by the Legislature and a Board of Rapid Transit Commissioners came into being with sufficient powers to lay out a comprehensive system of rapid transit, meeting the needs of the city at present, and capable of extension in the future, to meet its anticipated growth. The Commission has proceeded with the utmost diligence under the terms of the act. After giving careful and laborious attention to every suggested means of rapid transit, it submitted to the Common Council on the 20th day of October last a comprehensive underground system of rapid transit, which met with the general approval of the public and the almost unanimous commendation of the press. The line is located up Broadway to Fourteenth street, and thence by diverging lines to the east and west, reaching the largest centres of population least provided with rapid transit facilities. The report was promptly approved by the Common Council in accordance with the provisions of the act, and thereupon the Rapid Transit Commissioners proceeded to obtain consents to the building of the road. A very large number of consents have been obtained, but owing to difficulties arising from the fact that many pieces of property along the route are held by owners who are absent from the city, or by trustees without power to give consents, and that many owners fear they may be waiving some rights if they sign the consents and from other causes, the Commissioners, as I am informed, have not yet been able to obtain the consent of the majority of the owners along the line of the proposed route. It is therefore necessary, for the purpose of saving time, that advantage be taken of the provisions of the act authorizing an application to the General Term of the Supreme Court to have that court determine, on report of a Commission to be appointed by it, whether the proposed railway ought to be constructed and operated. Such application will doubtless be presented at the February General Term of the Supreme Court, and if that court, on the report of its Commission, determines that the road ought to be built and operated, such determination takes the place of the consent of the property owners along the line, and the franchise for the proposed railway should be ready for sale at public auction, in accordance with the terms and provisions of the act, in the coming spring.

"The subject of rapid transit for the annexed district is important in aiding its development. For its surface roads I favored the trolley system as being peculiarly adapted to its needs. The people of the Twenty-third and Twenty-fourth wards are at a disadvantage in their facilities for rapid transit which their geographical position does not justify. The elevated railroads of New York now extend on the west side of the city to 155th street. A great part of the population of the Twenty-third and Twenty-fourth wards is south of the line of 155th street. While the people of the west side are now enabled to proceed from their residences to their places of business in one railway by the payment of one fare, the people of the annexed district are compelled to patronize two different lines and pay two fares. When the proposed line of railway laid out by the Rapid Transit Commissioners is built these difficulties will be remedied. In the meantime, however, the situation must be considered and other means devised to place the people of this district on an equal footing with the residents of the lower side of the Harlem river. The returns to the Manhattan Elevated Railroad have been considered sufficient in the past to secure by the voluntary action of that corporation a uniform maximum rate of fare for the entire length of any of its routes of five cents. It is to be hoped that the same line of policy may lead that corporation and others owning independent lines and interchanging traffic within the limits of the city to adopt a similar rate for the entire length of their combined routes, making a just apportionment of fares based upon considerations of the greater advantages to the lines operated in the centre of the city over the suburban routes."

The above will be of particular value at this time inasmuch as it gives a brief history from the beginning down to the present time of what has been accomplished in the effort to secure rapid transit for this city.

ACCUMULATORS.

A battery cell, in its true sense, is the receptacle for the liquid and plates, but generally the word is employed to signify the vessel with contents complete, unless the contrary is indicated. A number of cells connected together form a battery. Secondary cells are generally called accumulators. The plates consist of positive and negative elements. All those of the same denomination in a cell are metallically joined together, but the dissimilar plates are not in contact one with the other, either inside or outside the cell. The plates form an electrical connection inside the cell only through the electrolyte, and outside by joining one set of plates to the other through a conductor, which may be very complex : such, for example, as a long length of wire, with one or more lamps in its course. In this condition, the circuit is said to be closed ; and unless the cell be exhausted, a current flows. When the outside conductor is broken, no current passes; and the circuit is open. The only object in employing a number of plates of each kind, instead of one positive and one negative, is to obtain a low internal resistance without the inconvenience of using very large single plates. Cells are of two kinds — primary and secondary. The primary cells are made in many ways, but all have one characteristic; namely, that, when exhausted, the whole or part of the chemicals employed must be renewed, and sometimes the plates also. For practical electric lighting purposes such cells are of no value. One description might, however, be excepted — the chlorine cell, generally named the Upward cell, after the inventor. But even this battery has its drawbacks and cannot be employed on a large scale. It must not, however, be supposed that a good primary battery may not one day be forthcoming, for it is quite within the bounds of possibility.

The other cells are termed secondary, because they may, without putting in fresh chemicals, be revived by simply passing a current through them.

In passing, it may be remarked that many cells, ordinarily termed primary, have yet the property of secondary cells. The Gassner dry cell is a good example.

It has become a practice among makers of secondary batteries to call true positives the negative plates, and vice versa.

The cells proper are made of glass or metal, and frequently of wood, lined with glass, pitch, or celluloid. For stationary work, glass is by far the best ; but for movable batteries, such as are used in launches and tramcars, other materials must be chosen.

The fluids or electrolytes are very numerous. They may be alkaline, acid or neutral, according to the plates employed and other considerations.

The plates may be all metallic, or one set may be of metal and the other of carbon or any suitable substance; and in some cases neither one nor the other is composed of metal.

There are but two sorts of cells which are of real value at the present time. In the one the plates are composed of spongy or of granular lead; and in the other the lead plates (or some alloy of lead) are perforated, and the holes are filled with lead compounds. Of the latter type there are numerous modifications employed to obtain the same end. There is a third type where lead plates are used in conjuction with zinc ones, but such cells cannot be reversed an indefinite number of times, owing to the fact that the zinc plates do not, at each reversal, keep to their original form, and owing also to the growth of zinc-trees. These cells, however, are useful for portable lamps and laboratory work, being of comparatively light weight for the energy they contain.

Cells of the plain lead type were first shown to be reversible by Planté, although earlier workers are said to have previously discovered this property. To Fauré appears to belong the merit of having so modified the Planté cell as to make it a practical one; in fact, those now so largely used are but improved Fauré cells.

The chief aim of all improvements in the lead-plate type is to make it porous yet strong, so as to offer as large a surface as possible to the electrolyte.

The second or perforated type may be termed pasted plates. The holes are filled with paste made by mixing red lead with sulphuric acid for the positive, thus forming lead sulphate, the negative paste being made of litharge mixed with sulphuric acid. In cells of this type as well as in those of the Planté kind, diluted sulphuric acid is employed for the electrolyte. There are many modifications of the pastes above mentioned.

The chemical action is the same for both types of plates, and may be explained generally by saying that, when the cells are charged more oxygen exists in the positive, and more hydrogen in the negative plates than when discharged.

EFFECT OF VARIATION OF THE AIR GAP.

As showing the effect of variation in the air space between the armature and the pole pieces of a dynamo the following will be of interest:

Mr. O. Firth, an English electrician, made some interesting experiments to determine the effect of gradually increasing separation of the magnets, and noting the corresponding electro-motive force. In a shunt dynamo having a normal electro-motive force of 52 volts on open circuit, the results obtained were as follows, the measurements being between pole faces and periphery of armature:

Speed.	Distance.	Volts.
2,000	Normal	52
"	$\frac{3}{16}$ inch	48
"	$\frac{5}{16}$ "	46
"	$\frac{7}{16}$ "	40
"	$\frac{9}{16}$ "	36
"	$\frac{5}{8}$ "	34
"	$\frac{11}{16}$ "	20

But a still more remarkable series of experiments were made with a small series-wound dynamo, with armature $5\frac{1}{2}$ inches in diameter by 6 inches long, built for an output of 15 ampères at 100 volts. It will be observed that the proportional fall of the volts exhibits values contrary to general expectation, and the figures altogether strikingly emphasize a growing opinion among electrical engineers that the greatest possible nearness of pole pieces and armatures is not necessarily a corresponding advantage. As in the former case, the measurements were taken between pole faces and the periphery of the armature:

Speed.	Distance.	Volts.
2,000	Normal	100
"	$\frac{1}{8}$ inch	94
"	$\frac{1}{4}$ "	90
"	$\frac{3}{8}$ "	86
"	$\frac{1}{2}$ "	78
"	$\frac{5}{8}$ "	76
"	$\frac{3}{4}$ "	68
"	$\frac{7}{8}$ "	64
"	1 "	56
"	$1\frac{1}{8}$ "	50
"	$1\frac{1}{4}$ "	42
"	$1\frac{9}{32}$ "	36
"	$1\frac{5}{16}$ "	30
"	$1\frac{11}{32}$ "	20

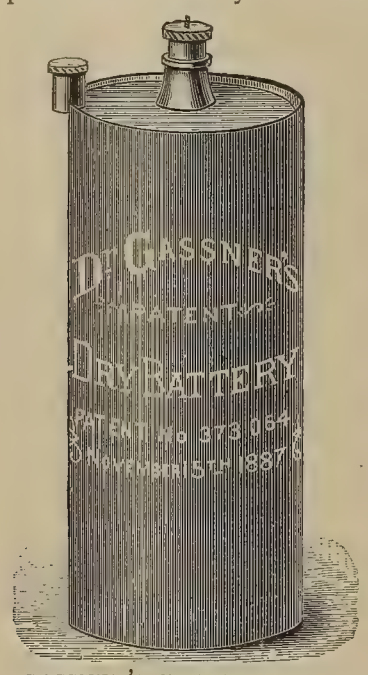
THE LOGAN ELECTRIC LIGHT COMPANY, Logan, O., was incorporated January 6, with a capital stock of $20,000. Incorporators : John Hansen, John F. White, J. A. Stiers, W. W. McCray and F. S. Case.

The electric light plant being erected at Key West, Florida, is a source of great curiosity to a great many of the natives, who have never seen anything of the kind before. The three large compound engines furnished by the Ball Engine Co., Erie, Pa., are the centre of attraction, the largest engine on the island hitherto being an antiquated 6 H. P.

DR. GASSNER'S DRY BATTERY.

The fact that many dry batteries have been produced and put upon the market in late years is positive evidence that there is a demand for a battery of this character. It may be said that most of them have some good features, and it is claimed that the cell herewith described and illustrated is one of the best on the market to-day. It has the advantage also of having a well-established reputation, and for general efficiency it is well known.

The Gassner dry battery was one of the first offered to the public. This battery is adapted for telephone and telegraph work, electric bells and medical uses, and possesses all the advantages of the Leclanché cell and none of its deficiencies. It is not affected by heat or cold, and is fit for work, therefore, in any climate. When at rest no chemical action takes place, hence, there is no consumption of the component parts of the battery. This battery is intended only for open-circuit work. If it should be run down from having been in a closed circuit its strength is greatly restored by rest, and it may be depolarized still further by passing through it a current from some outside source in the manner of charging storage batteries. It is not advisable, however, to do this frequently.



GASSNER'S DRY BATTERY.

The batteries are manufactured in different forms adapted to various uses.

There are over 100,000 of these cells now in use, and they are regarded with great favor among physicians. In fact, they are excellently adapted to all purposes where an intermittent current or one of short duration is required. The initial voltage of these cells is 1.55 and the amperage is very high.

Mr. H. Werlemann is the sole agent and manufacturer of this battery, at 97 Reade street, New York. Mr. Werlemann succeeded Mr. A. Schoverling.

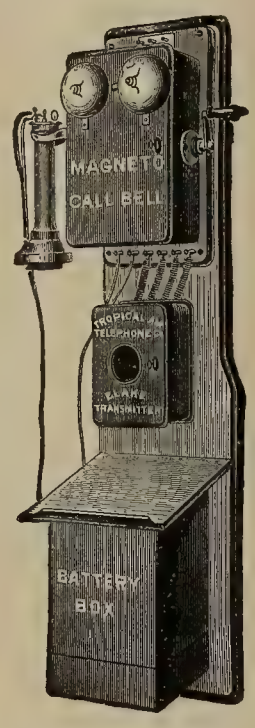
THE TROPICAL AMERICAN TELEPHONE COMPANY.

The industries of New York have just been increased by the removal of the headquarters of the Tropical American Telephone Company from Boston to New York, and what is Boston's loss is New York's gain.

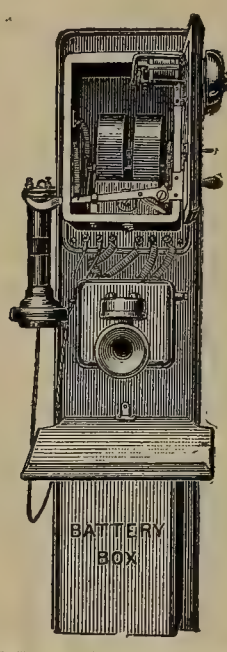
The company has opened offices at 95 Broad street, this city, in Rooms 303 and 304, from which its large and constantly increasing business will hereafter be directed and controlled.

This concern, as is well known, is the owner of Bell's and Blake's telephone patents and inventions in Central and South America and the West Indies, with which countries a large export trade is carried on. The company not only exports telephones, but all of the accessories of that valuable apparatus as well, such as switchboards, batteries, wires, cables, insulators, and line material of all kinds.

The company was organized in November, 1881, and is the source of all telephone supplies in those countries embraced in the territory referred to. In its business methods it differs radically from those of the Bell Telephone Company, in that it sells all its telephones outright in those countries, and it is therefore possible for a person in any one of the South American countries to own his own telephone plant. Such ownership, as is well known, is an impossible condition in this country.



CENTRAL OFFICE TELEPHONE.



NEW NO. 7 LONG-DISTANCE TELEPHONE.

The Tropical American Company has just received a certificate of honor and a gold medal, which were awarded by the International Exhibition held in Kingston, West Indies, last year, on its exhibit of telephones. An illustration of this diploma and medal are given herewith, as are also illustrations of a complete telephone set for export, and a Universal Long Distance Telephone set. It has also received a gold medal from the Republic of Colombia.



FAC-SIMILE OF GOLD MEDAL.



CERTIFICATE OF HONOR.

Mr. Charles Williams, Jr., owing to long-continued absence from the country, in Europe, has resigned as president and director of the company. The other officers of the company are: J. H. Howard, Vice-President and General Manager, and Harry Highley, Treasurer. Mr. Howard is well known in the general electrical trade, particularly in that branch relating to telephones, having been connected with the export business since 1880, and it is mainly through his enterprise, with the assistance of Mr. F. H. Harrington, the well-known New York representative of the company, that this concern occupies the important place it does in the South American trade. Mr. H. W. Bates is also connected with the New York office.

The company has complete sample sets of central office and long-distance telephones set up in its new offices, ready to be connected with a central office for purposes of illustrating their operation.

THE TROLLEY'S HARD FIGHT.

This interesting piece of nonsense appeared in a recent issue of a Buffalo daily paper, in reference to the trolley system in that city :

"We have here the trolley in its untamed wildness. It chases grocery wagons and family coaches with the same hungry ferocity and will pounce upon a horse-car with the slightest provocation. The trolley car is the juggernaut of the age. It is merciless and crushes out the life of whoever gets in its way. It is praised as a wonderful saver of time, but it sends many to the hospitals and a few to eternity. It is the invincible monster of the city thoroughfares, the demon that stops at the wave of a lady's hand or madly dashes to its own ruin in a passing train. Oh, these are days of singular experiences!"

No wonder it is fight, fight, fight for the trolley, when such absurd statements are made by the public press, to which the people are supposed to look for unbiased reports.

Of course a trolley car will run over people if they will persist in getting under its wheels; so will a horse car, and a lumbering stage-coach—which class of vehicles our Buffalo contemporary would probably like to see running in the Buffalo streets—will do as much personal injury. People are frequently run down by wagons in the streets; these vehicles are juggernauts in the same sense that electric cars are.

Buffalo would be a model city if it followed the dictates of the paper referred to—that is, a model of sluggishness and lifelessness.

IMPROVING THE TELEPHONE.

The Boston News Bureau on January 8 sent out the following information :

"We are able to announce that the American Bell Telephone Company has so forwarded its experiments in the telephone field that it has perfected a telephone by which whispers can be transmitted 500 miles with perfect distinctness."

ELECTRIC POWER IN A BREWERY.

The Blatz Brewing Company, of Milwaukee, Wis., has decided to adopt electric power exclusively. The company recently erected new buildings in which to carry on its extensive brewery business, and is now installing a complete light and power plant on the Mather system. The generators, of which there will be two, will consist of one 250 horse-power and one 100 horse-power machines. There will be twenty-three motors to distribute the power. In these motors lies the novelty of the equipment. Some of the units will be unusually large; for instance, two of the machines will be 50 horse-power, and three 40 horse-power each. Seven motors will be of 8 horse-power capacity, and the rest will be from 15 horse-power down to 1 horse-power, the latter used for ventilating. In all, the twenty-three motors will have a total of over 400 horse-power.

The excess of motor-power over generator-power is owing to the use of the machines being varied. While a large portion of them are carrying a load, there will be others at rest, the same as in any large-power plant where there are a great many units. It is expected to have a portion of this electric plant operating by March 1, and by May 1 the whole may be in use.

PERSONAL.

HON. ALLAN C. DURBOROW, JR., formerly business manager of our Western contemporary, the *Western Electrician*, now the representative in Congress of one of the Chicago districts, has been appointed chairman of the special committee of the House of Representatives on the World's Columbian Exposition. No more fitting appointment could have been made to that important position.

PROF. JOHN P. BARRETT, Chief of the Department of Electricity of the World's Fair, was in town last week.

RALPH N. SHAINWALD, President of the Standard Paint Company, will leave for California on the 15th inst. on a combined business and pleasure trip. He will probably be absent for a month or so.

MR. FRANK DE RONDE, Treasurer of the Standard Paint Company, was met in Philadelphia during the week; his many friends will be sorry to know that his eyes are giving him considerable trouble and there is little hope of their recovery, at least for a time.

MR. C. G. GOODRICH, Vice-President and General Manager of the combined street-railway systems of St. Paul and Minneapolis, sailed for Europe on Saturday with his family, to be gone three months.

THE TROLLEY IN BROOKLYN.

A NEW PHASE IN THE MATTER.

The Brooklyn Board of Aldermen at its meeting on Monday, January 11, passed by vote of 15 to 4 a new set of resolutions granting the four principal street-car companies in that city the right to substitute the trolley system on their lines in place of horse-power. No attempt was made to override Mayor Boody's veto of the resolutions.

THE "PARADOX" REFLECTOR SHADE.

F. Holman & Co., 128 Pearl street, New York, has placed on the market a reflector shade for incandescent lamps, which does not strain the eyes and which is highly-commended wherever used. The shade is made in two parts, the upper half being of metal, the reflecting surface of which is highly polished, nickel-plated tin, corrugated to best distribute the light, and the lower half a ground or etched glass bowl or dish, made with a rim which fits into suitably locking clamps attached to the upper half. The method of construction gives superior strength, durability and lightness. It is said that the light given out by an incandescent electric lamp when this shade is used is not only wholly utilized, but it is so directed and diffused that the resultant illumination is absolutely perfect. The "Paradox" reflector shade, as this shade is called, can be used for any system of incandescent electric lighting, and attached to any kind of fixtures, from simple flexible cord pendents to the most elaborate and costly electroliers.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Jan. 9, 1892.

MR. JAMES H. MASON, a well-known New York electrician, is now engaged in giving lectures on electricity, using in connection therewith a magic lantern. His address is 800 Putnam avenue, Brooklyn, and he is kept very busy. His lectures are extremely interesting, as may be judged by the long list of testimonials which he possesses. No one is better fitted for this class of work than Mr. Mason, as he is an entertaining talker, and thoroughly versed in the science, which he teaches in so interesting a manner.

THE TROPICAL AMERICAN TELEPHONE COMPANY, LIMITED, has moved its headquarters from 95 Milk street, Boston, to rooms 303 and 304, No. 95 Broad street, this city, making the change to enable it to handle its large and rapidly growing export business by placing it closer to the New York exporters with whom the bulk of its business is transacted. Hereafter the only offices will be in this city, the Boston office being discontinued. As New York is a more advantageous shipping-point than Boston, New York and Baltimore will be the only shipping-points of the company. This move has been contemplated for some time, the members of the company recognizing the wisdom of placing themselves in the centre of trade, and in closer touch with those with whom they dealt. The company has established recently a number of depots of supplies, among them one at Cienfuegos, Cuba, with Mr. Louis Elminger as selling agent, and one at San José, Costa Rica, in charge of Villafrauer Bros. & Co. One of the most conspicuous changes made, and one that will be regretted by his many friends, is the resignation of Mr. Charles Williams, Jr., as a director and president of the company, a step made necessary by his continued absence abroad. He will retain his interest as a stockholder in the company. This company is sole authorized exporter to South America, Central America and the West Indies of the American Bell Telephone, Blake Transmitters and Magneto Call-bells. All kinds of telephonic apparatus and telephone supplies of all sorts are kept constantly on hand for the export trade, and with its largely increased facilities for shipping the company will be able to handle its enormous business with greater satisfaction to its customers and itself.

TRUEX & VAIL, Electrical Exchange, Liberty street, this city, sole manufacturers and licensees for the Swinging Ball lightning arrester, report that they continue to receive many orders for these goods, no less than seven being received in the first mail of January 4. It is evident from the increasing demand for these arresters that central-station lighting managers fully recognize their advantages. Some of the users of these devices have sent in unsolicited testimonial letters of the strongest character. Every electric light company should protect its lines at all seasons of the year, and there is nothing better or more reliable than the Swinging Ball arrester. The demand for Walker ammeters continues to be very good. They are accurate and reliable instruments, as experience has abundantly proved, and are sold at very reasonable prices.

J. C. CHAMBERLAIN & Co. have opened headquarters in the Electrical Exchange Building, 136 Liberty street, this city, and will shortly have a full line of electrical supplies. Mr. Chamberlain is an expert electrician and is the inventor of a special machine for cutting gear-wheels for electric railway uses. He was at one time expert for the Fourth Avenue Electric Railway. He will undertake any special work requiring the services of an expert.

GENERAL O. E. MADDEN, well known in the electrical fraternity, has opened an office in the Electrical Exchange Building, 136 Liberty street. His many friends will be glad to know that he has got settled and everything looks prosperous with him.

MESSRS. ALEXANDER & CHAMBERLAIN, electrical engineers, 26 Liberty street, this city, have just received an order for 300 incandescent lamps, with a large order for arc lamps to follow. At the present time the firm is crowded with elevator work. Although but a short time in the field this concern is surpassing many an older one in construction work.

MR. E. T. COPELAND, 18 Cortlandt street, city, the New York agent of the Ball Engine Co., Erie, Pa., has sold to the Colonial Club, of this city, two Ball engines for its electric light plant.

MR. C. P. RUTTY has severed his relations with the McCreary Electrical Specialty Company, Electrical Exchange, this city, and is now connected with the advertising department of the *Engineering Magazine*.

MCLEOD, WARD & Co., 97 Liberty street, this city, recently closed a contract with the New York Biscuit Company, Tenth avenue and 15th street, for the wiring of the latter company's factory for 920 16 C. P. incandescent lamps; 6 "Ward" arc lamps, one Billberg dynamo and one 100 H. P. Billberg motor. The Billberg dynamos and motors are manufactured by T. H. Dallett & Co., York and Sedgley avenues, Philadelphia, Pa. McLeod, Ward & Co. will also install in connection with this plant an engine starting and stopping alarm system. In each and every department of the building is an electric bell, which the engineer rings by means of a switch before starting and stopping the engine.

THE SPRAGUE ELECTRIC ELEVATOR COMPANY, A. F. Mason, manager, has opened offices on the sixth floor, 15 Wall street, this city.

A CHANGE is announced on the staff of *Electricity*. Mr. Herbert Laws Webb and Mr. George H. Guy, its editors, and Mr. Charles McLean Paine have resigned.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	54 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	204 50
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y.	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y.	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	150 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.	35,430,000	100 00	103 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	5,000,000		*99
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	76 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	95 00
Edwards Manuf. Co., N. Y.	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	46 50
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		60 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	23 50
Laclede Gas pref	2,500,000	100 00	61 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co.	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	19 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	53 00
N. Y. and N. J. Tel. and Tel. 5s.	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	420 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50,000		*95
North American Railway Co.	39,767,200	100 00	17 50
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	50 50
Thomson-Houston pref.	4,000,000	25 00	26 50
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec.-Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100,000	100 00	75 00
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	83 50
Westinghouse Electric Co	7,000,000	50 00	13 50
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	15,550,000		18 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

THE CROOKSTON WATER WORKS, Power and Light Company, Crookston, Minn., is making preparations for extensive improvements upon its plant in the spring. A new solid granite dam, improved machinery and a large new pumping and electric light station are among the improvements contemplated.

FINANCIAL.

Our respected contemporary, *The Press*, a few days since mentioned a condition into which from many inconsiderable corporations one of the largest and best known monopolies has resulted. "There are no less than ninety-eight telegraph companies on record in the United States, all of which continue their separate corporate existence," centering practically in the control of the Western Union, with a small minority accredited to the Postal. What a financiering lesson for the youth of the land, intending to make economic diplomacy his occupation. The history is procurable, and its sinuous trend to the central and final contact and absorption presents characteristics, the mastery of which constitutes one a peer of the most successful modern Crœsus. Eighty odd millions of money earning regular and continuous dividends on its common shares, paying promptly all its fixed charges, with an ever-increasing surplus, extending its plant in advance of the settlement of the country, the leader of the government's postal service, the W. U. telegraph corporation as a parent company is without an equal. There are scores of investments, which, with the concentration and liberal, honest expenditure of capital, following the same rules as they have, will lead to the same result on other lines of industry. Money in hand at the chief office in such cases furnishes opportunities to labor at a distance, which, were it scattered, would be impossible, and by means of bonds and shares each laborer of an accumulative disposition is enabled to participate in the profits by the simple investment of his small surplus. In no other country would the people be permitted to own, control and enjoy such opportunities. There is a field in literature for a compiler to fill by assembling the various negotiations consecutively and tersely; explaining the manner in which a few of the various gigantic financial positions have been reached. I think one rule of procedure will be found to include them all with the advent of the New Year, and the various reports, national and local, setting forth our financial position. The totals are in many instances interesting to the 100,000 readers of the ELECTRICAL AGE, who it is our special business to keep well informed on all financial statistics appertaining to electrical development, interpersed with an occasional shunt to the affairs of more general interest. New York's January payments in dividends and interest are estimated at $78,126,614, the largest total ever reached. In January, 1891, the sum paid out was $62,531,759, an increase of $15,594,855. The government will also pay $1,930,000 for interest on the Pacific six per cents., $5,590,000 on the four per cents., and about $10,000,000 for pensions. The aggregate payments for the new year will no doubt cross the $100,000,000 mark, and as it is not our nature to retrograde, we bid fair to close the century with incomes sufficient to render a great many of us happy. The contracts for electric lighting have been closed at about the old rates. The city should have at least five times as many lights, but greater New York will bloom out after her visit to Chicago next year; possibly a few new garments may be donned for the benefit of those who pass through the city on their way to the Fair. The year's work of the Board of Electrical Control shows that 5,224 poles and 7,152½ miles of aërial wire have been removed, and 114 miles of subway have been constructed, which will accommodate 47 miles of electric light, 721 miles telephone and telegraph, and 121 miles Edison light service. There are now in use in the city 1420 miles of subways, as follows: Electric light, 578; telephone and telegraph, 721; Edison, 121 miles; there are 84 arc and 59 alternating circuits, making a total of 143 high-tension circuits in use in the subways, with 528 miles of electric light conductors. There are 29,666 miles of telephone and telegraph wires, and 383 miles of Edison conductors. Mayor Grant recommends substantially that the city construct a service of its own, to connect all its departments for all communicative purposes, using switches, dials or *other instruments* (which will soon be telephones). This is the beginning of the end. The total debt of the city is $97,550,000, with a tax rate of 1.90. Brooklyn's debt is $41,980,790, and Mayor Boody strongly advocates the annexation of all the villages near by in Kings County, and the construction of a second Brooklyn Bridge, which naturally advances the general annexation scheme another point. He also vetoed the trolley resolutions, which may delay electric-car service for a time. The outlook for the year is all that could be desired, stocks have taken another rise, and if some hitch is not found as was at the last boom, the Exchange members will be happy again. The Westinghouse Co. will very soon list its new shares on the New York Stock Exchange, where they should have been several years ago. The shares can be had still at par, but will not remain at that figure after the public can purchase through any broker at the market price.

There is not at this writing many, if any, shareholders in the New York City Electric Light, Telegraph, Telephone, Ticker, Call, or other companies using the subways in part or in whole, possessed of a sufficient interest to cause them to seriously study the situation, who are at all satisfied with the condition of things. Daily they see their good money in the shape of poles, cross-arms, insulators and wires, jerked down and carted off, not only annihilating principal but cancelling many fond hopes of interest, and with no real suggestion of ultimate recuperation, the electric superintendents apparently being expected to, against skilled opposition, invent and install a system at the expense of their employers, insulated from all the elements and senses. If the subways were complete in all parts of the city, an ordinance might be drawn up that would be satisfactory. In the absence of this fact, it has several times been intimated to me that the shortest road to perfection in this muddle is for the city itself to construct and absolutely own all the subways, as they now do the sewers, and lease them to all comers, charging for rental and maintenance under statutory or ordinance provisions, amply sufficient to cover all expenses, but without profit. The first two or three years, either or all parties might suffer, but very soon order would be brought out of chaos and complaints would receive prompt and competent attention. The expense and income would be public to all whose interest it is to know, and both the public and the shareholder be benefited. With the city in indirect control of the wires, the people would no more question their personal condition as to safety than they do now from a policeman's club or any other necessary evil. Investors are cautious, and rightly so; they should not be expected or permitted to erect a structure under municipal charter, subject to be destroyed by that same authority which primarily grants it a right to exist. Is it not possible that the correct thing in this metropolis is for the city to own the subways and lease out space or wires, permitting none other to be used? Remember this is the financial solution of the problem asked for.

The Edison General Electric Co., the standing member of the New York Stock Exchange, has declared its ninth quarterly dividend of 2 % on all the stock of the company, payable on the 1st of February. The Stockholders' Annual Meeting will be held on the 10th of February, the principal business being to elect Directors for the ensuing year. No doubt changes of importance will be made.

The Laclede Gas Co. reports having disposed of 100,792 ft. of gas last December, an increase over same month of 1890 of 9800 ft. Cash receipts were $119,464, an increase of $10,045; net profits from gas show an increase of $10,352, and other profits from electric and Pintsch works, bring the total net profit for the month up to $74,985. The total earnings for the year were $582,460, increase of $68,711, which covers the loss of city lighting of $100,000. Forty-five thousand dollars were spent out of earnings for permanent improvements. There is plenty of room and employment in all cities for both electric light and gas; in time, each will take its particular place, but for public lighting the electric light has come to stay.

EASTERN NOTES.

NEW ENGLAND OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET,
BOSTON, Jan. 9, 1892.

THE WROUGHT-IRON CASTING CO., South Boston, Mass., has recently installed a 100 H. P. automatic cut-off engine, built by the Ball Engine Co., Erie, Pa.

JOHN BECKER, Boston, Mass., who is building a works at Fitchburg, Mass., has purchased a 35 H. P. engine from the Ball Engine Co., Erie Pa., for his electric-light plant.

THE THOMSON-HOUSTON ELECTRIC COMPANY has purchased a tract of 60 acres between the tracks of the Boston and Maine and the narrow gauge railroads bordering on the Saugus river, on which it will erect coal sheds, enabling it to get its coal supply without transfer.

THE CONSOLIDATED ELECTRIC MANUFACTURING COMPANY, corner of Congress and Franklin streets, Boston, is distributing among its patrons and friends a neat paper-cutter made of celluloid. It will be found very handy for such purposes as opening letters, etc. D. L. T.

THE ATTICA ELECTRIC CO., Attica, N. Y., a new company recently established at that place, has purchased one 80 H. P. and one 50 H. P. Ball engine, built by the Ball Engine Co., Erie., Pa.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
CHICAGO, Jan. 9, 1892.

IT is reported that the Illinois Central Railway will adopt electricity for its suburban traffic at Chicago.

PITTSBURG & BIRMINGHAM TRACTION CO., Pittsburg, Pa., has ordered a 50 H. P. Ball engine from Dravo & Black, Pittsburg representatives of the Ball Engine Co., Erie, Pa.

THE YOUNGSTOWN ELECTRIC LIGHT CO., Youngstown, Ohio, has largely increased its electric-light plant, and has just put in a 350 H. P. Ball Cross Compound engine, built by the Ball Engine Co., Erie, Pa.

CITIZENS' ELECTRIC LIGHT CO., Braddock, Pa., is increasing its power by the addition of a 150 H. P. Ball engine, built by the Ball Engine Co., Erie, Pa., and sold by Dravo & Black, its Pittsburg representatives.

MR. W. L. ADAMS has been elected secretary and treasurer of the Electric Merchandise Company, Chicago, of which well-known company Mr. W. R. Mason is president. Mr. Adams succeeded Mr. A. H. England, who recently resigned this position.

SOME months ago reference was made in the columns of the ELECTICAL AGE to the suit instituted by Mr. Charles A. Lieb, of New York, against the Electric Merchandise Company, of Chicago, for infringement of patent of rail bonds. The case was duly tried, and Judge Blodgett on the 4th inst. rendered a decision strongly and emphatically in favor of the Electric Merchandise Company.

IN Covington, Ky., electric messenger call-boxes are to be used for the purpose of giving notice of leaks in the supply pipe of the Water Works Company. The boxes are to be located in houses along the line of the main pipe, and in case there should be a leak or a break in the line from any cause, a signal will be sent from the nearest call-box to the main office of the company. N. D. W.

HOW TO OBTAIN PATENTS.

The object of invention is to lessen labor and save time, and any one who can improve on existing methods or apparatus of any kind has something that is patentable. If such a person produces something new that is practical he certainly is entitled to protection at the hands of the government against the depredations of those who have no respect for law when there is a chance to make a dollar by unfair means. Every new thing of practical value is personal property and should be patented.

The patent department of the ELECTRICAL AGE makes a specialty of electrical patents, although it is just as efficient in general work. We are having remarkable success in our patent work, and applicants for patents through us get the very best service and the most reasonable cost.

For further particulars address John Henry Hull, Patent Department ELECTRICAL AGE, *Times* Building, New York City.

THE BAEHR ELEC. MFG. CO.

The Baehr Electric Mfg. Co., 110 Livingston st., Brooklyn, N. Y., manufactures the Baehr Switch, intended for breaking current of any number of volts and ampères. In its construction are two steel springs instead of one, and everything is visible.

It is a knife switch, which the company claims makes the best possible contact. The space between the different poles is the greatest that can be obtained.

The switches are made of polished brass and mounted on a straight base. The company claims it is the best, cheapest and most durable switch made.

The special feature of this switch is its cheapness. The Baehr Electric Mfg. Co. is also getting up a Snap Switch, which it claims is destined to be an improvement over all others of its kind. It is but 3 inches square and 2 inches high over all.

The motors of this company are meeting with great success.

Mr. Baehr is now working on a new resistance compound starting box, which he expects to have ready before long.

The company is prepared to manufacture all kinds of electrical apparatus for physicians' use, and all kinds of electrodes used in the treatment of disease.

It manufactures complete medical cabinets to run on incandescent light circuits, from which galvanic, interrupted galvanic and faradic currents can be obtained, and motor-dynamos for cautery work, dispensing with the use of batteries.

Cabinets operated by batteries constructed on

scientific principles are also made by this company, for those who cannot have the use of light circuits for this purpose. The company guarantees these cabinets to be superior to any other.

In addition to the above it manufactures motors of any horse-power for running air-pumps, for atomizers, dental engines or hammers, or for any other purpose where power is required. The motors may be operated on electric-light circuits or by accumulators or primary batteries; they are of high efficiency and extremely low speed and perfectly noiseless. The company also does incandescent wiring under the authority of the Edison Electric Illuminating Company of Brooklyn and the rules of the New York Board of Fire Underwriters.

The new adjustable cautery handles manufactured by this company have valuable features. The knife may be set at any angle to the handle and the switch used in connection with this apparatus, it claims, is superior to all other makes.

BUSINESS NOTES.

MR. ALFRED F. MOORE, manufacturer of insulated electric wire and cables for all uses, 200 and 202 North Third street, Philadelphia, is distributing a large calendar for 1892. He is also sending out with the same large sheets of blotting-paper, on which is an illustration of his quarters.

THE BRADY MANUFACTURING COMPANY, corner of York and Washington streets, Brooklyn, occupies a large factory for the manufacture of machinery of all kinds. It has special facilities for the manufacture of electrical apparatus and machinery, and its work is of the highest order. The company was established in 1872, and the officers are: President, James Cruikshank; Secretary and Assistant Manager, Barton Cruikshank, and Treasurer and Manager, James Brady.

SATISFIED WITH HIS BATTERY.

LA CROSSE, WIS., Nov. 26, 1891.

Jerome Kidder Mfg. Co.:

DEAR SIRS: I have a No. 5 Tip Battery Apparatus bought from * * * I have been pleased with the conduct of the battery. Respectfully,

A. M. ADAMS, M.D.

FOR SALE.

A large lot of hard-rubber battery-cells; outside dimensions, $7\frac{1}{4}\times7\frac{3}{4}\times11\frac{1}{4}$ inches high; shells $\frac{5}{32}$ of an inch thick; moulded cover with knob on top; several thousand in stock. Also 60 hard-rubber cells; inside measurement, $4\times15\times15$ inches high; thickness of shells, $\frac{3}{16}$ of an inch; without covers. All new cells. For sale at a bargain.

HARD-RUBBER CELLS, care of this office.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued January 5, 1892.

466,212. Electric Car-Brake. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Company, East St. Louis, Ill. Filed Jan. 10, 1891.

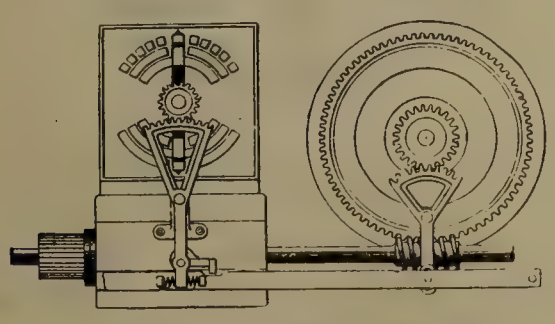
In an electric car-brake, the combination of brake shoes, a track-brake, an electric motor, a pivoted stem, a suitable connection between one of the brakes and the stem, a relatively longer connection between the other brake and the stem, and a train of-gear connection between the motor and the stem whereby the stem may be moved a greater or less degree and the respective brakes applied successively.

466,218. Railway Tie and Chair. Theodore S. Brooks, Garrison's, N. Y. Filed Jan. 17, 1891.

A metallic tie, elliptical or U-shaped in cross-section, with depending rounded ends, and having on its upper surface at each end two short parallel separated supporting-ribs integral with the tie, the upper surface of the tie being otherwise flat, the rails resting on the ribs, so that a space is left between the ribs under the rails, and clamps capable of being slipped into the spaces after the rails have been placed in position.

466,219. Car-Coupling. Perry Brown, Sharonville, Ohio. Filed April 18, 1891.

A car-coupler having a swinging clutch with a circular knuckle and an eccentrically-placed pivot.



466,447.—DEVICE FOR ELECTRIC ELEVATORS.

466,221. Car-Coupling. Harman Bunker, Barrie, Canada, assignor of one-half to James Herbert McKeggie, same place, John Charles McKeggie and George Tait Blackstock, Toronto, Canada, and Milo J. Althouse, Waupun, Wis. Filed July 16, 1891.

An automatic coupler comprising a hollow turret suitably pivoted in a draw-head on short pivots formed on the head and foot of the turret, thus leaving a space between the pivots, and an arrow-shaped link adapted to enter a slot in the turret and pass into the space between the pivots.

466,233. Car-Coupling. Joseph P. Hasty, Superior, Neb. Filed Sept. 12, 1891.

The combination, in a car-coupling, with a draw-head having a recess in the top front portion thereof and coupling-hook, with slot and pivot-pin, of a rod extending to the sides of the car, catch, chain and rod.

466,242. Car Starter and Brake. Sherman Joh and Wesley Barlow, Sims, Ind. Filed April 18, 1891.

In a car starter and brake, the combination of a car-axle having two separated gear-wheels rigidly secured thereto, with a supporting-frame mounted on the axle, a shaft pivoted to the supporting-frame, a gear-wheel loosely mounted on the shaft, means whereby the gear is adjusted to engage either of the gears secured to the car-axle, and a spring coiled in the stub-axle, whereby the momentum of the car is applied to coil the spring and the power of the spring in turn applied to propel the car.

466,289. Lamp-Socket. Jesse L. Hinds, Syracuse, N. Y., assignor to the Electric Engineering and Supply Company, same place. Filed July 23, 1891.

In combination, an insulator base-plate, a bracket consisting of a ring and oppositely-arranged arms secured to the base-plate, a second insulator-plate supported on the ring of the bracket, a lamp-engaging socket secured to the second insulator-plate, and movable lamp-engaging arms on the socket.

466,290. Lamp-Socket. Jesse L. Hinds, Syracuse, N. Y., assignor to the Electric Engineering and Supply Company, same place. Filed July 23, 1891.

The combination, with an insulator-base, of a bracket having depending end arms and a central arm or lug, a terminal carried by lug, a spindle journalled in the arms, a cam on the spindle, a spring having one extremity disposed on the outside of the bracket-arm and formed with a foot engaged with the bracket, a laterally-extending arm on the spring, having a projecting bearing-face adapted to be forced by the cam into engagement with one of the lamp-terminals, a bracket having one extremity secured to the insulator-base and the other provided with a nipple adapted to engage the other lamp-terminal, and a terminal on the bracket.

466,306. Electric Fire-Alarm System. Henry E. Jacobs, Milwaukee, Wis., assignor to Frank G. Bigelow, Moses H. Brand and George Knowles, Jr. Filed March 23, 1889.

The combination, with an electric motor and contact-collar revolved thereby, the latter having a continuous and an intermittent contact-surface, of a brush bearing on the continuous contact-surface and wired to the motor-magnet, an electric circuit including a thermostat, a magnet and its armature, contact-posts between which one end of the armature depends, two brushes resting on the intermittent contact-surface of the motor-collar and wired each to one of the contact-posts last named, a wheel revolved by the motor, having horizontal pins projecting from it in series, and a brush normally in circuit with a signal-box, but projecting in the path of the pins.

466,357. Electric Annunciator. Charles Molitor, Chicago, Ill. Filed Sept. 14, 1891.

The combination with a weighted arm of an annunciator indicating device, of a vertically-movable bar having a pin located in the path of the arm, an arm upon the bar, having adjacent concaved faces and a pivoted lever located to engage the concave faces.

466,367. System of Electric Distribution for Railways. Nelson W. Perry, Cincinnati, Ohio. Filed March 2, 1891.

The combination, in a system of electric distribution for movable translating devices, of a sectional current-conveyer, switches normally closing the gaps between the sections, two lines of sectional conductors, the corresponding sections of each line being connected with separate sections of the main current-conveyer, supplemental conductors lapping one line of conductors and insulated therefrom, and electrical connections between the supplemental wires and the main current conveyer.

466,368 System of Electric Distribution for Moving Translating Devices. Nelson W. Perry, Cincinnati, Ohio. Filed April 2, 1891.

The combination, in a system of electric distribution for movable translating devices, of a sectional current-conveyer, switches normally closing the gaps between the sections, and two lines of conductors arranged in pairs, the conductors in each line lapping but normally insulated from each other and the members of each pair being connected one with one section and the other with another section of the main conveyer.

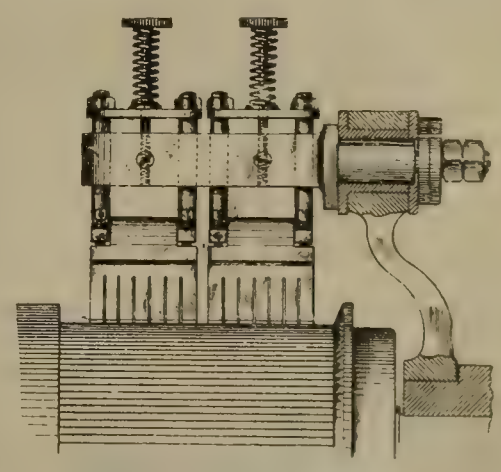
466,391. Insulator. William S. Andrews, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed May 27, 1891.

An insulator or similar device consisting of an insulating-body provided with a groove or depression, a metal cap having means for connecting a wire to it and having a corresponding groove or depression, and a body of metal extending from the depression in the body into the depression in the cap.

466,400. Cut-Out for Incandescent Lamps. Thomas A. Edison, Llewellyn Park, and John F. Ott, Newark, N. J., assignors to the Edison Electric Light Company, New York, N. Y. Filed Oct. 27, 1886.

In an incandescent electric lamp, the combination with the leading-in wires between the external contacts of the lamp and their place of sealing into the glass, of a spring adapted to bridge the wires and an inflammable fastening device normally holding it out of bridging contact.

466,427. Extensible Electrical Conductor. Benton C. Rowell, Boston, Mass., assignor of one-half to



466,448.—COMMUTATOR BRUSH AND HOLDER.

D. Howard Vincent, same place. Filed April 13, 1891.

In combination with the terminals of a discontinuous electrical contact-rod or trolley-wire, an extensible electrical conductor supported at one terminal, a projecting finger connected with the conductor and adapted to be operated by a passing car to extend the conductor across the space between the terminals, and a weight or spring to withdraw the conductor from that space when the car has passed.

466,447. Device for Electric Elevators. Rudolph C. Smith, Yonkers, assignor to Otis Brothers & Company, New York, N. Y. Filed March 17, 1891.

In an electric elevator, the combination, with an electric motor, a switch controlling the motor, and the hand-rope for controlling the switch, of a locking device for the switch and means connected to the hand-rope for releasing the locking device.

466,448. Commutator Brush and Holder for Dynamo-Electric Machines and Motors. Frank J. Sprague, New York, N. Y., assignor to the Edison General Electric Company, of New York. Filed Dec. 10, 1886.

The combination, with a commutator cylinder, of an end-on commutator-brush having its end bevelled in two directions.

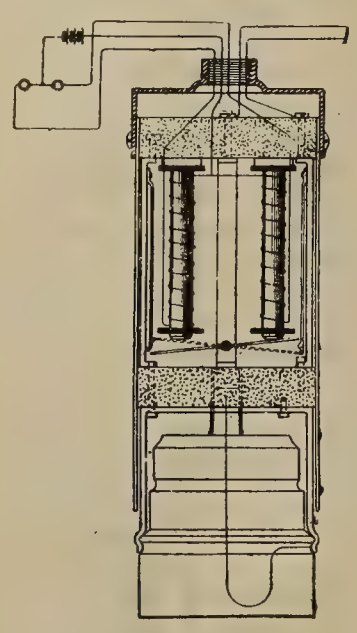
466,450. Damper-Controller. John V. Stout, Easton, Pa. Filed March 23, 1891.

The combination of a valve or damper, a magnet for

opening and a magnet for closing the valve, an armature or armatures for the magnets, a coupling between the valve or damper and the armature or armatures in positive engagement during the first part of a movement of the valve, but the positive engagement being broken during the following movement of the valve, the magnets being in circuits controlled by a thermostatic circuit-controller, a circuit maker and breaker in the circuit of each magnet in addition to the thermostatic circuit-controller, and means moving with the valve to open the circuit through the magnet last energized and to close the circuit at the circuit maker and breaker in the circuit of the other magnet.

466,460. Art of Electrolytic Decomposition. Thomas A. Edison, Menlo Park, N. J. Filed May 26, 1882.

The process of decomposing substances, consisting in subjecting them to the action of an electric current when under high temperature and pressure.



466,511.—LAMP-SOCKET.

466,471. Underground Conduit for Electric Railways. Charles P. Tatro, Spokane, Wash. Filed Nov. 14, 1891.

The combination, in conduits for electric railways, of a series of pipe-sections having an insulated wire in each, the wire having projecting branch ends, a branch coupling joining the adjacent ends of pipe-sections, a branch pipe in the coupling covering the branch ends of wire, the branches being secured together in a metallic contact, and a switch-shield secured upon the branch pipe over the end of the wires.

466,492. Cable Telegraphy. Wilson E. Facer, Cleveland, Ohio, assignor to George S. Iddings and M. M. Hobart, same place, and George N. Morton and S. W. Wood, New York, N. Y. Filed Dec. 22, 1890.

An induction-coil provided with a local circuit with opposed contact-points, a key extending between the contact-points, and a line-wire including a circuit-closer controlled by the key.

466,505. Combined Electrical Protective and Time-Detecting System. Jamin S. Morse, New York, N. Y. Filed June 5, 1891.

The combination, with a system of thermostat-circuits centering at a given point, a time-recording mechanism, and independent recording-circuits corresponding to the thermostat-circuits, of a switch or bridge for simultaneously closing breaks in corresponding thermostat and recording-circuits, an electro-magnet included in the circuit of the bridge, and a circuit-controller in the recording-circuits operated thereby.

466,508. Electric Switch. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Filed March 17, 1891.

An automatic switching device for electric circuits, comprising a yoke-shaped supporting-base, electro-magnets fixed thereon, a rocking lever pivotally supported at the apex of the base, armatures carried by the lever and under the influence of the electro-magnets, contact-plates upon the ends of the lever, contact-springs completing the main circuit through the plates, and a circuit independent of the main circuit energizing the electro-magnets.

466,509. Electric Drop-Light. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Filed April 29, 1891.

The combination, with the winding-cylinder of an electric drop-light, of a circuit-breaker making continuous frictional contact therewith and and thereby operated automatically by the rotation thereof, the circuit-breaker making and breaking circuit at any point in the range of adjustment of the drop-light.

466,510. Electric-Lamp-Socket Switch. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Original application filed March 17, 1891. Divided and this application filed July 24, 1891.

A switch for electric lamps, comprising a stationary disc of insulating material fixed within the barrel of the lamp-socket, an electro magnet or magnets fixed to the disc, an armature attracted by the magnet or magnets, means carried by the armature for actuating a rotatable conducting-disc, and a contact completing the lamp-circuit through the conducting-disc.

466,511. Electric-Lamp-Socket Switch. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Original application filed March 17, 1891. Divided and this application filed July 24, 1891.

The combination, with an electric-lamp socket, of two sets of electro-magnets contained within the socket, a separate circuit independent of the lamp-circuit for each set of magnets, a manual switch controlling each of the circuits, a rocking lever controlling the supply-circuit and operated by either set of magnets, and spring detents connected in the lamp-circuit and arranged to engage the lever, and thereby to control the lamp-circuit in either of its operative positions.

466,518. Apparatus for Synchronizing Clocks. Ludwig Von Orth, Berlin, Germany. Filed Jan. 23, 1891.

In combination with a telephone system or other network of wires, a master-clock at the central station provided with a circuit-closer, an auxiliary line, including the circuit-closer and a battery, a resistance, interpolated in the ground-wire of the central station to divide the current, as specified, and a series of secondary clocks, all so arranged that on the closing of the circuit of battery by the master-clock divided circuits pass over all the telephone-subscribers' wires and to the secondary clocks of the clock subscribers.

466,519. Circuit-Controller. Henry P. White, Kalamazoo, Mich. Filed April 29, 1891.

The combination of a rail of a railway-track, a fulcrumed lever having one end beneath and in contact with the under side of the rail, a swinging lever constituting one of the terminals of the circuit, a chain attached to the axis of the swinging lever and to the free end of the fulcrumed lever which is acted upon by the rail, and a metal plate constituting the other terminal of the circuit in position for the swinging lever to come in contact therewith when the rail is borne down by the weight of the cars, whereby the circuit is closed.

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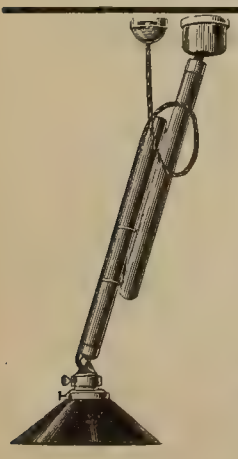
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THE QUESTION OF THE DAY.

The chief question of the day in large American cities is rapid transit, and the dissatisfaction with existing methods of street transportation has grown with phenomenal rapidity within little more than a year. New York, Brooklyn, Boston, Philadelphia, Chicago, Baltimore and many other large cities, are all seriously grappling with the problem of providing better transportation facilities in their respective streets, and they are all after the best system. They all seem to want electricity as the propelling power, but they hesitate when the trolley system is suggested. Surely here is a chance to make the electric system acceptable to all, and a fortune awaits the lucky one who solves the problem.

ELECTRICITY AT THE WORLD'S FAIR.

As the time for the opening of the World's Fair approaches the greater is the interest taken in this vast enterprise. What concerns the electrical fraternity most, of course, is the electrical department of the exhibition, which will undoubtedly be the feature of the Fair, and it is interesting to note that good progress is being made in the construction of the noble edifice which is to be known as the Electrical Building.

The original plans of this building have been changed somewhat; these changes, however, affect the external appearance of the building more than any other feature, and in our opinion vastly improve its appearance.

We publish a description and an illustration of the Electrical Building on the page following this, and we think that most all of our readers will agree with us that it is an elegant looking structure, and one that the electrical fraternity will have good reason to take great pride in.

THE BROOKLYN TROLLEY MATTER.

It looks now as if the establishment of the trolley system on the lines of the four street-railroad companies in Brooklyn was an assured fact.

On the 13th instant the Board of Railroad Commissioners at Albany approved the application of the Brooklyn City and Newtown Railroad Company for permission to substitute the trolley system on its line in place of horses, and the action is supposed to indicate that similar steps will be taken in reference to the applications of the other companies seeking to accomplish the same object.

The Board, in granting its approval, fixes certain conditions which the railroad company must comply with. These conditions require that the railroad company shall take every precaution possible to avoid accidents in the operation of the trolley system. It must construct a longitudinal guard wire over the trolley wire so as to prevent broken telephone or other wires from coming in contact with the trolley wire; every car must be equipped with guards in front of the wheels, coming within two inches of the track, to prevent persons being run over, and it must use reasonable and proper means to prevent currents from its wires, through leakage, induction or otherwise, from interfering with the currents on wires of other companies, whether telephone, telegraph or other lines.

These conditions are reasonable, and it would seem that with faithful compliance with the same the Brooklyn people need have nothing to fear. It is as much to the interest of the companies themselves as to that of the public to have the lines constructed properly and substantially, and there is no reason to suppose that the work on the Brooklyn roads will be otherwise than first class and of the most approved character.

CHEER FOR BROOKLYNITES.

Apropos of the existing agitation in Brooklyn over the question of the introduction of the trolley system on the street-railroad lines in that city, the article published in our last issue from the pen of Mr. A. A. Knudson, headed, "Points on the Trolley," possesses much interest.

Mr. Knudson is a well and favorably known electrician and is abundantly qualified to speak on this subject. The account he gave of a case in Scranton, Pa., where a man deliberately took hold of one end of a broken trolley wire—the end nearest the power station—one rainy night without suffering any other effect than a scorching of his fingers, will have a wholesome effect on the minds of the few timid ones who labor under the delusion that the electric current used on railway circuits is sufficiently powerful to annihilate human life in the "twinkling of an eye."

It has been asserted time and again that a railway current has never yet destroyed a human life, and this assertion is strongly backed by records. But the mere statement of the fact that not a single person has yet been killed by a trolley current does not make on the mind as deep an impression as an account giving all the facts in one specific case, where a person has received the full charge in his body, and Mr. Knudson's description of this one case will, we think, go a great way towards allaying any fear that may exist in the minds of timid Brooklynites, if there is any.

THE DYNAMO IN TELEGRAPHY.

One of the most valuable applications of the dynamo-electric machine is for the generation of currents used in telegraphy. It is but a few years since that the experiment was made in the New York office of the Western Union Telegraph Company of using dynamos for this purpose, and although at first the practical value of this innovation was questioned the many improvements that have since been made, and with a consequent better knowledge of the underlying principles of the dynamo, these machines have come to be regarded by telegraph officials as valuable and important adjuncts to the successful operation of telegraph wires out of large offices.

It was some time after the New York plant was installed that the system was improved to a sufficient extent to warrant its use in other large offices, but by patient experimentation the dynamo current was finally subjugated and made to do the work that the unreliable chemical battery had been so long depended on to perform. At the present time dynamos are used in the Chicago, Pittsburg, New York and other large offices of both the Western Union and Postal Telegraph Companies, and their use effects a very great economy in operating expenses. The current from machines is always reliable and steady and there is no running down or weakening of current as is common where batteries are used. Besides this advantage there is great economy in the matter of space for the installation, as compared with the battery plant of equal output, and the labor necessary for its care is very much less.

We publish elsewhere in this issue an interesting article concerning the dynamo plant recently installed in the St. Louis office of the Postal Telegraph Company, under the supervision of Mr. F. W. Jones, the company's electrician. We also give in connection therewith two illustrations showing the connections between the dynamos and quadruplex apparatus. This plant, we understand, contains many new improvements in the application of dynamo currents to telegraphic work, and it may be said that this installation represents the latest development in this direction.

THE ELECTRICAL BUILDING AT THE WORLD'S FAIR.

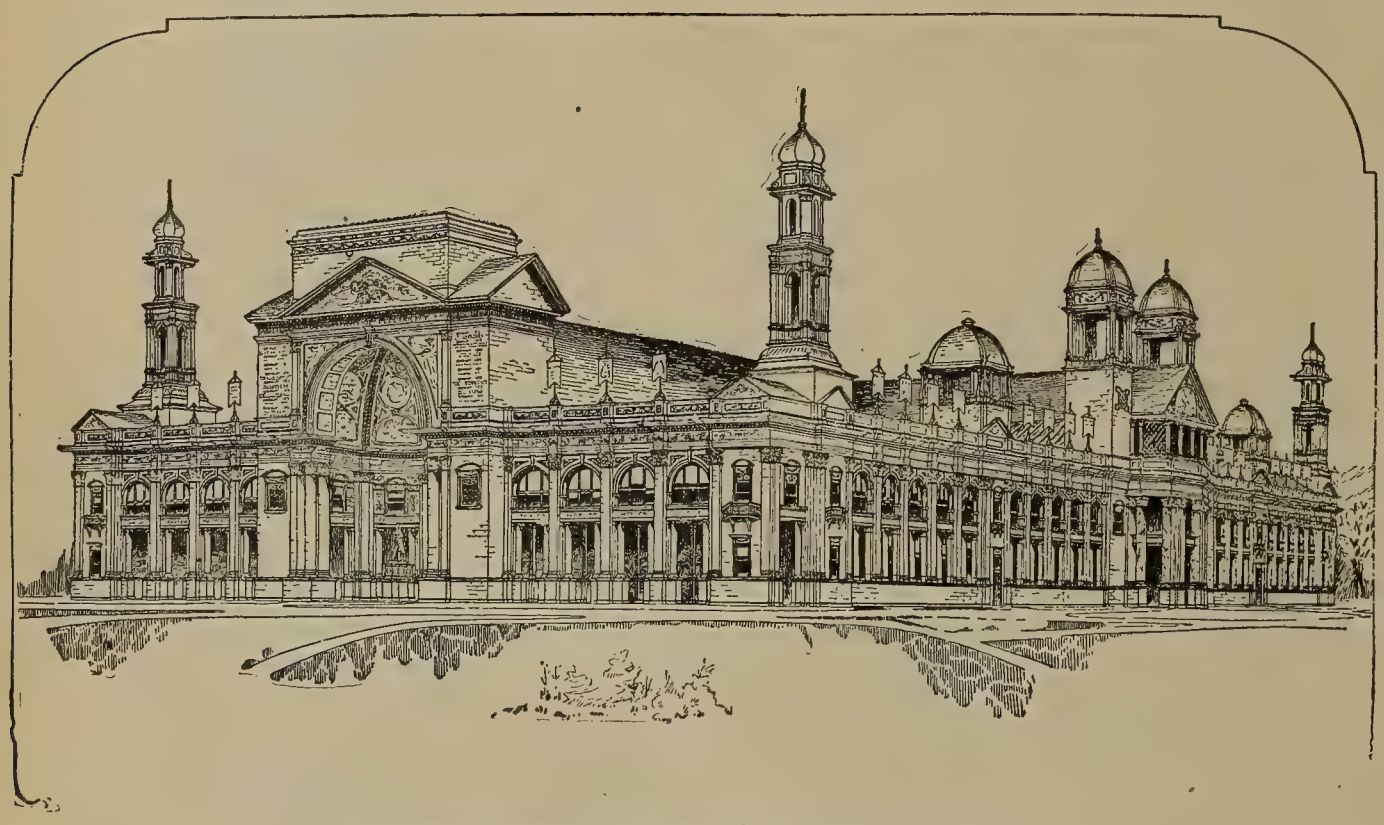
In view of the progress being made in the construction of the Electrical Building on the grounds of the World's Columbian Exposition, Chicago, the following description of that structure will be of interest :

The Electrical Building, the seat of perhaps the most novel and brilliant exhibit in the whole Exposition, is 345 feet wide and 700 feet long, the major axis running north and south. The south front is on the great Quadrangle or Court; the north front faces the lagoon ; the east front is opposite the Manufactures Building, and the west faces the Mines Building.

The general scheme of the plan is based upon a longitudinal nave 115 feet wide and 114 feet high, crossed in the middle by a transept of the same width and height. The nave and the transept have a pitched roof, with a range of skylights at the bottom of the pitch, and clearstory windows. The rest of the building is covered with a flat roof, averaging 62 feet in height, and provided with skylights.

The second story is composed of a series of galleries connected across the nave by two bridges, with access by four grand staircases. The area of the galleries in the second story is 118,546 square feet, or 2.7 acres.

The exterior walls of this building are composed of a continuous Corinthian order of pilasters, 3 feet 6 inches wide and 42 feet high, supporting a full entablature, and resting upon a stylobate 8 feet 6 inches. The total height of the walls from the grade outside is 68 feet 6 inches.



ELECTRICAL BUILDING, WORLD'S COLUMBIAN EXPOSITION.

The north pavilion is placed between the two great apsidal or semi-circular projections of the building ; it is flanked by two towers 195 feet high. The central feature is a great semi-circular window, above which, 102 feet from the ground, is a colonnade forming an open loggia or gallery, commanding a view over the lagoon and all the north portion of the grounds.

The east and west central pavilions are composed of two towers 168 feet high. In front of these two pavilions there is a great portico composed of the Corinthian order, with full columns.

The south pavilion is a hemicycle or niche 78 feet in diameter and 103 feet high. The opening of the niche is framed by a semi-circular arch, which is crowned by a gable or pediment, with smaller gables on the returns, and surmounted by an attic, the whole reaching the height of 142 feet. In the centre of this niche, upon a lofty pedestal, is a colossal statue of Franklin, whose illustrious name intimately connects the early history of the Republic with one of the most important discoveries in the phenomena of electricity.

At each of the four corners of the building there is a pavilion, above which rises a light open spire or tower, 169 feet high. Intermediate between these corner pavilions and the central pavilions on the east and west sides, there is a subordinate pavilion bearing a low, square dome upon an open lantern. There are thus ten spires and four domes. The entablature of the great Corinthian order breaks around each of the pilasters of the four fronts, and above each pilaster in the Attic order is a pedestal bearing a lofty mast for the display of banners by day and electric lights by night. Of these masts there are in all fifty-four.

The first story of the building is indicated in these façades between the great pilasters of the Corinthian order, by a subordinate Ionic order, with full columns and pilasters, forming an open screen in front of the windows.

The Electricity Building has an open portico extending along the whole of the south façade, the lower or Ionic order forming an open screen in front of it. The various subordinate pavilions are treated with windows and balconies. The details of the exterior orders are richly decorated, and the pediments, friezes, panels and spandrils have received a decoration of figures in relief, with architectural motifs, the general tendency of which is to illustrate the purposes of the building.

The appearance of the exterior is that of marble, but the walls of the hemicycle and of the various porticos and loggia are highly enriched with color, the pilasters in these places being decorated with scagliola, and the capitals with metallic effects in bronze.

In the design of this building, it was proposed by the architects to so devise its details and general outlines, that they might be capable of providing an electric illumination by night on a scale hitherto unknown, the flag-staffs, the open porticos, and the towers, especially, being arranged with this in view. Van Brunt & Howe, of Kansas City, are the architects. The cost is $375,000.

It was proposed that the hemicycle or niche, which forms the south porch, should have either a great chandelier or crown of lights suspended from the centre of the half dome, or should be provided with electric lights masked behind the triumphal arch which forms the opening of the niche.

POWER-STATIONS.

There are several things to be considered in the location and construction of a power-station in order to obtain the best results for the least money. If possible, the power-station should be placed at the electrical centre of the railway system, near the railroad or wharf where coal may be delivered at minimum cost, and near a water-supply that will allow the use of condensing engines. It is next to impossible to secure all these advantages at once, and it becomes a question as to which of the above conditions is the most important. Generally that position of the power-station which affords steam-power at minimum cost is the one to be chosen, because a failure to fulfil the first condition above outlined can be satisfied by an initial and final outlay for copper, while a failure to fulfil those conditions which reduce the cost of steam-power to a minimum results in a continual outlay which is in almost every case far in excess of the cost of the additional copper for transmitting the power over the increased distance.

The engine-power of a station should be divided into units proportioned to the traffic in the particular case in question. For instance, if a road required the maximum output of the station at night and morning and only $\frac{1}{5}$ of the maximum output during the remainder of the day, the engine-power should be divided so that $\frac{1}{5}$ of the total power may be furnished when it is needed, without excessive loss due to inefficiency.

The power-house should be designed with a view to future, as well as present, needs. It is possible to so design a building that extensions may be made without disturbing the machinery in the least. This is, of course, most advantageous, as it allows the addition to be made without inconveniencing the operation of the road.

THE TROLLEY FOR BROOKLYN.

The Board of Railroad Commissioners at its meeting in Albany, January 13, made public the following decision on the application of the Brooklyn City and Newtown Railroad Company for the approval by the board of a change of motive-power from horses to the overhead single-trolley electric system :

"This application, dated November 23, was lodged with the board. After the advertisement in the press of Brooklyn a public hearing was had at the Common Council Chamber, in the city of Brooklyn, on January 6, 1892. The railroad company was represented by John N. Partridge, President. No opposition was made either in person or by letter.

"Affidavits of Dominick H. Roche, Secretary of the Board of Assessors of the City of Brooklyn, as to the consents of the abutting property holders as compared with the local assessed valuation on the line of the road, were submitted to the following effect :

	Assessed Valuation.	*Consents Obtained.*
Water street, from Fulton to Washington streets	$853,000	$766,500
Fulton street, from Water to Front streets	425,400	415,000
Front street, from Fulton to Washington streets	381,500	245,500
Washington street, from Water to Fulton streets	2,714,300	2,055,000
Fulton street, from Washington street to De Kalb avenue	6,179,700	3,605,500
De Kalb avenue, from Fulton street to Wyckoff avenue	4,691,740	2,706,570
Total	$15,245,640	$9,793,570

"From this table it will be seen that the total assessed value of property on the line of the route is $15,245,640, of which the company has secured consents aggregating $9,793,570.

"At a meeting of the Common Council held Monday, December 21, 1891, resolutions were passed approving of the proposed change of motive-power. In view of the above recited facts, and for the same reasons set forth in the decision of the board in the application of the Coney Island and Brooklyn Railroad Company for approval of a change of motive-power of this date, the board deems that it is justified in approving, and does hereby approve, of a change of motive-power by the Brooklyn City and Newtown Railroad Company from horses to the overhead single-trolley electric system on that portion of its route on Water street, from Fulton street to Washington street, on Fulton street, from Water street to Front street, on Front street, from Fulton street to Washington street, on Washington street, from Water street to Fulton street, on Fulton street, from Washington street to De Kalb avenue, on De Kalb avenue, from Fulton street to Wyckoff avenue, with the following conditions, however, which are made part of the approval.

"First, the company shall conform to all the requirements set forth in the resolutions of the Common Council of December 21, 1891.

"Second, the company shall construct a longitudinal guard-wire over the trolley wire, so as to prevent broken telephone, telegraph or other wires from coming in contact with the trolley wire.

"Third, no car shall be run with less than two men to operate it. Every car shall be equipped with guards in front of the wheels, coming within two inches of the track to prevent persons being run over.

"Fourth, the company shall take all reasonable and proper means to prevent the currents from its wires, through leakage, induction or otherwise, from interfering with the currents upon the wires of other companies, whether telegraph, telephone or other wires.

"The company shall conform to all the reasonable requirements of the local authorities heretofore or hereafter legally imposed.

"By the board,

"WILLIAM C. HUDSON, *Secretary.*"

This action on the part of the Commissioners is regarded as indicating that the other Brooklyn roads, which are seeking the same privileges, will be granted permission to change their power from horses to electric, and that whatever action may be taken by Mayor Boody on the resolutions reintroduced at the meeting of the Brooklyn Board of Aldermen on the 11th instant will be immaterial.

Gen. Slocum, the President of the Brooklyn and Coney Island road, is quoted as saying that his company would begin work at once, and that electric trolley cars would probably be running from Hamilton Ferry to Coney Island before the beginning of summer.

AUTOMATIC AND MULTIPLEX TELEGRAPHY.

BY F. N. GISBORNE, C.E., M.I.E.E.

In a former paper upon "The Inception of Electrical Science and the Evolution of Telegraphy," read in Section III. of the Royal Society of Canada, and subsequently revised and published by the Canadian Society of Civil Engineers, the concluding paragraph read as follows:

"That the most successful and profitable telegraph companies of the future will abandon the present system of a multiplicity of wires for the transmission of intelligence, and at business centres and important stations will employ female labor for perforating and comparing with the original manuscript dispatches, to be forwarded by AUTOMATIC transmitters; an additional wire being operated by Morse sounders for the correction of errors, and also for the requirements of intermediate local business, such additional wire being available for duplex, quadruplex or MULTIPLEX instruments."

The foregoing conviction has been confirmed by late improvements both in automatic and multiplex apparatus, whereby telegraphy can now compete profitably with the postal systems in such long-distance countries as Canada and the United States.

Twenty-five cents for a ten-word message, exclusive of address and signature, does not appear to be an excessive charge when the time saved is material, and when business men have learned by experience how much information can be conveyed within such limited number of words; but to the uninitiated general public 100 words at the same tariff rate would be a great boon, and add materially to the volume of both commercial and social intercommunication.

The practical means by which such desirable result can be accomplished with profit to investors may now be considered.

Thousands of miles of poles and wire at a primary cost of millions of dollars for construction and a vast outlay for maintenance and renewals can be dispensed with by the adoption of automatic and multiplex telegraphy. By the former 1,000 words per minute have been correctly transmitted, during stormy weather, between cities 1,000 miles apart; and by the latter one wire is utilized for a dozen distinct and parallel circuits.

A skilful Morse operator transmits during a day of eight or nine working hours an average of twenty-five words a minute, and by a Wheatstone automatic repeater 300 to 400 words can be sent over moderately long circuits; but the latter apparatus requires considerable auxiliary labor, as every dot and dash in each alphabetical letter has to be stamped out separately prior to transmission per wire.

Duplex, quadruplex and multiplex instruments require separate skilled operators for each and every circuit utilized in such systems, so that the economy is limited to the reduced number of wires, etc., between stations.

Hitherto the speed of automatic transmission over long-distance circuits has been limited by static induction in the line wire, causing dots and dashes to run into each other, and thus appear at the terminal station in a continuous line, but such difficulty has also been overcome.

Multiplex telegraphy, on the other hand, requires practically perfect synchronism between the instruments at both ends of the line, the elimination of static induction, and as many electrical impulses per second as will render it impossible for a skilled Morse operator to close his key without intercepting a current in connection with corresponding sections of subdivided dial plates, over which rapidly revolving arms are making synchronous contacts.

Hitherto multiplex telegraphy has been limited to direct connections between terminal stations; but this objection has also been provided for by the several inventions herein referred to.

By the above system the Morse dot and dash code of signals is transmitted by means of perforations in a strip of paper, and received either by chemical decomposition or by ink registers.

The rapid preparation of accurate perforations is therefore of primary necessity.

In the Wheatstone automatic alternating or double-current system each integral part of a character or letter is perforated separately, and such operation is therefore much slower and less accurate than if each letter was punched out by a single movement. Nineteen punch dies (including the feeding row) are required for such system.

By the Anderson single-current system much simpler perforations, requiring but six dies, are necessary, the holes (*vide* diagram) representing the spaces between each dash or dot, and each complete letter of the alphabet being punched out by a single type-writing movement.

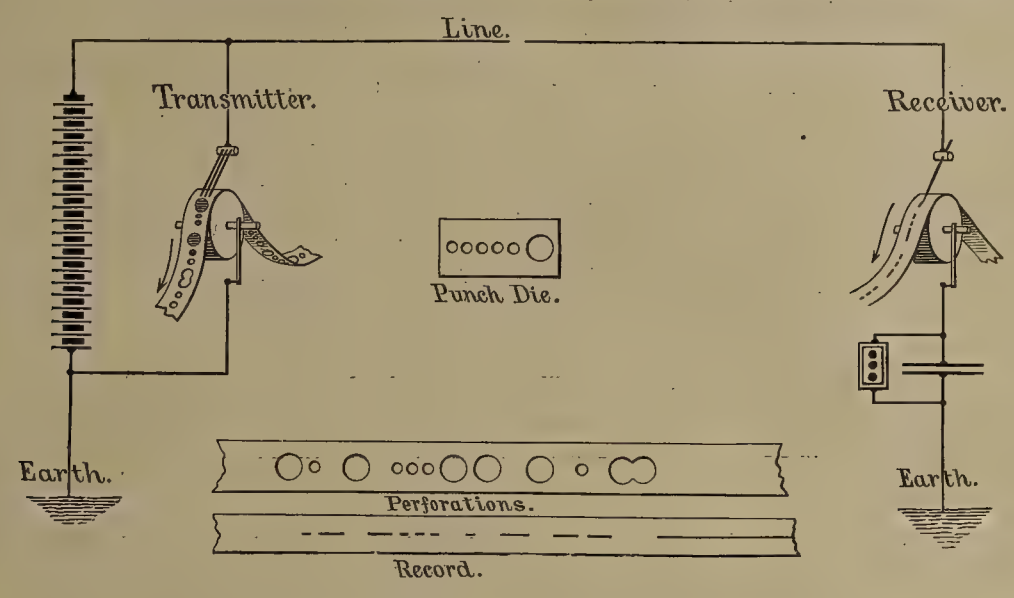


DIAGRAM OF ANDERSON'S SINGLE-CURRENT SYSTEM.

The transmittter is placed in a shunt from line to earth, the battery being normally connected to line.

The advantage of such arrangement in rapid signalling is that the line is connected to earth through a path of no appreciable resistance between each signal, the cessation of the signal and the grounding being simultaneous; thus the largest portion of static induction escapes at the transmitting end, leaving the minor portion to be contended with at the other terminus.

After passing through the recorder the current reaches the condenser and thence to earth, controlled in the usual manner by resistance coils.

The electric signal, after leaving its record upon the chemically-prepared paper, enters and charges the condenser to a degree more or less approaching its own potential. When the signal impulse begins to weaken, the static charge near the receiving end tends to follow and prolong the record, but is met by the counter-charge of the condenser, and is thus neutralized, the resistance in the condenser shunt being from four to six times greater than that of the line.

Herein is shown the further advantage of the perfect grounding of the line at the sending end by the more complete discharge of the condenser between each signal; for if the usual arrangement of transmission by direct open and close contact of line and battery be substituted, the condenser becomes so completely charged after two or three signals that no further record can be obtained unless the resistance in the shunt is so far reduced as to impair its clearness.

Hitherto automatic systems have worked best in wet weather, owing to the lessened static induction from leakage; but the new system works equally well in all weathers. It is also free from the necessity of continuous readjustments.

The record obtained is also remarkably well defined even at the reported speed of 3,000 words per minute over a copper wire of two ohms per mile resistance and 351 miles in length, experimentally utilized, between New York and Washington cities.

Again, repeated work at 600 words per minute has been produced over a copper-wired line between New York and Chicago, 1,027 miles in length, as clearly as it would have been by direct transmission. (*Vide* Plate No. 1.)

The possibility of obtaining a multiplicity of signalling circuits in a given line wire by methods other than those comprised in quadruplex telegraphy is presented in the systems that have been devised to transfer the line wire from one set of instruments to another similar set successively at both ends of the circuit, and thus afford to each corresponding apparatus an intermittent connection so rapidly recurring as to be practically continuous. This is the principle of the established Delany system, whereby six circuits can be obtained on a single line wire.

It has, however, been found in practice that such number of circuits is limited to 100 mile distances, or four over 200 miles. Again the receiving apparatus is actuated by currents emanating from the transmitting end only, thus rendering the system inapplicable for intermediate stations. Thirty-four current impulses per second = three impulses per dot signal, are also necessary for operating it at the ordinary maximum rate of transmission.

By the Keeley system signals are manifested by pulsations emanating from both terminal stations concurrently, such currents being of alternative polarity, occurring twenty-four times in a second, the position of each key in the circuit determining the polarity of the current passing through it.

The receiving apparatus comprises a polarized relay, with an induction coil so arranged that a single effect is produced by a given pulsation of current on the main circuit.

Twenty-four pulsations, alternating in polarity, per second, are ample for the fastest practical speed of manipulation.

The receiving apparatus is sufficiently sensitive to respond to currents of .003 = $\frac{1}{333}$ of a second's duration on a No. 8 iron wire 300 miles in length; thus ($\frac{1}{333} \div \frac{1}{24}$) rendering thirteen distinct circuits available for operation.

A reference to the diagram will explain how the important advantage is obtained of operating way stations without the necessity of equipping them with additional main batteries.

With the foregoing perfected apparatus at command, the cost and capabilities of the combined systems may now be considered.

A first-class telegraph line, constructed with cedar poles 30 feet in length and 6 inches diameter at top, with cross-arm and oak pins 1½ inches diameter, improved porcelain insulators, one No. 4 hard-drawn copper wire and one No. 6 galvanized iron wire, fully equipped with instruments, etc., would cost between $400 and $500 a mile, or say for a through main line between New York and Chicago, or from Quebec *via* Montreal, Ottawa and Toronto to the United States frontier 1,000 miles, $500,000 maximum.

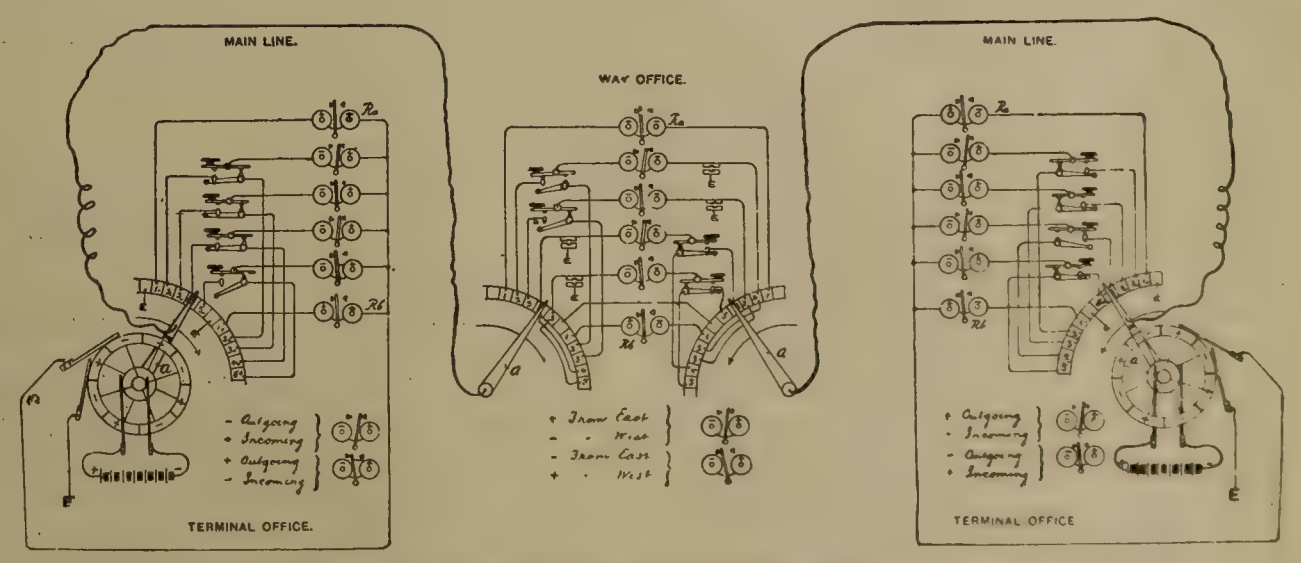


DIAGRAM OF KEELEY SYSTEM OF MULTIPLEX TELEGRAPHY.

Such class of line would remain in good working condition for over thirty years, and could be permanently maintained at an annual cost of not exceeding $15,000 per annum for repair and renewals.

The minimum capacity of transmission of intelligence during eight hours out of the twenty-four would exceed 50,000,000 words = 500,000 messages of 100 words each per annum.

To conduct such amount of business the salaries

of operators, perforators and copyists would not exceed $25,000 per annum ; rentals, management and incidentals, $20,000 ; to which add maintenance and renewals, $15,000—in all $60,000 per annum maximum.

The revenue from 500,000 messages at 25 cents for 100 words, minus 3 cents for delivery, would be $110,000, plus press news income; thus the minimum net profit would be $50,000 = 10 per cent. upon the capital expended, and this upon an estimate of 500,000 messages per annum only, whereas the certainty is that they would exceed 1,000,000, and thus yield over 30 per cent. dividends.

The foregoing estimates are based upon the knowledge acquired after forty years' experience in practical telegraphy, and can be relied upon as substantially correct.

The only question remaining for consideration is the present and prospective amount of business available for the foregoing results.

Between New York and Chicago over 2,500,000 telegrams and 10,000,000 letters are now annually interchanged. At least one-eighth of the latter would, under a 25-cent tariff for 100 words, be transmitted by wire; thus any company conveying one-third of the telegraph and one-eighth of the postal business would have four times the estimated minimum number of 500,000 messages at immediate command.

Again, the dozen commercial through main wires between Quebec and the United States frontier, *via* Montreal, Ottawa and Toronto, convey 1,000,000 telegrams per annum, and the postal service over 6,000,000 letters ; thus, with one-third of the telegraph and one-eighth of the postal business at command, more than double the estimated number of 500,000 messages are immediately available.

The argument thus confirms the correctness of the quotation at the commencement of this paper, namely, "that the most successful telegraph companies of the future will abandon the present system of a multiplicity of wires in favor of automatic and multiplex apparatus."

DYNAMO PLANT IN THE ST. LOUIS OFFICE OF THE POSTAL TELEGRAPH CO.

BY D. B. GRANDY.

The dynamo plant which was recently installed in the St. Louis office of the Postal Telegraph Company by Mr. F. W. Jones, Assistant General Manager and Electrician of that company, consists of 16 Edison generators, 14 of which are of 1.5 K.W., and 2 of .5 K.W. capacity. They are arranged in series of eight machines in duplicate, one series being in use while the other is held in reserve. Each series consists of two machines run at a potential of 350 volts, two at 130, one at 160, one at 80 and one at 50 volts, and one "intermediate" machine at 100 volts. The two 350-volt machines in each series furnish currents of opposite polarity and are used for multiplex work exclusively. The 130-volt potentials are used for both quadruplex and single wire current; the 160-volt and 80-volt potentials for single-wire currents only, and the 50-volt machines for local and branch circuits. The 100-volt "intermediate" machine in each series is placed in a loop and can be cut in as an "intermediate" battery wherever desired.

The plant is driven by a 10 H. P. Edison motor for each series of machines, the power being obtained from the Missouri Light and Power Co.'s station about half a mile away. There are two circuits over different routes from the power station, so that the chance of interruption is reduced to a minimum.

The system of quadruplex apparatus in use is that of F. W. Jones, and the method of applying the dynamo current differs materially from that in use by the Western Union Company. The dynamo-room is in the basement formerly used as a battery-room. The leads from each machine are carried in cables to the operating-room above, where they are distributed, through resistance coils contained in a cabinet adjoining the switchboard. Each lead to the multiplex apparatus or switchboard first passes through about 3 ohms resistance per volt of pressure. Each disc of the switchboard has its separate lead from the dynamo, in which the proper amount of resistance is inserted. The 350-volt potentials do not go to the switchboard; after passing through appropriate resistances, the leads are carried directly to the quadruplex and duplex apparatus.

The local and loop circuits have a resistance of about 200 ohms, the instruments being wound to about 20 ohms resistance and the machines run at about 40 volts potential, which gives a very strong and satisfactory "local." The accompanying diagram, Fig. 1, illustrates the method of applying the dynamo current to the quadruplex in Mr. Jones' system, the pole-changer and single transmitter only being shown. The lever of the pole changer is in two sections, insulated from each other. The office of the transmitter is to throw the line from 350 to 130 volts or *vice versa*, as it is opened or closed. It will be observed that the rear portion of the pole-changer lever constitutes a continuity-preserving key, but as the potentials, which are momentarily short-circuited by it, are the smaller (130 volt), the total difference of potential is but 260 volts through 2,000 ohms resistance, and there is no sparking whatever at those points, and but very little at the front points, though the potential difference there is 700 volts.

The arrangement of the multiplex local circuits is also a peculiar feature of the system, and is in some respects more convenient than that in use by the Western Union.

Diagram 2 shows a section of the loop-jack, and the method of connecting two quads together, and of putting in loops.

The current from the dynamo enters the board at the right-hand buttons of the three-point switches, after passing through resistances of 30 ohms in each circuit; thence, when the switch-bars are in their normal position (to the right), it passes to the tables, through the instruments, and back to the lower part of the spring-jack. The upper part of the jack goes to earth through a resistance of 140 ohms.

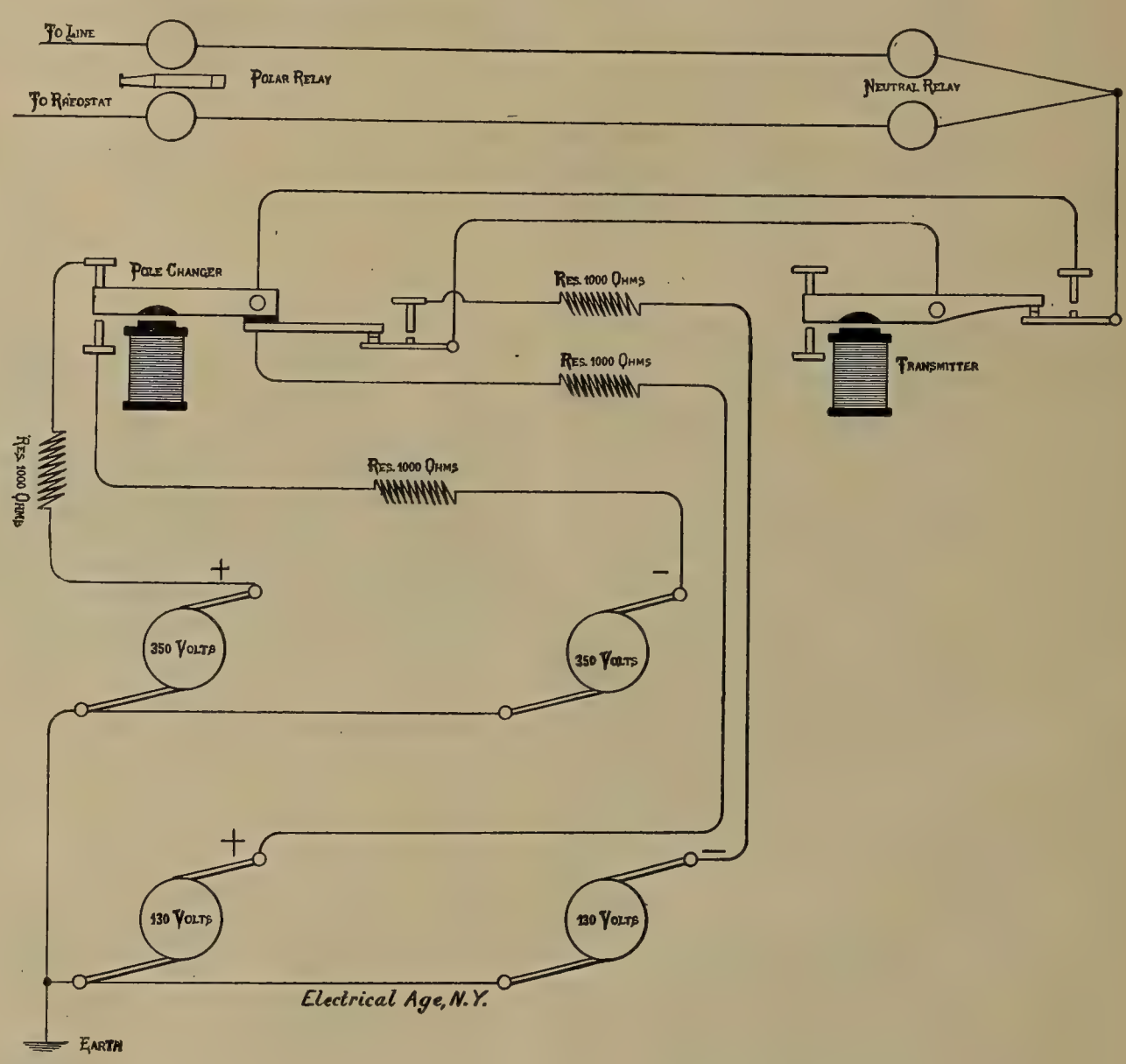


DIAGRAM OF QUADRUPLEX DYNAMO-CIRCUITS, POSTAL TELEGRAPH OFFICE, ST. LOUIS.

The branch wires are brought to wedges at the board, having one side insulated, and are inserted in the jack contact side down, thus grounding the circuit at the outside office instead of through the upper part of the jack and resistances. The branch wires have an artificial resistance of 120 ohms. The left-hand buttons of the three-point switches are all connected to wedges as shown at the left hand of the diagram. The wedges of either side of any quad set, if inserted in the proper spring-jacks of any other set, and the three-point switches turned to the left, connect the sending local circuit of each set with the receiving local of the other. Thus, to connect the polar sides of the first Kansas City and first Chicago quad sets, the wedge A would be inserted contact down in the jack marked "Send" of the polar side of 1st Kansas City, and wedge B, in the same manner in the jack marked "Receive." The three-point switches of polar 1st Chicago are turned to the left, and the through circuit is completed. The "local" current then enters at the three-point switches of polar 1st Kansas City, traverses the instruments of that set to the jack, thence over the wedges A and B to switches of polar 1st Chicago, the bars of which being on the left-hand button the current passes through the instruments of that set, back to the jack and to ground, through the resistances; or if a branch wire is inserted there, to ground at the branch office. It will be noted that in this system a grounded branch-office circuit can be inserted at the same time that two quad or duplex circuits are connected through. The branch circuit must be a metallic loop, in order to permit its insertion in a multiplex local circuit which is working into another multiplex set.

There are now in use eleven quadruplex sets, two duplex sets, two half sets and two full sets of Toye repeaters. The quadruplexes are worked at potentials of 350 and 130 volts long and short ends; the duplex sets at 350 volts.

The plant and entire apparatus of the new system have given perfect satisfaction, and the vast improvement over the 5,000 cells of gravity which it displaced is, as may be imagined, thoroughly appreciated by Chief Bartlett and his assistants, who were rapidly growing gray under the old order of things in the irrepressible conflict with weak locals, "long ends off," "short ends weak," and the various other miseries incident to the use of chemical batteries in telegraphy. The Postal Telegraph Company has, under the efficient management of Mr. C. Dougherty, built up an excellent business in St. Louis, and with the improved facilities now possessed, it will be able to handle its constantly-increasing business in a manner more satisfactory to the business public than heretofore.

GAS EXHIBITS AT THE WORLD'S FAIR.

A circular recently issued by General Manager W. E. Barrows, of the Gas Appliance Exchange, Philadelphia, voicing the sentiment of the gas manufacturers in relation to the World's Fair, is said to have caused considerable commotion among the Exposition officials. The circular reads as follows:

"The writer, representing the gas-appliance exchanges and through them a large majority of the manufacturers of gas utilization appliances, has endeavored to get from the World's Columbian Exposition authorities some idea as to what provision has been made for the gas industry, stating to them that as there were over $400,000,000 invested in this business it was reasonable to expect some special provision would be made for it. From all the resources which I have at my command I have been gathering information, and I am firmly of the opinion that the electrical industry has absorbed all of the interest of the management of this department of the Fair, and has convinced them that it is not necessary to have any gas on the ground for any purpose. We understand that Congress is to be asked, immediately upon its organization, for a loan of $5,000,000

or more to aid the authorities in carrying on their fair, and we hope that both you and your stockholders will inform your representative in Congress that you object to taxation without representation, and ask them to see to it that no further appropriation is made by Congress until assurance has been given that gas will have the same opportunity of representation as an industry as has any other industry of the same magnitude."

It is stated that the American Gas-Light Association appointed a World's Fair committee to secure space for a display. This committee recently met and presented a request for a separate gas building, but the Fair managers are said to be averse to giving up a whole building to an industry that is being rapidly displaced except for fuel purposes. It is thought, however, that by co-operation among gas manufacturers a creditable display will yet be made. Another source of irritation to the gas men is the fact that the whole Fair is to be illuminated by electricity.

CORRESPONDENCE.

GOOD FOR FUTURE USE.

Editor ELECTRICAL AGE: I have recently received a complimentary pass to Kansas City, Mo., via electric cars propelled by storage batteries at a speed of 250 miles per hour. We are thankful that there are not any of the many hard conditions usually attached to such favors when passes are issued by railroad companies generally.

There is only one drawback upon the very generous offer—that is, the speed is hardly up to requirements of the present time. Two hundred and fifty miles per hour is far below what is now promised by some very distinguished members of the late Pittsburg Convention of electrical railway men.

Two hours from New York to Chicago is what we are informed we may expect in the near future.

Five hundred miles per hour sounded startling at first, but as no one at the convention seemed to doubt the possibility, but all approved by their silence, we think we will wait until the "two-hour" time table is established and take passage by that, as startlingly low rates are also promised.

Two hundred and fifty miles per hour is now too slow for electric roads; it is not much in advance of the speed of the "Penn. Central" Railway, as it is stated upon the authority of a journal whose editor was on the train returning to this city from the said Pittsburg Convention, that a speed of 200 miles an hour was attained.

We have great faith in our fellow-men, especially of the scientific persuasion, and shall implicitly believe all these statements and promises until the results are reached or we are forced to a contrary conclusion, which latter we hope never will be. We have only one little vexatious doubt to trouble us; it was said that many members of the said convention were most enthusiastically "hilarious" at nearly the close of the "sessions" as they were about to depart for their homes. Just what deductions should be made from statements of members on account of "hilarity" we have been unable to find out after diligent inquiry. The matter should attract the attention of Mr. Edison, for he only named as his maximum speed from one to two hundred miles per hour. When there comes a statement that the "Penn. Central" has accomplished all that, first time trying, and that upon the authority of a distinguished electrical engineer or expert connected with one of the electrical journals, no deduction can be fairly made from the statement except what may possibly be attributed to the "hilarious condition" of the writer who gave the account.

Upon the whole we think we will keep the "pass" so kindly furnished us and will avail ourselves of the train that starts first, even though the speed be not more than 250 miles per hour.

Respectfully yours,

NEW YORK. D. N. K.

P. S.—Would it be regarded as impossible to establish a line of Aluminum Electric Flying Machines from say some convenient point on the "*Solar System*" to the "Milky Way" for the transportation of "Cranks." There certainly would be no lack of passengers.

WINDING FIELD-MAGNETS.

It has long been known that a magnet with a considerable length of core possessed a greater attractive strength than one with short limbs. But the superior effect is not due to the length of the core; it is due entirely to the fact that long magnets are furnished with longer magnetizing bobbins, containing a greater number of turns than short magnets. It is well known that the field-magnets of dynamos cannot be made too short. The shorter they are the less their magnetic reluctance. But there is always a well-defined limit to this condition. It is impossible to get upon the limbs of an exceedingly short magnet the turns of wire requisite to provide the magnetizing force needed to project the magnetic lines through the armature. In other words, we must have the proper number of ampère-turns upon the limbs, and these must be wound to a convenient depth, so as to provide for radiation of heat. In the best dynamos the exciting coils seldom or never have a depth (from the surface of the core to the outside surface of the coil) exceeding one-half the diameter of the core (if round). There are many old time-honored rules to be found in the text-books respecting the dimensions of electro-magnets, and amongst them several which lay the depth of bobbin windings at various values, from the full diameter of the core to one-fourth of its diameter. These may be safely neglected, and attention given entirely to the convenience of the case and the question of the emission of heat. It is, of course, advantageous to employ a high current density for many reasons. Hence dynamo builders, in many cases, design the depth and gauge of the wire to allow of the highest safe temperature.

Cotton-covered copper wire is almost invariably preferred for all common dynamo work. While cotton may be said to be a sufficiently good insulator, it conducts heat away quicker than silk. But the cost of the latter renders its employment prohibitive, except in special cases. It is important to use wire neatly covered. If the insulation is not uniform, irregularities will occur in the winding, which will increase with each layer coiled. Double cotton-covered is generally preferred, but this must not be too thick. Perfect covering is far more important than merely thick covering. The aim of the coverer should be to insure tight and perfect coating of the wire in the case of both windings of cotton.

The conductivity of the wire is a most important matter. It should in no case be under 95 per cent. of that of absolutely pure copper, and is frequently higher. It should not be "hard drawn." This makes it extremely stiff and resilient, and therefore very unmanageable in the case of winding an armature. It should be soft, round (if of that section), and smooth on the surface. The reputed gauge of the wire is frequently not the actual gauge, so that this point should be tested before making calculations. A very slight difference in size makes a very great difference in resistance or carrying capacity.

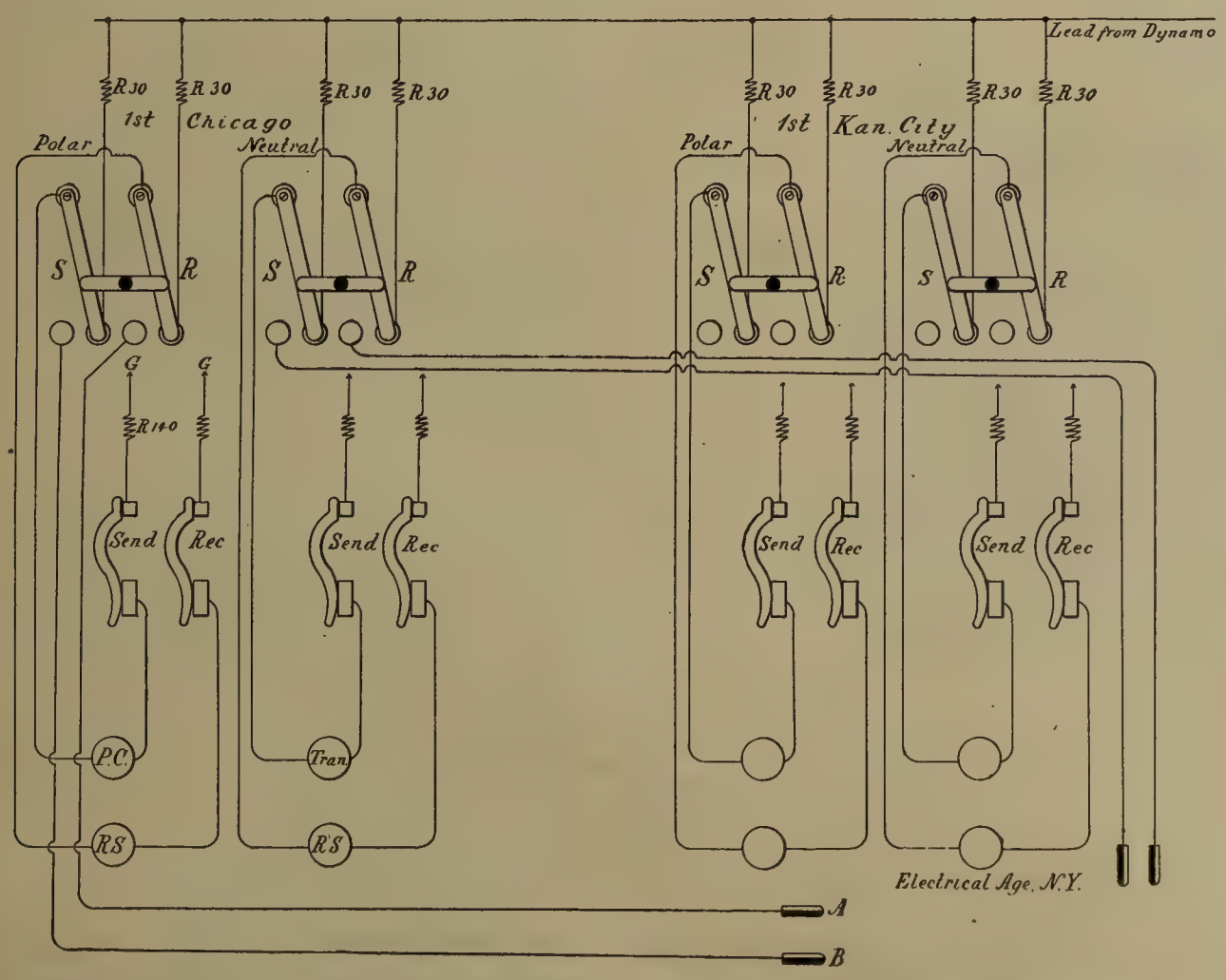


DIAGRAM OF LOCAL CONNECTIONS OF QUADRUPLEX, ST. LOUIS OFFICE OF POSTAL TELEGRAPH CO.

THE TROLLEY IN PHILADELPHIA.

There is a bright prospect that before many months rapid transit will be inaugurated on some of the branches of the Traction Company's system, says the Philadelphia *Record*. The permission of Councils has been long secured for the use of the trolley in certain streets in West Philadelphia over which the Traction cars run, and early in the spring work will be begun and rapidly pushed forward on the Haddington and Paschalville branches of the company. The streets are particularly well adapted for the trolley system, being wide, and as the travel is not heavy fast time can be made.

If the system proves successful, as no doubt it will, it will be gradually introduced on all the branches of the Traction Company's lines with the exception of those now using cables. Other methods of electric propulsion may also be experimented with, but from present indications the trolley system will be finally selected as affording the cheapest and most convenient method of electric travel. Nothing definite has as yet been done regarding the use of the trolley system within the limits of the old city proper. Should the Traction Company secure one of the roads it is now endeavoring to add to its system, it will probably be used for the introduction of the trolley.

A prominent official of the Traction Company said that a careful investigation of the merits of electricity as a motive-power showed the advisability of its introduction. Its use on the various lines controlled by the company would effect a great saving in expense and would greatly increase the gross receipts. Owing to the possibility of running the cars oftener and more rapidly many more passengers would ride.

Arrangements are now being made with a large electric company for the introduction of the trolley system. This company will erect the necessary plants and run them experimentally for a short period, after the expiration of which time, if the experiment is a success, the Traction Company will purchase the plants and continue to operate the lines with them.

Regarding the Frankford branch of the Traction Company, the same official said that work might not be started for some time. The company had the authority to lay tracks for horse lines on certain streets in Frankford, but at the time of the application for permission to use electricity, there was such a clamor against the overhead wire system that for the time being that portion of the matter was dropped. At a favorable opportunity the matter will be taken up again and pressed to a conclusion. If permission is granted for an overhead system, work will be started within a very short time.

CONSOLIDATION.

The electric light companies of Plainfield and Elizabeth, N. J., are negotiating with a view to consolidation. It is intended to connect these two cities, which are twelve miles apart, with electric current, and feed the intervening towns, some seven in number.

IMPROVED ELECTRIC PUMP.*

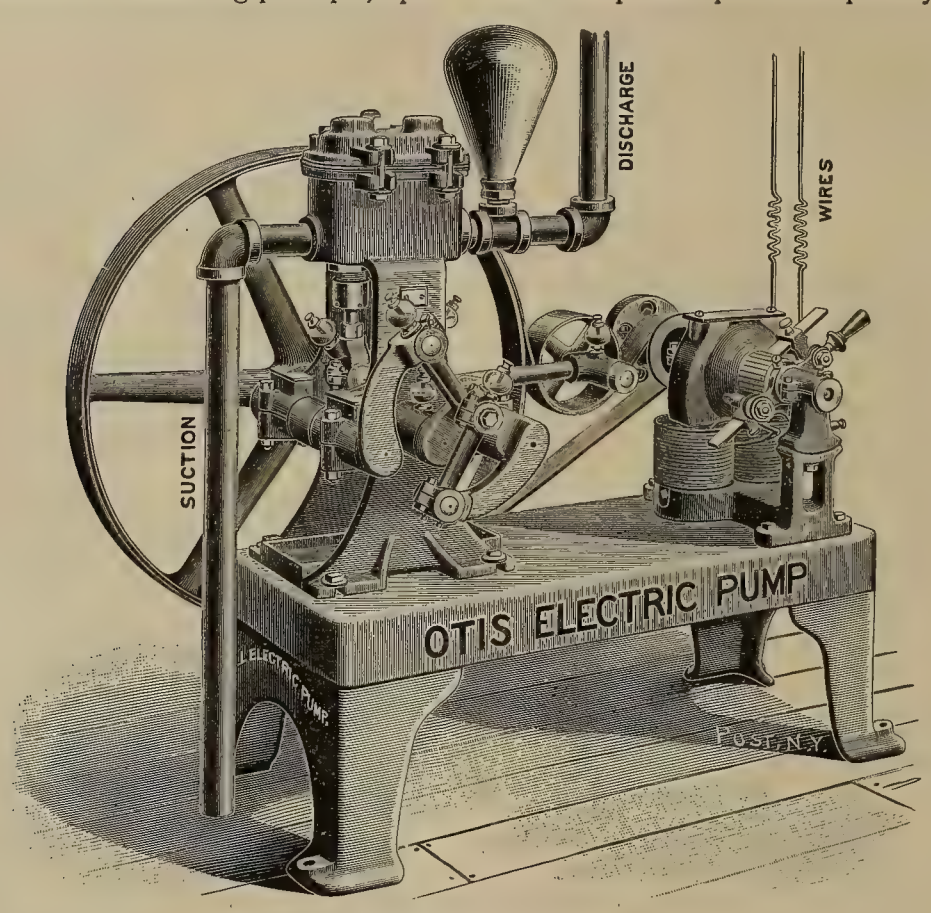
The electric pump illustrated and described below is designed to supply the demand for a reliable machine of this class and to fully meet the exacting requirements of this service.

It is the embodiment of all that is desirable in electric pumps; it is constructed to operate upon a novel principle, the water being moved with a continuous and unvarying flow, entering at the suction, and passing through valved pistons, thence out at the discharge.

The advantages of this principle of action are many; prominent among which is its entire freedom from the shock, jar or water-hammer, usual in other styles of pumps; another is the economy in power naturally resulting from the constant motion of the column of water, as it does not require as much power to keep a body in constant motion as it does to move it with an alternate starting and stopping motion.

Another advantage arising as a natural result of the continuous action is the even distribution of the work at all points of the revolution of the pump, thereby creating a uniform resistance to the action of the electric motor. This is absolutely necessary to insure durability, as an intermittent or variable resistance to the motor would soon cause the total destruction of the armature winding, and necessiate expensive repairs.

To be brief, the continuous-acting principle, upon



PUMP OPERATED BY ELECTRIC MOTOR.

which all of the pumps are constructed, avoids all of that harsh, noisy and unsteady operation so common in pumping machinery in general.

For domestic use, and other light services, they are eminently adapted to supersede all of the other troublesome and objectionable devices (with their disagreeable features), such as steam, gas, oil, hot-air engines, etc., wherever it is possible to connect with the lines of the electric lighting or power circuit.

The following are some of the features of importance which commend this pump as the most perfect, reliable and satisfactory method of elevating or moving water or other liquids, viz.:

It is automatic in its action, and always keeps the tank full, without requiring attention or the services of an attendant, the action being as follows: There is placed at the tank, and in the electric circuit, a switch or cut-out, which is operated by the action of a float, as it rises and falls with the water; for instance, when the tank has filled to the desired height, the float acts to cause the switch to break the circuit and stop the pump until the water-level is lowered by drawing from the tank, and the float descends and causes the switch to again complete the circuit and start the pump, to again fill the tank; when it will again be stopped, until more water is drawn out. This is a very important feature, as it is extremely gratifying to know that there is always a supply of water ready for immediate use, without the constant, daily attention required by other pumping machines.

Other features for consideration are: These pumps are cheaper in first cost; cheaper to run; cheaper to maintain; they are noiseless; they are clean; perfectly safe, no explosions; always ready for operation; do not get out of order; require no coal, thus avoiding ashes, dust and dirt; there are no gases; no offensive odors; little or no attention is required, it being only necessary to refill the oil-cups about once in two weeks.

These pumps are particularly adapted to furnishing water for domestic use, for office buildings, for irrigation, for watering live stock, for protection in case of fire, operating elevators, as well as for many other purposes.

* Otis Brothers & Co., New York.

RAPID-TRANSIT PLANS FOR BOSTON.

The elevated railroad plan for Boston has been endorsed by the Rapid-Transit Commissioners as the only method of securing quick transportation in Boston and its suburbs. The plan contemplates the building of an elevated electric road with a tunnel under the Common. The road will be known as the Metropolitan Railroad. The elevated lines will circumscribe the centre of the city, and will connect with the terminus of each of the surface steam railroads now entering the city. From this belt road several radial lines will be built to connect the main road with the outlying sections of the city and its suburbs, such as Charlestown, Cambridge, South Boston and Roxbury.

The Commissioners believe that a tunnel under the Common is an unavoidable necessity. It will lessen the expense of taking property in that neighborhood. It is believed that no corporation will be able to build the proposed road without the financial aid of the city or State, and it is not at all improbable that the city or State may take entire control of the railroad if the present plan is adopted by the Legislature.

The damage to property in the heart of the city alone, which will be taken by right of eminent domain in laying out the proposed line, aggregates $2,468,600, exclusive of the Quincy Market, which is owned by the city of Boston, and which will be cut in two by the road.

THEORY OF EFFICIENCY OF ELECTRIC MOTORS.

If a galvanometer be included in a circuit with a battery and an electric motor, it is found that the current is weaker when the electric motor is working than when the electric motor is standing still, and that the faster the motor runs the weaker does the battery current become. This is due to electro-magnetic induction between the moving and fixed parts of the motor, which, as it spins round, generates a back-current. The electro-motive force due to this inductive action increases with the speed of the motor, so that the back-current is strongest when the machine runs fastest. If the motor be loaded so as to do work by moving slowly against considerable forces, the back-current will be small, and only a small portion of the energy of the current will be turned into useful work. If it be set to run very quickly, so as to generate a considerable back-current, it will utilize a larger portion of the energy of the direct current, but can only run fast enough to do this if its load be very light. Jacobi calculated that the practical efficiency lay between these two extremes, and that an electric motor would turn the energy of a battery into work in the most effective way when it was allowed to do its work at such a speed that the battery current was thereby reduced to half its strength. This is indeed true if it be desired to do the work at the quickest possible rate. But where economy in working is desired, and when it is not needful to get through the work as rapidly as possible, or to consume materials in the battery at a great rate, then a higher economic efficiency will be attained by making the electric motor do lighter work and spin at a great speed; for if the electro-motive force of the battery be E volts, and the counter electro-motive force of the motor while running be e volts, then the efficiency of the motor (that is to say, the ratio which the work it takes up from the current bears to the whole energy of the current) will be equal to $\frac{e}{E}$. Now if the motor be allowed to run more quickly e will increase proportionately, and if it runs very quickly e may become very nearly equal to E; that is to say, the motor will utilize very nearly all the energy of the current. But since, by Ohm's law, the current is $\frac{E-e}{R}$ it follows that if e is very nearly as great as E, the current will be reduced to a small fraction of its original strength. The materials of the battery will be more slowly used, and it will take a longer time to do the total amount of the work, but the percentage of energy of the current turned into work will be higher. A good modern dynamo-electric machine used as a motor can attain an efficiency of over 90 per cent.

The cost of working electric motors by batteries, however, is great. A pound of zinc contains only about one-sixth as much potential energy as a pound of coal, and it costs more than twenty times as much; the relative cost of equal amounts of energy is therefore about 120:1. But, as shown above, an electro-magnetic engine will turn 85 per cent. of the electric energy into work, while even good steam-engines only turn about 10 to 20 per cent. of energy of their fuel into work, small steam-engines being even less efficient. But, reckoning electro-magnetic engines as being five times as efficient as steam-engines of equal power, the necessary zinc is still 24 times as dear as the equivalent amount of coal. This calculation does not take into account the cost of acids of the batteries. In fact, where strong currents are wanted, batteries are abandoned in favor of dynamo-electric machines, worked by steam or water power, or by gas-engines.

In the case of transmission of power the expense may be far smaller if the original water-power costs little. The dynamo machine may turn 90 per cent. of the mechanical power into the energy of electric currents, and the electric motor may convert back 85 per cent. of the current energy (or 76 per cent. of the original power) into work.

EXPENSES OF OPERATING ELECTRIC ROADS.*

The following details of operating expenses on electric roads of a given capacity will no doubt be of value for reference:

For roads of 10 or 15 miles and upwards, operating 20 or more cars per day, averaging 105 to 110 miles each, grades moderate, the operating expenses, based upon the experience of 22 roads, will average about as follows:

	Per Car Mile (Cents).
Maintenance of roadbed and track	.54
Maintenance of line	.12
Maintenance of power plant:	
Repairs on engines and boilers ..... .180	
Repairs on dynamos ..... .101	
Miscellaneous repairs ..... .078	
	.36
Cost of power:	
Fuel ..... .868	
Wages of engineers and firemen ..... .653	
Wages of dynamo tenders and mechanics ..... .220	
Oil, waste, water and other supplies ... .218	
	1.96
Maintenance of rolling stock:	
Repairs on motors (ex. gearing) ..... .695	
Repairs on gearing and trolleys ..... .594	
Repairs on car bodies and trucks ..... .512	
	1.80
Transportation expenses:	
Wages of conductors and motormen ... 4.262	
Wages of starters, switchmen, track-sweepers, etc ..... .268	
Cleaning and inspecting cars ..... .238	
Oil, waste and other supplies ..... .083	
Accidents to persons and property .... .061	
Miscellaneous ..... .068	
	4.98
General expenses:	
Salaries of officers and clerks ..... .743	
Office expenses ..... .138	
Advertising and printing ..... .061	
Legal expenses ..... .068	
Insurance ..... .161	
Miscellaneous ..... .091	
	1.26
Total ..... cents	11.02

* Edison General Electric Co. New York.

EDISON-LALANDE BATTERIES IN TELEGRAPHY AND TELEPHONY.*

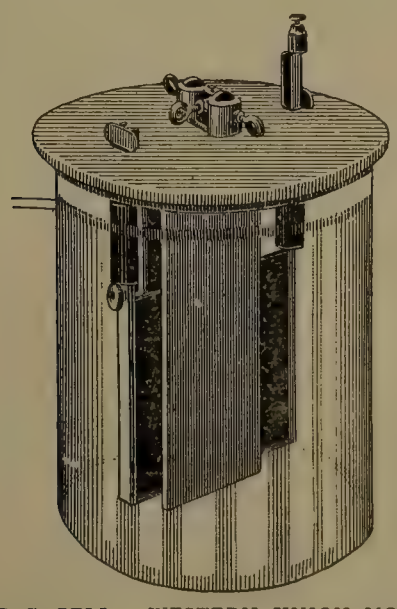
Constant improvements are being made in the Edison-Lalande batteries, and it is thought now that these celebrated cells have been brought to the highest degree of perfection.

In our issue of January 2 last we described and illustrated Edison-Lalande Cautery and Faradic batteries, for which purposes these cells are excellently adapted. It cannot be said, however, that they are better adapted for one class of work than another; they are equally serviceable for all classes of work where an electric current is required. As Mr. Edison himself said once, "these batteries are next to a dynamo."

For telegraph and telephone work these batteries have made a large reputation, and they are constantly growing in favor. The chief advantages of the Edison-Lalande cells for telegraph work are their extremely low resistance and great constancy of output. They maintain the maximum current until the cell is completely exhausted and ready to be replenished. In a battery of one hundred and fifty Edison-Lalande cells the total internal resistance would be less than 4 ohms. Such a battery will operate most efficiently as many as 30 distinct main-line wires, and its exellence is specially demonstrated in wet weather, when the gravity battery fails altogether, but the Edison-Lalande delivers practically the same amount of current under the worst conditions of weather as under the best. As a local battery for working Morse sounders the Edison-Lalande cell is also admirably adapted on account of its great constancy. In most telegraph offices it is customary to operate each sounder by means of a local battery of two gravity cells. With the Edison-Lalande cell, four, six or a dozen sounders can be operated from one battery consisting of two or three cells. In an actual test in the Western Union central office, a battery of three Edison-Lalande cells ran 15 sounders for 105 working hours. In the Chicago office of the Chicago and North Western Railroad, two Edison-Lalande cells were substituted for 80 Callaud cells, for working local sounders, with excellent results.

In telephony the most important requirements in a telephone battery are low internal resistance and constancy of E. M. F.; also freedom from local action or consumption of materials when on open circuit, convenient form, long life and freedom from the necessity of constant inspection.

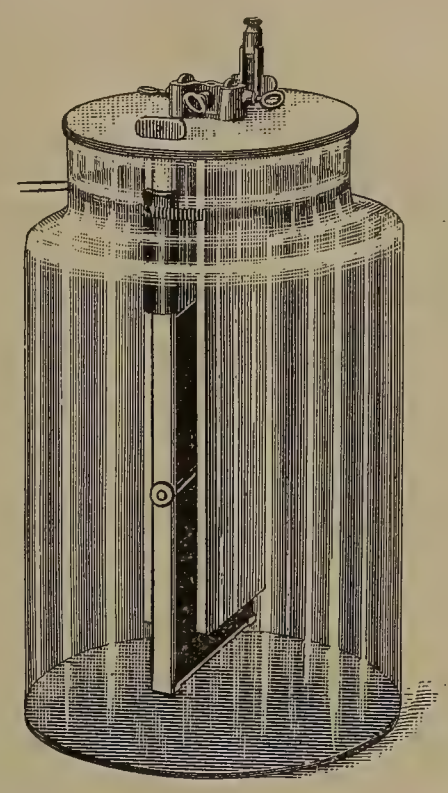
The internal resistance of the Edison-Lalande battery is low and constant, which quality adds materially to the efficiency of the transmitter. The E. M. F., although not so high as the initial E. M. F. of the Leclanché, is constant during the whole life of the cell, and there is an entire absence of polarization or local action. Add to these advantages that there is no porous cup to crack, that no creeping of salts takes place, that no corrosion involving bad connection between the terminal and the electrode can occur, and that the cell is clean to set up and convenient to handle, and it is plain to all that the Edison-Lalande cell is pre-eminently the telephone battery of the future.



TYPE G CELL. WESTERN UNION MODEL.

The new type of Edison-Lalande telephone cell which has recently been brought out, Type D, deserves special notice, as the E. M. F., owing to its peculiar construction, is considerably higher than the Leclanché cell, while at the same time the internal resistance is very much less. This cell is a square, vitrified porcelain jar, with a partition in the middle, and is made just to fit into the battery-box under telephone transmitter. It is said to be the perfection of telephone batteries, and is destined in a very short time to entirely replace all other batteries on local telephones. It is also equally well adapted to use with long-distance instruments on account of its great constancy and low internal resistance.

In all Edison-Lalande cells there is practically no consumption of materials within the battery when no work is being performed, and from a given amount of zinc a given amount of work or current can always be depended upon. Indeed, the company calculates with remarkable accuracy just how much current may be obtained from a cell of a given type.



LARGE TELEGRAPH "LOCAL" CELL, TYPE P.

* Edison Mfg. Co., Orange, N. J.

THE BUFFALO CONVENTION.

As the time approaches for the holding of the Convention of the National Electric Light Association in Buffalo on February 23, 24 and 25 next, the question of exhibits is receiving consideration and attention.

With a view to the settlement on some definite plan, a letter has been issued by Secretary Porter to associate members of the association to ascertain what they propose to do in this direction. The following is a copy of the letter:

"The Fifteenth Convention of this Association will be held in Buffalo, N. Y., February 23, 24 and 25, next; headquarters at the Iroquois Hotel.

"Inquiries have been made regarding the holding of an exhibition in connection with the meeting, but the matter has not yet been decided. Should enough members signify their desire to exhibit to justify the management in taking such action, space and power will be provided *gratis*.

"Kindly advise me, at your earliest convenience, of your wishes in the matter."

"Very respectfully,

"GEO. F. PORTER, *Secretary*."

NEW INCORPORATIONS.

The Fehr Electric and Manufacturing Company, Hoboken, N. J., was incorporated January 9, with a capital stock of $100,000. Incorporators: J. Fehr, L. A. Fehr, Hoboken, N. J.; G. Cronemeyer, New York, N. Y.

The Citizens' Electric Light, Power and Heat Company, Dubois, Pa., was incorporated January 11, with a capital stock of $2,000. Incorporators: Chas. E. Bostwick, J. A. Terpe, George E. Grier, all of Dubois, Pa.

The Ellenville Electric Light Company, Ellenville, Ulster county, N. Y., was incorporated January 11, with a capital stock of $30,000. Incorporators: John H. Kemp, John B. Murray, Delhi, N. Y.; and Edwin Russell, Ellenville, N. Y.

Sierra Valley Telegraph Company, Sierraville, Cal., has been incorporated with a capital stock of $20,000. Incorporators: Maurice Fitchard, Sierraville; Ed. J. Freeman, Sierra Valley; W. H. Lemon, Sierra City; Joseph Escoe, Loyalton; Joseph R. Escoe, Beckwith.

The American Watchman's Time Detector Company, Jersey City, N. J., was incorporated January 5, with a capital stock of $100,000, to manufacture electrical clocks, electrical fire-alarms and other electrical and mechanical appliances, etc. Incorporators: J. S. Morse, A. G. Morse, E. B. Seeley, of New York, N. Y.; and C. L. Carrick, Jersey City, N. J.

The Mercantile Telegraph Company, Chicago, Ill., was incorporated January 7, with a capital stock of $100,000. Incorporators: Julius Schweiger, Geo. Einstein, Henry H. Kennedy.

Montgomery Electric Light and Power Company, Montgomery, W. Va., was incorporated January 6, with a capital stock of $50,000. Incorporators: T. B. Davis, J. W. Montgomery, J. C., O. L. and Seth Montgomery, Montgomery, W. Va.

The Marshall Electric Company, Marshall, Ill., was incorporated January 8, with a capital stock of $200,000. Incorporators: Emma Ewalt, Annie J. Travis, C. C. Travis.

The Paris Electric Light and Railway Company, Paris, Tex., was incorporated January 8, with a capital stock of $300,000, to manufacture electric power for light and operation of street railway. Incorporators: S. J. Wright, J. J. Walsh, John Martin.

The American Aluminum Company, Denver, Col., was incorporated January 8, with a capital stock of $2,000,000. Incorporators: Henry Harper, Robert McKnight and John A. Proud, all of Philadelphia, Pa.

The Roland T. Oakes Company, Holyoke, Mass., was incorporated January 2, with a capital stock of $8,000, to manufacture general electrical supplies. Incorporators: Roland T. Oakes and Arthur J. Newell, of Holyoke, Mass.

The Suburban Electric Company, Elizabeth, N. J., was incorporated January 8, with a capital stock of $300,000. Incorporators: A. M. Young, J. K. Smith, Waterbury, Conn.; H. Hayes, Newark, N. J.; J. B. Giffert, Elizabeth, N. J.

The Dixon Power and Lighting Company, Dixon, Ill., was incorporated January 9, with a capital stock of $75,000. Incorporators: F. A. Watson, A. C. Bardwell, F. A. Truman.

The Westmoreland Electric Company, Greensburg, Pa., was incorporated January 8, with a capital stock of $50,000. Incorporators: Daniel Manahan, E. H. Bair, J. E. McFarland, all of Greensburg, Pa.

The Castle Electric Company, Castle, Mont., was incorporated January 6, with a capital stock of $50,000. Incorporators: John L. Fraser, Hanson H. Barnes, Nahum T. Dinsmore, George E. Simon and Charles E. Miller, all of Castle, Mont.

SAFETY GUARD FOR ELECTRIC OR CABLE CARS.*

A large percentage of accidents on street railways is due to passengers attempting to get on and off moving cars. Similar accidents are of frequent occurrence on steam cars, and the cause in all cases is the missing of the step or losing hold of the handles. On electric and cable lines in cities were trailers are connected with the motor car, such accidents are frequent.

A device designed to prevent the person from getting under the wheels of the following car or cars in case he should accidentally lose his hold on a forward car, is described and illustrated herewith. The object of the apparatus is to throw the person away from the car should he lose his hold, and to push him to one side out of the path of the following car, should he miss the step and fall under the same.



SAFETY GUARD.

The device consists of a plate or board extending from the top part of the fender to a point near the track rail as shown in the illustration. This plate or board projects laterally from the car fender at an

* Edward Markell, Room 15, Glenn Building, Baltimore, Md.

angle, or, in other words, flares outwardly, and it has a flange by which it is bolted to the rear side of the fender, the flange extending the length of the board. The board is made adjustable by means of vertical slots through it and horizontal slots in the fender, which construction allows for both vertical and lateral adjustment.

In case a person loses his hold on the handle the guard throws him outward away from the car, and should he miss the step and fall under the car, the dependent portion of the guard will push him to one side and out of the path of the car following.

It is evident that the use of this arrangement obviates all danger of any one falling backward between the cars.

This guard is adapted to different classes of cars, the one shown in the illustration being especially constructed for street cars, but it may also be applied to steam cars.

RAPID TRANSIT IN NEW YORK CITY.

On January 15 the Rapid Transit Commissioners filed, in the County Clerk's office, New York City, a petition to the Supreme Court, General Term, asking for the appointment of a Commission for the purpose of deciding whether the underground roads should be built along the routes selected, notwithstanding the failure to get the requisite consent of the property owners.

The petition shows that the value of the land along the routes is $240,127,734. The Commissioners have got the consents of owners of $52,613,380. Owners of $135,435,809 worth have "not given" their consents. A number have not been heard from.

The motion for the appointment of these Commissioners will be made before the General Term the first Monday of February.

WEST END'S NEW POWER-HOUSE.

The new power-station of the West End's Railroad Company, which is about ready for use, is but a minute's walk from the East Cambridge station of the Lowell road, and occupies a portion of the plant of the New England Glass Works. The part occupied by the West End has been practically all rebuilt, some of the walls of the buildings being unable to withstand the jar of the huge engines which furnish the powers for the dynamos. The work of excavation and foundation laying, one of the most important branches of the building of an electric plant of this magnitude, occupied a considerable time, and it is now about a year since the first steps in the work were taken. While the East Cambridge plant is an extensive one, it does not of course compare in size to that of the central-power station on Albany street. The cost of the latter can be judged somewhat from the fact that the Cambridge station will cost when completely equipped, in round numbers, $750,000.

The power generated at the station will supply the Somerville, Charlestown and part of the East Cambridge electric lines, and later on will supply the proposed lines in Medford, Malden and Everett. At its maximum of power, which includes the replacing of the present dynamos with more powerful ones, it is likely that some 500 electric cars could be run on the power generated at this station alone.

Two large buildings are necessary for the machinery, a boiler-house 133 x 50 ft. and the power-house 100 x 119 ft. In the boiler-house are four patterns of Babcock & Wilcox boilers, representing in the aggregate 4,000 horse-power. It is expected that when the plant is fully completed one more battery will be added, but at present four are sufficient. The smoke and heat from the boilers are not allowed to pass up the enormous flue into the 230-foot chimney without a trip through the economizers, which prevent any appreciable waste.

The engines are triple expansion, condensing machines, with independent air-pumps, and came from the manufactory of E. P. Allis & Co., of Milwaukee. Two of them are of 1,000 horse-power, capable of being raised to nearly 2,000, while the third is of 500 horse-power with 1,000 possible. The fly-wheels of the two larger are 28 feet in diameter, with a 10 feet 7 inches face and two belts each. The centre engine has a fly-wheel of 26 feet diameter, and a 5 feet face running one belt. The power is transmitted from these over the belt tighteners to the counter-shafting, which connects with the dynamos on the floor above. The cylinder dimensions of the 1,000 horse-power engines are 23, 36 and 2 inch, with a 48-inch stroke, and those of the 500 horse-power, 16, 25 and 36 inch, also with a 48-inch stroke. The fly-wheels make 70 revolutions a minute, and the weight of the larger wheels is 78 tons each, with a 26-ton shaft, and that of the smaller wheel 35 tons, with a 15-ton shaft.

The shafting is 10 inches in the main and 8 inches in the bearings, and is adjustable in all directions. It consists of three lengths, 34 feet 7 inches long, each length weighing six tons. One engine may run all the shafting, or each engine may run its own. The shafting is coupled by Hill clutches of 1,000 horse-power each. The chief noticeable thing about the engine is the position of the walnut-encased receivers, which are above instead of below the engine, as is usually the case. This position is not for any economical reason, but simply to give a more massive appearance, the receivers reaching far above the second floor.

From the huge counter-shafting below and back of the engines the power is transmitted to the dynamos on the floor above. Eight Thomson-Houston dynamos of 150 horse-power each are already in place, which will be run by the engine which is to be started shortly. The power of the smaller engine will be communicated to four other dynamos, and that of the third engine to another set of eight, making a total of 20 dynamos of 150 horse-power each, a total of 3,000. It is calculated that these dynamos are only temporary, and the plan is to replace them with permanent ones of about 400 horse-power each. The switchboard is equipped with all the latest appliances for a first-class plant.

The work of putting in the requisite machinery was accomplished by two enormous cranes, which handle the large masses of iron with ease. The heavy expense has not been confined entirely to the buildings, for it has been found necessary to run a steam dredger up and down Miller's river, upon the banks of which the plant stands, in order to provide a channel through which boats with the heavy supplies of coal necessary may pass. The dredger has been busily at work for some time.

The completion of this work will mark the conclusion of the West End's plans for electric lines in the suburbs to the north of Boston, and with the power provided at East Cambridge all the traffic in these towns can be taken care of easily for some years to come. The electric lines in Somerville and Charlestown will be running sooner than has been expected at one stage of the plant's progress, and it is a question of time only when the Malden and Medford circuit will also be supplied with the means of more rapid transportation than they now enjoy.

The earnings of the West End for the three months ending last December 31, as compared with the year preceding, are as follows :

	1891.	1890.	Inc.
Gross earnings.	$1,540,496.50	$1,493,583.78	$55,912.72
Exp. & Chgs.	1,270,249.28	1,330,525.71	Dec. 60,276.43
Bal. for Div.	279,247.22	163,058.07	Inc. 116,189.15

The net increase of $116,189 is made both by the gain in the gross and the decrease in the operating expenses. The gross earnings of 1890 show the gross of this quarter was .248 of the whole year, while the operating expenses showed the proportion of the quarter of that year was .266. Proceeding on the basis of these figures, should the first quarter of 1891 be followed by a corresponding increase for the whole year, the earnings for the current year, as compared with those of 1890, would figure at something after this fashion :

	1891.	1890.
Gross	$6,271,000	$5,968,984
Ex. less div	4,774,000	4,990,674
For dividends	1,497,000	978,310

This increase in gross earnings would not be larger than has been shown regularly in the past years, and the decrease in operating expenses is fully justified by the results obtained thus far by the operation of the electric cars. Last year the amount necessary for dividends was, for preferred stock $512,000, and for common stock $376,000, making a total of $888,000, leaving a surplus of $90,000. At the present time the company has outstanding $7,150,000 of common stock. On this, 10 per cent. dividends are paid, making the dividends in the current year $1,217,000. Providing the earnings already shown are as well for the rest of the year as for the first quarter, this will leave the company, after all dividends, a surplus of $280,000.

A SIGN OF THE TIMES.

One hundred and fifty horses, which had formerly done service on the line of the Citizens' Traction road in Pittsburg were placed on sale at auction in that city a few mornings ago. They sold very slowly, the highest bringing less than $25.

MR. M. J. SULLIVAN, well known among the electrical fraternity in New York and elsewhere, is now editor of the *Street Railway Gazette*, of Chicago. We wish Mr. Sullivan much success in his new position.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Jan. 16, 1892.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of this city, has declared its regular quarterly dividend of 1¼ %, payable February 1 next.

MESSRS. THOS. H. DALLETT & CO. have awarded the contract for the wiring of the new Biscuit Co.'s factory to Messrs. McLeod, Ward & Co., they having received the contract for the entire lighting and power which was by mistake attributed to Messrs. McLeod, Ward, & Co.

THE double track of the Fourth avenue horse-car line in this city is now equipped from the junction of the Bowery and Fourth avenue to 8th street with the Duplex street-railway track, which is giving entire satisfaction. It is likely that in the near future the entire line will be be laid with this rail.

MR. G. F. SPENCER, manager of the business of I. P. Frink, deceased, manufacturer of reflectors, 551 Pearl street, this city, reports that he is overwhelmed with orders. He manufactures incandescent lamp reflectors for theatre and church lights, which are claimed to be superior to any other.

THE NATIONAL ELECTRIC MANUFACTURING AND CONSTRUCTION CO., of this city, has secured the franchise and contract for lighting Port Henry, N. Y., by electricity and the new company has purchased the interest of the Gas Company, which will be abandoned. This is the first instance where the electric light has superseded gas.

ROBERT A. KEASBEY, 58 Warren street, city, the well-known dealer in Magnesia Sectional Coverings for boilers, steam-pipes, etc., is meeting with immense success in this class of trade. The Magnesia Sectional Boiler and Steam-Pipe covering as installed by Mr. Keasbey, is said to be superior to any other kind of covering on the market.

MR. W. DWIGHT WIMAN, son of Erastus Wiman, and the General Manager of the Richmond County Heat, Light and Power Co., at St. George, S. I., received a painful injury a few days ago while attempting to extinguish a slight fire which had broken out in the office of the company. Mr. Wiman in attempting to break in the door of the office with an axe cut himself on the left foot, inflicting an ugly wound.

THE ZUCKER-LEVITT CHEMICAL COMPANY, 40 Murray street, city, moved January 15 to its new and capacious building, 10–14 Grand street, where it will manufacture its new dynamos and motors. When the company has its new factory and salesrooms fully equipped, it will be one of the finest in this section. It will install the very best machinery that can be secured for the manufacture of its high-grade dynamos and motors. It is understood that Mr. Max Mayer, the inventor of the dynamo and motor, will be the chief electrician in the new factory. Mr. Mayer is a young man of great promise who has been prominent in electrical circles for some years. He is a most capable, expert electrician, having studied under one of the most prominent electricians in this section.

BROOKLYN.

MR. FRANK C. MASON, the superintendent of the police telegraph, Brooklyn, was visited a few days ago by C. R. Huntley, president of the National Electric Light Association, and C. F. Peck, of the executive committee of the same organization. They inspected the system of police telegraph and the patrol signal system.

THE temporary power house of the Brooklyn City Railroad Company, at Second avenue and 52d street, is being enlarged for the purpose of putting in more apparatus to supply current for the Third avenue road from the city line to the Fort Hamilton terminus.

THE MERGENTHALER LINOTYPE COMPANY, 89 Tribune Building, city, is erecting a five-story brick factory, 100 x 100 feet, in Brooklyn for light machinery. The building will cost about $58,000. Possibly some electrical engineering concern may make contracts for electric light and power.

THE BLAKENEY ELECTRIC COMPANY, 431 and 433 Broadway, Brooklyn, N. Y., reports large sales of Rhumkorf coils, of which it makes a specialty. This company is manufacturing these coils for all purposes : gas lighting, medical outfits, laboratory and student's use. The "Terror" induction coil is meeting with large sales, students of physics finding them to be just what they need. The company is also manufacturing a very efficient toy motor, just the thing for amateur electricians. A large stock of other makes of motors, motor fans, electric bell outfits, fluid and dry batteries and other electrical supplies are to be found in the company's well-fitted salesrooms.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE :

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	64 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	60 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	210 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00

Bucksport Elec. Co. 6s., Me.....	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s...	20,000		*102
Circleville, O., L. & P. Co.....	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000.000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co.....	7,716,000	100 00	151 00
Complete Elec. Con. Co., N. Y...	50,000	100 00	175 00
Cons. Electric Light Co., N. Y...	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y....	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.....	35,430,000	100 00	103 00
Cons. Gas & E. Co., Batavia, 6s..	80,000		*95
Cons. Subway Co., N. Y.....	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.....	15,000		*99
Desant Elec. and Sig. Co., N. Y..	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.....	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. 6s.....	300,000		*101
Detroit Electrical Works.....	1,000,000	10 00	9 00
Direct U. S. Cable Co., Ltd.....	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co.....	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.....	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.....	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.....	5,000,000		*100
Edison Elec. Ill., Lebanon, Pa....	80,000	10 00	13 75
Edison Illuminating, N. Y.....	4,500,000	100 00	76 00
Edison Electric Light Co., Phila..	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	91 00
Edwards Manuf. Co., N. Y.....	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y.....	120.000	15 00	16 00
Elizabeth E. L. Co., N. J.....	100,000	10 00	4 50
Erie Telephone.....	4,800,000	100 00	45 00
Excelsior Electric Co. 6s, N. Y...	300,000		par
Fargo Gas & Elec. Co. 6s, Dak...	100,000		*95
Fidelity Trust Receipts.....	25,000,000		60 00
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*98
Fort Wayne Elec. Co.....	4,000,000	25 00	12 50
Franklin Electric Co., N. Y.....	5,000.000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky.....	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co.....	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref.8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s.....	15,000		*95
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co.....	250,000	100 00	20 00
Hoboken Land & Imp. 5s.....	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn. 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light. N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill....	50,000		*99
Kansas Elec. Co. 6s, Mo.....	20,000		*98
Laclede Gas Co.....	7,500,000	100 00	22 25
Laclede Gas pref.....	2,500,000	100 00	61 00
Laclede Gas 5s.....	10,000,000		*83
Law Telephone.....	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s....	50,000		*94
Little Rock Edison E. L. & P. 6s	30 000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light.....	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph.....	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y..	3,500.000	100 00	100 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N.Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	110 00
Nassau M'f'g Co., New York.....	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I.....	150,000	100 00	100 00
Nat'l Lead Trust.....	9,000,000	100 00	19 75
New England Butt Co.....	100.000	1,000 00	1,000 00
New England Phonograph Co....	12,500	100 00	420 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	53 00
N. Y. and N. J. Tel. and Tel. 5s..	1,500.000		*98
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co.....	20,000	100 00	420 00
N. Y. Storage Baty. Co.....	100,000	100 00	58 00
Newark L. & P.....	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio..	50.000		*95
North American Railway Co....	39,767,200	100 00	16 50
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph.....	10,000.000	100 00	37 00
Pennock Baty. E.L.& Impt.Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light.....	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn.....	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I.....	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*96
Rockaway Elec. Light.....	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston.....	300.000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich..	50.000		*98
San Diego Gas & Elec. Co. 6s. Cal.	750.000		*90
Sawyer-Man Elec. Light Co., N.Y.	125.000	100 00	100 00
Shaver Corporation, N. Y.....	100.000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co.....	16,000	100 00	480 00
Swan Incandescent.....	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y..	1.000.000	100 00	80 00
Staten Island L. H. & P. Co.....	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50.000		*99
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co., N. Y.....	900.000	100 00	100 00
The Hall Signal Co. pref., N. Y..	100.000	100 00	105 00
The Ongley Electric Co., N. Y...	250.000	100 00	90 00
The Railway Impt. Co., N. Y.....	10,000.000	100 00	100 00
Thomson-Houston Electric Co....	6.000.000	25 00	50 50
Thomson-Houston pref.....	4,000.000	25 00	26 50
T.-H Electric Co. 5s, Boston.....	500,000		*98
T.-H. E. L. Co., Yonkers, 6s.....	100,000		*99
T.-H.L.H. &P.Co., Binghamton 6s	100,000		*99
Tucker Elec. Const. Co.. N. Y....	50.000	100 00	100 00
Twin City Rapid Transit, N. J...	20.000,000	100 00	100 00
United Elec. Light and Power...	3,000,000	100 00	40 00
United Elec. Traction 6s.....			*20
United Elec. Traction Co.....	1.370,000	100 00	
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100.000	100 00	75 00
Vine Street Motor Co. 6s, Colo..	100,000		*95
Western Union.....	86.188.852	100 00	83 50
Westinghouse Electric Co.....	7,000.000	50 00	12 75
Westinghouse Elec. Co. pref. 7s..	3.000.000	50 00	50 00
West End L., Boston.....	13,550,000		17 75

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

I want to call the attention of those who have been in the little breeze which has ruffled the usually calm crest of speculation on the Stock Exchange for the past few weeks to a few of the electric securities which are cashing this month in their regular way their coupons in the city of New York, and which may be easily sold at the current rate of exchange at any spot in the country where a premium is demanded for bills on this city as a safe and increasing investment for all the money the street has permitted them to claim ownership to for a brief space. This list is about ten per cent. of those payable in New York, and especial notice is requested to the widely-separated location of their operations. Asheville Light and Power Co.; Austin Water Light and Power Co.; Memphis St. Ry. Co.; Dallas St. Ry. Co.; Duluth St. Ry. Co.; Harlem Lighting Co.; Mankato Gas and Elec. Light Co.; Metropolitan Ry. Co., Oregon; Omaha Ry. Co.; Pensacola St. Ry. Co.; Phœnix Elec. Lt. Co.; Streator Ry. Co.; Third Av. Ry. Co., N.Y.; Waterloo Gas and Elec. Lt. Co.; Weatherford Water, Lt. and Ice Co.; West Side Ry. Co., Wis.; Abiline Water and Elec. Lt. Co.; St. Paul City Ry Co.; Wellington Lt. and Heat Co.; Minneapolis St. Ry. Co.; Montgomery Elec. Lt. Co.; Aluminum Brass and Bronze Co.; Eau Claire Lt. and Power Co.; Flushing St. Ry. Co.; Lincoln Water, Lt. and Power Co.; Asheville St. Ry. Co.; Middlesborough Belt Ry. Co.; Richmond Ry. and Elec. Lt. Co.; Western Union Tel.; Thomson-Houston Pref.; Brooklyn City Ry. Co.; Brooklyn Municipal Elec. Lt. Co.; Brooklyn Citizens' Elec. Lt. Co.; N. Y. and N. J. Tel. Co.; Com'l Cable Co.; Brush Elec. Ill. Co.; Chicago Junction Ry. Co.; Edison Illuminating Co.

Capitalists who put money into American electric industries, or who have the matter under advisement, should frequently consult the columns of some reputable authority making a specialty of the subject, preferably the ELECTRICAL AGE or STREET RAILWAY NEWS, and note the contracts closed by the various corporations; whether it be patents, making a market on account of their adaptability to some extensive line of the science, or energetic presentation by capable managers; improved generators, producing greater electro-motive force at decreased expense; impregnable insulation; desirable circuit construction; aërial, subterranean or surface, or sparkless and noiseless motors; including the broad list of hangers-on, such as water-wheels, boilers, engines, belting and cars, and then invest when the most profitable sales are made for a cash return. It is not always the largest volume of business which pays the best, but that from which the quickest "receipt in full" for the largest gain is given. One method perhaps as safe as any other, is found in the style and tone of the advertisements. Bear in mind these are read and discussed by competitors who have no mercy, and if that which is advertised is not of the best quality of its kind the investor will hear of it immediately it is published. It is said man has two vulnerable points, his belly and his pocket. For the first we have two well-known establishments in this immediate vicinity, Dennet's, of Park row, and Rogers', of Park place; the first good of its kind, but the kind is poor, consisting generally of nursery or dairy goods and confections, of which a hungry man may eat till tired and depart unsatisfied, probably feeling that he has had the best in the city for his cash allowance; the other, Rogers', late steward of the Astor House, where thousands of the best feeders, regular and transient, did demand and were served for their mid-day meal with all the solid luxuries, washed down by the finest vintages; also mine host of the United States Hotel at Far Rockaway, where the prosperous politicians during the summer revel in everything eatable and drinkable which the Long Island Railroad can be induced to transport, and now settled down in his city home serving daily in all the various methods the finest fish, flesh and fowl dinners and luncheons obtainable in the busy mart, and from which one departs with regret that so much time must be wasted before it can be done again, knowing it was an investment from which he receives immense profit. Both are rolling up wealth, one in nickels, the other in dollars. So it is in New York, as proven by the Mayor's action with the two electric-light systems, one the aërial or arc, the other the subterranean or incandescent, each good of its kind, but each from the first, to date, claiming that the other, as a permanent investment, would eventually bankrupt all who trusted their capital in the business. My advice is to divide the money you can invest between the two kinds; the profit from the fittest is sure to be more than the loss by the superseded system. But with the multitude of electric industries outside of light there is no better criterion than the electrical papers.

There are less than a dozen parent companies whose bonds, shares and promissory or endorsed notes have a value known to the moneyed institutions scattered over the country, and their business is small as compared with the volume of money represented by the profits on securities in nowise connected with them. The local company or industry with good management is the surest and most profitable.

PHILADELPHIA NOTES.

MR. H G. CLAY, having withdrawn from the firm of Clay, Pepper & Register, the firm name will now be known as Pepper & Register.

THE Philadelphia electrical people say that either Mr. Charles T. Thackara or Prof. E. Houston would make a good president for the new electric club, which will soon be organized in this city.

H. T. PAISTE, the well-known dealer in cut-outs, switches, lamp-sockets, etc., has his new factory running in fine order, and his offices in excellent shape for the reception of customers and friends.

CORNELIUS & ROLAND, 1612 Chestnut street, are turning out some handsome electric and gas fixtures. This firm deals in electric, gas and combination fixtures of all kinds and fine lamps and does artistic metal work of every description.

MR. CHARLES THACKARA, of the Thackara Manufacturing Company, the well-known dealer in electric and combination fixtures, says that the demand for this class of goods is larger than is usual at this season of the year. He will furnish all the fixtures for the new residence of Mr. S. H. Austons, Jr., on Walnut street. Mr. Austons' house is to be fitted with a great variety of electric appliances.

MR. OTIS K. STUART says he has received an unusually large number of inquiries concerning the New Germania Direct Current Dynamo. The low speed and low centre of gravity of this machine render it especially applicable where vibration must be entirely avoided; and the patented self-oiling bearings form a good feature in isolated plant work. Mr. Stuart thinks that theatres, hotels and laboratories could not find a better machine for their purposes.

QUEEN & CO., who recently moved to 1010 Chestnut street, are looking as bright as a new dollar in their new quarters, their fine testing apparatus being shown to the best advantage. The company has just brought out a new Toepler-Holtz machine, with double revolving glass discs or plates, and a number of other valuable improvements. When seen by your correspondent it was connected to Geisler tubes arranged to form the name of "Queen & Co., etc.," the whole making a beautifully illuminated sign when the discharge from the machine was passed through the tubes. The company is constantly adding to its already large line of laboratory apparatus. W. F. H.

EASTERN NOTES.

NEW ENGLAND OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET,
BOSTON, Jan. 16, 1892.

THE STERLING COMPANY, Boston, manufacturer of water-tube safety-boilers, has closed contracts with the following concerns: Minneapolis Street Railway Co., 2,000 H. P.; (second order) City of Toledo, for the waterworks, 1,500 H. P. The latter order was given to the company in competition against every type of boiler manufacturer in the United States, there being some twenty bidders on the work. Owing to the increased business, Mr. J. Bradford Sargent, the New England agent for this company, has been obliged to engage the services of his brother, H. E. Sargent, who has had several years' experience in this line of trade. Mr. Sargent has just sent to press a very neat eight page leaflet setting forth the many good points of the Stirling water-tube boilers. D. L. T.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
CHICAGO, Jan. 16, 1892.

THE DETROIT ELECTRICAL WORKS, Detroit, Mich., announces that Mr. Frank B. Rae, is no longer in its active employ, and that his patents on electric railway and other work have been assigned to the company.

THE BUCKEYE ELECTRIC CO., Cleveland, O., is moving into its new factory, the building of which was necessitated on account of the company's large and increasing trade. The new plant is much larger than the old, and it will enable the Buckeye Company to better keep up with its orders.

THE THOMSON-HOUSTON COMPANY is negotiating for the purchase of a site at Pullman, Ill., on which to erect a large factory. Nothing definite has yet developed, but it is stated that the company will expend about $500,000 in establishing the new plant, and that it will probably give employment to between 500 and 1,000 men.

THE ELECTRIC MERCHANDISE COMPANY, of Chicago, is enjoying its enlarged quarters at 11 Adams st. This improvement was greatly needed. It enables the company to carry a fuller stock of goods and places it in a position to fill all orders promptly upon the shortest notice. No company in existence can begin to show the immense stock of electric railway supplies for cars, the line and the station which this company always has on hand. All systems are provided for and managers of electric roads recognize the advantage of being able to order everything needed for their lines from one house. With increased stock of goods and improved facilities for shipping the company is well fitted for conducting a rushing trade in the spring. The company says the outlook for the spring business is encouraging. N. D. W.

WAGNER-QUEEN VOLTMETER.

A few weeks ago we described the new portable voltmeter which bears this name, and which has been placed on the market by Queen & Co., of Philadelphia. The prominent features of this instrument are such that render it of great value to electricians for

measuring both alternating and direct currents. It is very portable, weighing only 22 ounces, and the dimensions of the case are 7¾ by 4 by 2″, so that it can be carried in a good-sized pocket. The pointer is dead beat and direct reading, and the indications are accurate within one per cent. The price is also very low, which is of importance to those purchasers who may not feel warranted in buying the more elaborate and standard one, such as the Cardew type. We are informed by the makers that up to date the demand has far exceeded the supply of these voltmeters. A large quantity is being pushed through their factory and they hope soon to keep up with the orders as received, so that delays in shipment will not occur. It will be well for those in need of a good portable voltmeter for both alternating and direct currents to obtain a copy of circular No. 265 from Queen & Co.

AN ENTERPRISING FIRM.

Messrs. Baker & Ryder, electrical engineers, who opened an office at 180 Broadway nearly a year ago, have established a good trade. They carry on a business as electric-light wiring contractors, and undertake the installation of complete isolated electric-light plants. They have in their offices samples of fans and motors in operation and ventilators. They also contract for the installation of all kinds of office and household electrical specialties.

The firm consists of John Baker and A. H. Ryder, both of whom are old and experienced electricians, having been formerly connected with the Edison Company. During the past year, since their copartnership, they have installed a large number of incandescent and arc lamps and isolated plants, among which may be mentioned the wiring of Aldrich Court, 45 Broadway, this city, which building they practically re-wired throughout. Previous to their work considerable difficulty had been experienced with grounds, all of which have been successfully and permanently removed. They also wired all the elevators and are at the present time putting the fixtures and lamps in the cars. Mr. Baker secured the contract for the isolated plant now in the Columbia Building, 29 Broadway, which is owned by Mr. Spencer Aldrich.

Among other installations undertaken by this firm are those in the Crawford Shoe Company's stores in the East, and it has lately installed an isolated plant for the United States Projectile Company, Bay Ridge, L. I., consisting of one 150-light Edison dynamo, ten "Ward" arc lamps and fourteen incandescent lamps of 16 C. P., which are used in the factory where the manufacture of the projectiles is carried on. The firm has just completed an Interior Conduit contract in A. Stroh's restaurant in West 22d street, this city, and they used over 1,000 feet of this well-known tubing. When the plant was started for the first time not a single flaw was developed, which speaks well for the character of the work of this firm.

Mr. Baker, the senior member of the firm, has a reputation for excellence in wiring. He has been wiring for the Edison system since 1880, and when the Edison Company installed its first station in Pearl street, Mr. Baker had charge of all wiring in connection therewith. He wired for 11,000 lamps at the start, and when the current was turned on for the first time, there was not a single break or a fault, and both Mr. Edison and Mr. Johnson made some very favorable comments on Mr. Baker's work, which they said was unprecedented.

Mr. Ryder was formerly connected with the old Fuller-Wood Co., afterwards changed to the American Manufacturing Company, as electrician, when Mr. James Brady, of Brooklyn, made the old Fuller-Wood machine, and he is a protégé of Mr. J. J. Wood, now the chief electrician of the Ft. Wayne Electric Company, of Ft. Wayne, Ind. Mr. Ryder installed his first plant for the Fuller-Wood Co., in Boston, in 1882–83, and personally supervised the work. Since that time Mr. Ryder has been connected with the Manhattan Electric Company, of New York, and afterwards with the Edison Illuminating Company, of New York, when he became associated with Mr. Baker.

PRAISED ON ALL SIDES.

In glancing over our exchanges we find frequent mention and high commendation of the Philadelphia and Reading Railroad, which, under the wise and vigorous policy instituted by President A. A. McLeod and ably prosecuted by his devoted lieutenants, has reached a degree of prosperity that a few years ago seemed impossible of attainment.

To meet the demands of the travelling public of to-day it is necessary that a railroad company shall furnish not only speedy and safe transportation, but luxurious accommodations as well. All these requirements are met in the fullest measure by the Reading, which certainly deserves its pet appellation, "The Royal Route." The road is in exceptionally fine condition, and its motive-power and car equipment are constantly being improved and added to. It enjoys the proud distinction of owning and running the fastest locomotive in the world, the famous "No. 206," which made the world's record of a mile in 39¾ seconds

BUSINESS NOTES.

The Ball Engine Co., of Erie, Pa., report the following recent sales of simple engines: John Becker, Fitchburg, Mass., one 35 H. P.; Thomson-Houston Co., Boston, Mass., one 100 H. P.; one 80 H. P.; Lewis Benedict, Attica, N. Y., one 50 H. P.; William Howell Caldwell, Union City, Tenn, one 80 H. P.; Hygeia Hotel, Old Point Comfort, Va., one 60 H. P.; Gale Shoe Mfg. Co., Haverhill, Mass., one 35 H. P.; Kittanning Elec. Lt., Ht. and Pr. Co., Kittanning, Pa., one 150 H. P.; New England Conservatory of Music, Boston, Mass., one 35 H. P.; Columbia Electric Lt. Co., Philadelphia, Pa., one 200 H. P.; Osage Electric Light Co., Osage, Iowa, one 50 H. P.; Commonwealth Iron Co., Commonwealth, Wis., one 35 H. P.; Eugene Sites, Loraine, O., one 100 H. P.; Hix, Crosby & Co., Richmond Va., two 60 H. P.; Schmidt Building, Pittsburg, Pa., one 35 H. P.; Vandergrift Building, Pittsburg, Pa., one 60 H. P.; Central District Tel. and Tel. Co. Bldg., Pittsburg, Pa., two 50 H. P.; Pitts. Iron and Steel Engineering Co., Pittsburg, Pa., one 80 H. P.; Halifax Mfg. Co., Lake Village, N. H.; one 35 H. P.; Lockport Gas Light Co., Lockport, N. Y., one 100 H. P.; S. J. Lefevre, Gibson City, Iowa, one 100 H. P.; Edison General Electric Co., Portland, Ore., three 150 H. P. The company also reports the following sales of engines of other classes: Industrial Improvement Co., Brockton, Mass., one 300 H. P. Cross Com.; Palace Hotel, San Francisco, Cal., one 100 H. P. and one 200 H. P. Cross Com.; Newark Elec. Light Co., Newark, N. J., one 300 H. P. Cross Com.; Edison Light and Power Co., Minneapolis, Minn., one 300 H. P. Cross Com.; Electric Improvement Co., San Francisco, Cal., one 100 H. P. Tandem Com.

THE PELTON WATER WHEEL CO., 143 Liberty street, New York City, or 121 Main st., San Francisco, Cal., reports a season of great activity both in its San Francisco and New York works; orders for 492 wheels having been filled during the past year, of capacities varying from 10 up to 1,200 H. P., an increase in number of nearly 100 over that of the previous year. While the majority of these wheels have been sent to the mining districts of the Great West, large numbers have gone to Mexico, China, Japan, Australia and many other foreign countries for mining, electrical and various other purposes. The extraordinary success that has attended the introduction of the Pelton Wheel in all parts of the world indicates that it is more fully meeting the varied requirements of such service than anything ever before introduced, as well as the fact that there is a better appreciation of the value of water powers for all industrial enterprises. Any information relating to this system can be obtained by addressing the Pelton Water Wheel Co.

PERRET MOTORS IN A PRINTING-HOUSE.

The following copy of a letter explains itself:

OFFICE OF THE NEW ERA,
LANCASTER, PA., Jan. 1, 1892.

Mr. E. H. Cutler, Manager, the Elektron Mfg. Co.

DEAR SIR: One year ago we substituted electrical for steam power in the *New Era* printing house. A 20-horse-power Perret motor furnishes power for the machinery in the main pressroom, driving a Goss Perfecting newspaper press, with double folder, an Adams and three cylinder book presses, freight elevator and the machinery in stereotype foundry.

A 10-horse Perret furnishes power for the half dozen presses and other machinery in the jobbing department, with ample reserve power for increase of both plants. The performance of these motors has been satisfactory in all respects. They run free from sparking, maintain a uniform speed under all variations of load, and cost nothing for engineering. We would not exchange for steam-power upon any consideration. They are always ready for duty at any hour of the day or night without waiting to "get up steam." Steam for drying matrices is furnished by Murray's generator and steam table combined, which is both economical and convenient. As you are aware, we selected the Perret motor from a number of competitors because, while equal to the best in points in common, it was the only one which developed its maximum power at such slow speed as enabled us to run our line-shafts without the intervention of countershafting.

The experience of a year fully confirms our judgment in the selection of these machines.

Yours very truly, WARFEL & GEIST.

It may be added that this was the first power plant installed by the Elektron Company for this purpose, and it has installed many others with equal success.

WORTH A DOZEN OTHERS.

JANESVILLE, WIS., Dec. 5, 1891.

Jerome Kidder Mfg. Co.

SIRS: Enclosed find * * * * * * * * Electricity meets every want. —— battery was used, also ——, but I would rather have one Kidder than a dozen of either the others. * * *

Yours respectfully, G. E. LAKE.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued January 5, 1892.

466,541. Electric Reciprocating Tool. Harry N. Marvin, Syracuse, N. Y., assignor to the Marvin Electric Drill Company, same place. Filed June 6, 1888.

A generator for reciprocating tools provided with independent energizing-circuits, consisting in the combination of a field-magnet, a revolving armature, a complete ring-collector forming one terminal of the armature circuit, a partial ring-collector forming the other terminal, a single brush bearing on the complete ring and two brushes in position to make contact with the collector alternately, and two working circuits, including, respectively, the coils of the drills and leading from the two brushes of one collector to the single brush of the other.

466,562. Incandescent Lamp. Perrin Grant, Portsmouth, Va. Filed July 7, 1891.

In an incandescent lamp, the combination of a neck carrying the lamp-globe and provided with a valved exhaust-passage, with a removable cone-shaped plug carrying the leading-in wires, air-tight packing between the neck and plug, and a nut and cap.

466,576. Globe-Guard for Electric Lights. Charles P. Robbins, Calais, Me. Filed May 11, 1891.

A guard for electric-light globes, consisting in an annular metallic shell adapted for an engagement and fit in the neck of the globe and provided with a surrounding and outwardly and upwardly extending annulus of mica.

466,604. Electrical Signal-Box. Thomas F. Gaynor, Louisville, Ky., assignor to the Gaynor Electric Company, same place. Filed Jan. 23, 1888.

The combination of terminals, a circuit-closer provided with a tension-spring, a lever adapted to control the movement of the circuit-closer and being provided with a handle and a tripping-trigger, also adapted to control the circuit-closer and being provided with a tripping-lever.

466,620. Multiple-Signal Transmitter. Charles E. Nash, Newton, Mass. Filed May 2, 1891.

The combination, with a motor provided with a number of signalling-surfaces for transmitting distinct signals, a hand-operative pull or starting device therefor, and a hand-operative signal-selector by which the desired signalling-surface is placed in control of the circuit, of a case inclosing the hand-operative devices and preventing access thereto when shut, and a citizen's key or operating-handle which may be introduced when the case is shut, and projections operated by the key, adapted to operate the hand-pull and also to engage with the hand-operative pointer and move it to a definite position.

466,644. Electric Push. John F. Wollensak, Chicago, Ill. Filed Oct. 23, 1891.

In electric pushes, the combination of a plate of insulating material, binding-screws for holding both ends of the circuit-wires arranged on the outside and both extending through into the interior to operate as contact-points, a loose button to be pushed when it is desired to complete the circuit, and a rocking disc arranged intermediate the button and the binding-screws, which completes the circuit as it is pressed in by the button through direct instrumentality of both binding-screws.

466,664. Electric Battery. Patrick B. Delany, South Orange, N. J. Filed Nov. 13, 1890.

In a battery, the combination of zinc and copper elements, a conductor leading from the copper element, and a jar within which the zinc and copper elements are contained and which is provided with an aperture near its edge, through which the conductor from the copper element passes.

466,686. Electric Meter. Charles K. Huguet, New Orleans, La. Filed Dec. 3, 1890. Renewed Dec. 9, 1891.

In an electric meter, the combination, with a closed receptacle, of an electrode projecting through the bottom of the latter and having an inwardly-threaded eye, a cylindrical adjustable screw held and adapted to work in the eye within the receptacle, and an electrode provided with a head, having an arm arranged opposite one end of the screw.

466,702. Multiple-Switch-Board Busy-Test Circuit and Apparatus. Frank A. Pickernell, Newark, N. J. Filed Aug. 17, 1891.

A busy-test system for metallic-circuit multiple switch-boards, consisting in a series of metal spring-jack frames or plug-sockets for each circuit, supporting but insulated from

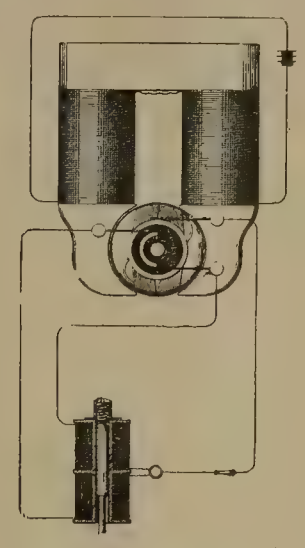
spring contacts or terminals representing the conductors of the circuit, and independent conductor for each circuit extending between the several spring-jacks of the circuit and uniting electrically the insulated metal frames thereof, plug-connectors adapted to be inserted in the plug-sockets and each provided with independent insulated contact-pieces at its tip and stem arranged to connect with the circuit-terminals, a third contact-piece arranged to connect with the plug-socket frames, a testing-battery having one of its poles in permanent connection with the third contact-piece, and a telephone or similar testing-instrument detachably connected in circuit with the tip contact-piece and with the return-conductor of the battery.

466,720. Process of Obtaining Insoluble Chlorides by Electrolysis. Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed April 24, 1891.

A method of producing insoluble chlorides direct from the metals, consisting in constituting the metal or metals to be converted into a chloride or chlorides the anode in an electrolytic cell in a neutral chloride solution, and then converting the metal or metals into an insoluble chloride or chlorides.

466,725. Magneto-Telephone for Personal Wear. Alonzo E. Miltimore, Catskill, N. Y., assignor, by direct and mesne assignments, of one-half to George G. Schroeder and Frank Palmer, Washington, D. C. Filed Feb. 24, 1891.

In an audiphone, a telephonic receiving-instrument consisting of a diaphragm of approximately the same shape as the mouth of the middle ear, a beading surrounding the diaphragm, a bar mounted on the beading and projecting forward from the forward edge of the diaphragm and having a trough in its inner face, spring-clips adapted to engage the ear and connected to the forward end of the bar, one of the clips having a trough in its inner face communicating with the trough within the bar, an electro-magnet carried by the bar over the centre of the diaphragm, and wires within the troughs in the clip and bar connected to the coil of the magnet.



466,541.—ELECTRIC RECIPROCATING TOOL.

466,726. Insulator. George B. Norgrave, Philadelphia, Pa., assignor to Richard I. Brewster, New York, N. Y. Filed April 9, 1891.

An insulating-support for electric wires, consisting of a metal piece having integral jaws inclining outwardly and then inwardly, and two identical blocks of insulating material, having longitudinal grooves having their sides inclined to correspond with the inclination of the jaws and tapered longitudinally.

466,737. Lubricator for Trolleys. Edwin M. Doig, Denver, Colo., assignor of one-fourth to William J. McKerley, same place. Filed Aug. 17, 1891.

The combination, with a trolley-wheel made fast to its spindle, of a frame in which the spindle rotates, the frame being provided with oil-chambers on each side, one surrounding each spindle-journal, removable bushings surrounding the journals and screwed into openings in the frame and passing through the oil-chambers, and openings in the bushing permitting the passage of oil from the chambers to the journals.

466,760. Regulation of Dynamo-Electric Machines. René Thury, Geneva, Switzerland, assignor to Cuénod, Sautter & Company, same place. Filed Aug. 4, 1891. Patented in Switzerland.

In combination, a dynamo-electric machine, generator, or motor provided with a rotatable arm or brush-carrier, collecting-brushes and auxiliary brushes applied to the arm or brush-carrier, an auxiliary electric motor, differential gearing between the auxiliary motor and arm or brush-carrier, a relay for controlling the auxiliary motor, and circuit connections between the auxiliary or tell-tale brushes and relay.

466,761. Safety-Fuse for Electric Conductors. James A. Wotton, Atlanta, Ga., assignor of one-half to John D. Easterlin, same place. Filed Oct. 12, 1891.

A fragile high-resistance element in circuit and an explosive substance associated therewith in such a manner as to be ignited upon the heating of the high-resistance element.

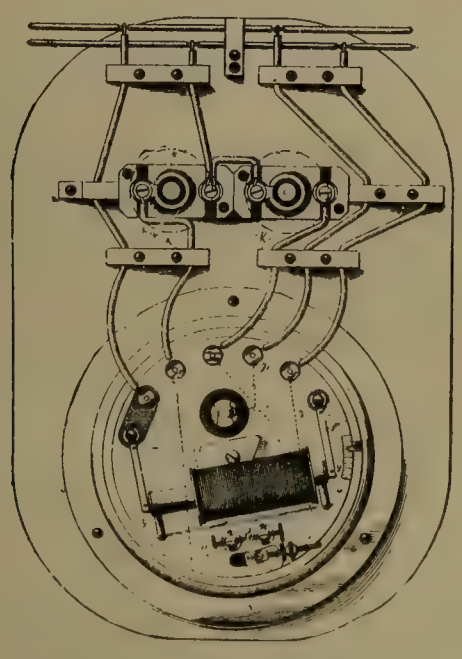
Issued January 12, 1892.

466,781. Electric Steam-Engine Governor. Frank M. Garland, New Haven, Conn. Filed Feb. 26, 1891.

A steam engine governor consisting of a valve having a spindle bearing a worm-gear, an oscillating worm meshing with the gear, and a continuously revolving disc adjacent to the worm, whereby the worm is rotated in opposite directions, according to its position of oscillation.

466,784. Electrical Annunciator. William F. Harte, Omaha, Neb., assignor to The Automatic Call Manufacturing Company, same place. Filed July 25, 1891.

The combination, with a case, of wires, battery and call-bell forming a part of the circuit, contact-posts, driven hand having a wheel for consecutively engaging the posts, contact-posts, an arm for detachably engaging the posts, and a ratchet.



466,787.—ELECTRIC INDICATOR.

466,787. Electric Indicator. Charles W. Holtzer and George E. Cabot, Brookline, assignors to the Holtzer-Cabot Electric Company, Boston, Mass. Filed April 6, 1891.

An electric indicator consisting of the combination of a rotary insulating-plate adjustable angularly to any position within predetermined limits, a solenoid mounted upon the plate eccentrically, a pivotally-suspended core for the solenoid suspended from projections on the plate, a beam or rod carried by the core and provided with electric contacts located between electric contacts projecting from the plate, and means for adjusting the rotary plate angularly, the axes of the core and solenoid being normally at an acute angle to a horizontal line.

466,798. Electric Battery. John S. Nowotny, Cincinnati, Ohio, assignor of one-fourth to William H. Robinson, Covington, Ky. Filed March 23, 1891.

A carbon battery, having radially-projecting walls extending from the outer wall toward a common centre, the sides of the walls being corrugated, the walls and bottom being of carbon.

466,800. Wire-Support for Electric Railways. William Q. Prewitt, Lexington, Ky. Filed March 26, 1891.

In a trolley-track hanger, two members provided with laterally-extended securing-flanges jointedly engaged with each other, and constructed with clamping-jaws channelled to receive the conductor between them.

466,802. Electric Switch. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 13, 1891.

A circuit making and breaking switch having a circular track with a series of double inclines and a rotary cross-arm for connecting the contacts.

466,807. Electric Trolley. Elmer A. Sperry, Chicago, Ill. Filed June. 24, 1891.

In an electric trolley, an upright flexing coiled erecting-spring and a trolley supported thereby, with a swivel-joint connection between the trolley and the spring, combined with a connection of the trolley independent of the spring for preventing or controlling the rotation of the trolley with reference to the spring.

466,820. Battery-Zinc and Method of Making the Same. John Beattie, Jr., Fall River, Mass. Filed March 30, 1891.

An element for galvanic batteries, consisting of an alloy of zinc, mercury and magnesium.

466,825. Method of Electric Welding. Peter Gendron, Toledo, Ohio, assignor to the Gendron Iron Wheel Company, same place. Filed June 17, 1891.

An improvement in method of electric welding, consisting in shaping the abutting ends of the material to have contact at points in proportion to the mass, heating them by a current of electricity, and subjecting them to end pressure.

466,832. Electric-Motor Car. Elbert B. Phillips, Cleveland, Ohio. Filed Jan. 6, 1891.

The combination, with a car, of a motor having a rotatable armature axially placed with reference to and directly connected with a car-axle and rotatable field-magnets, a gripper or holder for preventing the rotation of the field-magnet, so that the motor may propel the car direct, a gripper, and gearing between the axle and the field-magnets adapted to be put into and out of action, so that the motor may propel the car through the gearing.

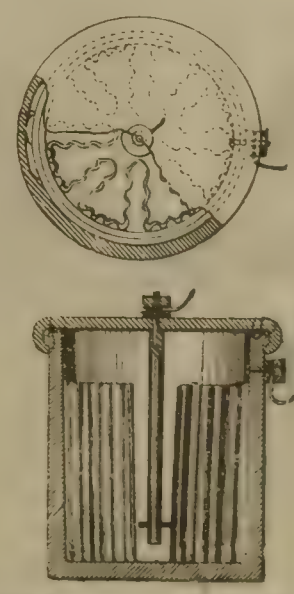
466,856. Electric Fuse or Detonator. Paul Ward and Edward M. Gregory, London, England. Filed May 13, 1890.

466,858. Printing-Telegraph. John E. Wright, New York, N. Y., assignor, by mesne assignments, to The American Type Telegraph, of New Jersey. Filed Sept. 5, 1891.

In a printing-telegraph receiver, the combination of a power-driven pulley or shaft, an escapement in frictional connection therewith, a magnet for determining the extent of movement of the escapement, a rotary type-wheel, a cam intermediate to the type-wheel and escapement, a power-driven shaft and connections for moving the cam and adjusting the type-wheel to positions corresponding to those of the escapement, and an electro-magnet for locking or releasing the shaft.

466,865. Automatic Electric Heat-Alarm. Morrill S. Pierce, Westport, Leonard H. Desisle, Lamoine, and Orville C. Oliver, Eden, assignors to the Electric Heat Alarm Company, Bangor, Me. Filed Dec. 15, 1890.

An electric heat-alarm consisting of the combination of a hollow metallic reservoir, a quantity of mercury within the reservoir, a metallic plug partially filling the reservoir and having a small downwardly-extending tubular bore, a conductor-wire or wire spindle supported and insulated within the plug and extending to such point as that it may be reached by the mercury when expanded and rises in the tube, the whole in combination with an electric battery having one of its poles connected with the plug and the other with the insulated conductor wire or spindle, and a bell or other alarm or indicator connected with and operated by the electric battery.



466,798.—ELECTRIC BATTERY.

466,870. Annunciator. David Heineman, Wabash, Ind. Filed March 16, 1891.

466,914. Railway Electric Motor. Charles F. Winkler, Troy, N. Y. Filed March 20, 1891.

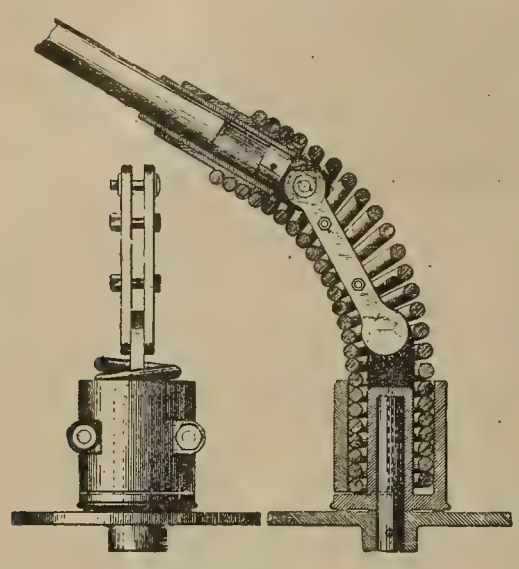
The combination, with a car-axle, of an electric motor geared directly thereto, the motor having field-magnet coils divided into sections placed approximately at right-angles to and overlapping each other.

466,937. Electric Converter. Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed Sept. 28, 1889.

In a converter, a core made of two pairs of blanks, each blank consisting of a long and a short arm, and coils wound around the long arms of each set of blanks.

466,953. Ammeter. Charles F. Brush, Cleveland, Ohio. Filed Nov. 21, 1889.

In an ammeter, the combination, with a yielding plate, of a rock-shaft mounted thereon, means for limiting the movements of the rock-shaft in both directions, a pointer or indicator secured to one end of the rock-shaft, a double flexible conductor secured at its ends and connected at a point between its ends with the rock-shaft, and means for causing one part of the conductor to have its temperature altered relatively to the other part of the conductor by the current to be measured and thereby cause a partial rotation of the rock-shaft and with it a movement of the indicator or pointer to indicate the strength of the current on a scale or graduated plate.



466,807.—ELECTRIC TROLLEY.

466,956. Bracket for Trolley-Wire Supports, etc. Edward P. Russell, Newburyport, Mass. Filed Sept. 11, 1891.

As an improved article of manufacture, a cast-iron bracket adapted to be secured to a post or other support, and having at or near its inner end a wire-holding rod or pipe receiving and holding socket, and at or near its outer end an adjustable pipe or rod receiver and holder.

466,972. Brush-Holder for Commutators for Dynamo-Electric Machines. Isaac H. Bartholomew, Northford, Conn. Filed Aug. 13, 1891.

In a holder for the commutator-brushes of dynamo-electrical machines, the combination, with a frame-piece, of a brush-carrier pivotally connected therewith, and a hand-piece located between the brush-carrier and the frame-piece for lifting the former to retire the brush.

466,973. Electric Elevator. William Baxter, Jr., Baltimore, Md., assignor to the Baxter Electric Motor Company, same place. Filed Sept. 3, 1888.

In an electric-elevator system, the combination, with an electric motor and hoisting mechanism operated thereby and provided with a hoisting-rope of a car suspended by such rope in a hoistway, a motor-circuit supplied with a current of constant potential, a switch upon the car with contacts in the circuit, and a circuit-controller operating normally to open the circuit and operating with the contacts when moved to close the circuit through the motor to actuate the hoisting mechanism.

466,981. Trolley for Electric Railways. John Kuehnle, Detroit, Mich., assignor of three-tenths to Edward Martyn, same place. Filed Sept. 5, 1891.

In an electric railway, the combination, with a contact-arm carrying a contact device at one end and pivoted to the car at the other end, of a tension device for the arm, comprising a compression spring-rod and a connection between the rod and the contact-arm.

467,023. Lightning-Arrester. George W. Spittle, Campos, Brazil. Filed Sept. 3, 1891.

467,048. Electric Motor. John H. Palmer, Boston, Mass., assignor of one-half to Richard Smith, Sherbrooke, Canada. Filed March 23, 1891.

The combination, with an electric motor having its armature and field-magnets free to revolve in opposite directions, of means for retarding or stopping the revolution of one part of the motor, consisting of a gas or fluid compressor.

467,050. Electrically-Controlled Car-Switch. Burt I. Potter, Boston, Mass. Filed Jan. 13, 1890.

In a track system, the combination of the following elements: a track-rail, a switch point or rail adapted to be electrically controlled and operated, an electrically-impelled car, an electric conductor or conductors extending along the track in the direction of travel of the car and electrically connected with the switch-actuating mechanism, a contact or contacts for the conductor or conductors carried by the car, and an electric switch carried upon the car and serving to connect one or another of the conductors with the source of electricity which supplies the car-motor.

467,073. Dumb-Waiter Signal. Frederick J. Zahner, Stanwich, Conn. Filed Aug. 14, 1891.

467,075. Electrical Heating Apparatus. Arthur E. Appleyard, Boston, assignor to H. L. Millis, trustee, Millis, Mass. Filed Jan. 16, 1891.

In an electric-heating apparatus, the combination, with a cylindrical inclosing shell or casing, of an inflexible block of homogeneous heat-conducting insulating material within the shell, the block having a pocket, a rod or pencil of compressed carbon in the pocket, a plate secured to each end of the block for holding the rod in position, and electrical connections with the rod or pencil.

467,078. Rheostat. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed June 5, 1889. Divided and this application filed Jan. 12, 1891.

The combination, with a resistance composed of a series of metallic plates in contact with one another, of a contact passing over the plates, consisting of a roller journalled on an arm which is movable on a centre eccentric to the roller.

467,085. Electric Insulator for Boilers. Peter Decker, Norwalk, Conn. Filed Sept. 25, 1891.

An electric insulator introduced in a pipe-connection between a steam-boiler and a steam-engine to break an electric circuit between them.

467,102. Nautical Signal or Sea-Telephone. Ernst Huber and Frederick J. Kneuper, New York, N. Y., assignors of one-third to James R. Davies, same place. Filed April 25, 1891.

The combination, in an apparatus for receiving, transmitting and indicating sound, of a sound-wave intercepter, a resounder, a receiver, a director, an indicator, sound-wave connections between the several parts above named, an electric battery and an electric circuit extending from the battery to and through the resounder, receiver, director, and to the indicator.

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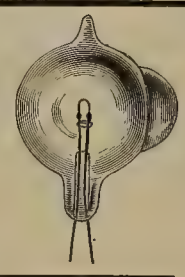


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THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

The electrical exhibition at the Crystal Palace in London, which will be opened shortly, promises to surpass all previous efforts in this direction.

Among the interesting exhibits will be that of the post-office, which will show the various instruments used in the telegraph service during the past 50 years. This takes us back to the beginning of telegraphy, and the old instruments used in these days will no doubt attract a great deal of attention.

A feature of the exhibition will be a reproduction by telephone of music from theatres in London, Birmingham, Manchester and Liverpool. This will be a novelty to a majority of the visitors to the exhibition, who for a small sum will be permitted to listen to the far-off music.

A FAR-OFF VIEW.

The London *Lancet* seems to enjoy privileges in connection with electrical executions in this State that are denied our own papers. Its latest effusion on the electrical method of execution concerns the execution of Loppy, the last one who suffered the death penalty in this State for his crime. Our contemporary has insisted all along that the victims of the death-chair are stunned into insensibility by the first shock, and that, in the case of Loppy, the man showed evidences of struggle and life after he was "struck and liberated from the current." It further asserts that "he was so scorched and burned that the air around him became offensive to breathe."

The latter assertion does not agree with the reports of the affair printed in home papers, and how our far-off contemporary comes into possession of these details it would be interesting to know. It is well known that that paper is bitterly opposed to the electrical method of execution, and never lets a chance go by to say so, but it would seem that it would strengthen its argument more to keep closer to the facts than to indulge in so much speculation.

A GOOD PLAN.

We think that the recommendations of Secretary Pope to the Council of the American Institute of Electrical Engineers to hold meetings in other cities besides New York should be favorably acted upon. The idea is a good one, and no doubt such a course of action would build up and strengthen the society more than can be done in any other way. But that is not the only advantage that would result. The society is of more than local character; it is national; yes, and international. By holding meetings in different cities the Association would acquire a standing among scientific bodies that would be to a greater degree commensurate with the character and scope of the body. By holding all its meetings at home there is danger of attaching to the association the impression that it is a "local" body —that is, lives and thrives in New York alone. It would be unfortunate to let such an impression get abroad, and in order to offset any such tendency, meetings should be held in different places, so that the national character of the association could be more strongly emphasized.

This land of ours is a broad one, and to get a broad view of it and what is being done in it we must go about and see for ourselves what is going on.

Secretary Pope's plans are evidently well thought out and matured, and should they be favorably acted upon there is no doubt that the society will take an important place among contemporaneous scientific bodies.

A GREAT TELEGRAPH OFFICE.

The magnificent operating department in the Western Union Telegraph Company's reconstructed building at the corner of Dey street and Broadway, this city, will probably be opened for business January 31.

It will be remembered that through a disastrous fire on July 18, 1890, the entire operating department and battery-rooms of this company were completely destroyed. Temporary quarters for the operating department were established on the fourth and fifth floors, and that portion of the old building above the fifth floor was torn down and a new and better adapted structure erected in its place. The result of this is a queer combination of architecture —one building on top of another. Apart from its external appearance, however, the building is far superior for the purpose for which it was erected than the old one was; indeed, there is no comparison. The old establishment was very poorly adapted to the uses it was designed to be put to, while the new building is in every way admirably suited to the purposes of a great telegraph central office.

Everything used in the new office is of the latest and most approved pattern; everything is modern, and represents the highest degree of development. "Do everything right at the start, and get the best of everything," was the motto adopted by General Eckert in the equipment of this elegant establishment, and it needs but a glance around the office to see that it is indeed a model of its kind. Nothing has been spared to make it so, and the result is this great telegraph corporation now has an office that surpasses everything of like character in the world. The only office that can at all be compared to it is the central office in London, and that, according to those who are competent to speak on the subject, does not approach the completeness and magnitude of the new Western Union quarters.

One notable feature of the new office is the entire absence of batteries; not a single cell is used in the equipment for any purpose whatever, not even for the operation of the sounders. Dynamo-electric machines generate all the currents used, and the dynamo plant is probably the most complete in existence —that is, for telegraphic purposes. There are no less than 41 of these machines, and they are wound for the generation of currents of different voltages, according to the uses to which these currents are applied, a short wire, of course, requiring less current than a longer one.

The entire displacement of batteries by dynamos in a telegraph office marks a new era in telegraphy. Up to very recent times it was thought that dynamos could not be adapted to the requirements of telegraph work, but through the ingenuity and skill of American electricians the problem has been completely and satisfactorily solved, and the chemical battery, which for so many years had the field all to itself, is, like the street-car horse, being rapidly displaced by the newer form of power. Of course it is understood that batteries will continue to be used in small offices where the business is not sufficiently large to warrant the maintenance of a dynamo plant.

Another novel feature of this grand office is the method of distributing messages from one section of the room to another. The carrier system adopted seems to meet every requirement of the service, and is a marvel of ingenuity. The motive-power necessary for the operation of the carrier system is supplied by an electric motor, and the service seems to be all that could be desired in so large an office.

We publish elsewhere in this issue an article giving many interesting facts in connection with the equipment of this great office, and several illustrations which in themselves are of extreme interest. In order to compare the new with the old we give an illustration of the new office, made directly from a photograph and a view of a portion of the old office as it was before the fire. We also give an illustration showing the destruction wrought by the fire on July 18, 1890. The destruction was complete, as will be seen by reference to this illustration; nothing that was destructible escaped. We also give a view of a portion of the dynamo plant, which is located in the basement of the building, two stories below ground.

The features of the head of this vast concern are also shown in connection with the article. General Thomas T. Eckert is well known all over the world as a leader in telegraph matters, and it is due almost entirely to his keen and correct judgment and executive ability that the Western Union Telegraph Company stands where it does to-day in relation to the affairs of the country, and, indeed, of the world.

THE WESTERN UNION TELEGRAPH COMPANY'S NEW OPERATING-ROOMS, AT NEW YORK.

On Sunday next, January 31, the Western Union Telegraph Company will occupy its new and magnificent operating-rooms on the seventh and eighth floors of its building on the corner of Dey street and Broadway, New York.

It will be remembered that on July 18, 1890, a disastrous fire took place in this building, which completely destroyed the battery-room, on the sixth floor, the operating-room, on the floor above, and the book-keeping department and the offices of the Associated Press on the ninth floor. Temporary quarters for the operating department were established after the fire on the fourth and fifth floors, which were not damaged by the fire, and in these cramped and illy-ventilated quarters the vast business of the largest telegraph office in America has since been carried on.

Meantime the portion of the building damaged by the fire has been torn down and rebuilt on a scale and in a manner that will likely stand for generations to come, as a monument to the genius and ability of the master-mind which planned and directed the gigantic undertaking. We refer to General Thomas T. Eckert, the General Manager of the Western Union Telegraph Company, who without doubt stands at the head of telegraph leaders in this country, both as to experience and executive ability.

The new portion of the building has five floors, making in all ten stories, and the roof is flat, giving all the available space possible. The mansard roof of the old building was to a great extent waste room, besides being an eyesore, from an architectural point of view. The new structure, however, while not particularly attractive from the outside, has the appearance of solidity and massiveness that the old building did not possess. It possesses also the additional, and most valuable feature, of having more available room for the uses of the vast institution which occupies it.

In addition to the rebuilding of the burned portion, the building next adjoining on Dey street, also owned by the Western Union Company, was pulled down, and an elegant structure erected in its place simultaneously with the rebuilding of the main building. This addition on Dey street was built in such a manner that the upper stories were brought to the level of those of the main building and the wall between the two removed, combining the two sections into one. The two operating-room stories are thus greatly enlarged, making elegant quarters for the handling of the great volume of business daily passing through this office.

The new office is said to be the largest and most completely equipped telegraph office in the world, not excepting the general office in London.

The seventh and eighth floors are devoted to the operating department. The dimensions of each are 75 feet on Broadway by 200 feet on Dey street, and the two floors are lighted in the daytime by large windows on all four sides. At night light is provided by 600 incandescent lamps artistically arranged in clusters around the pillars which run down the rooms. The current for these lamps is generated in the basement by Edison machines.

On the seventh floor are located the Commercial News Department (which collects and distributes the quotation service of the Grain, Oil, Cotton, Coffee and Stock Exchanges, and from which a general news-ticker service is operated); Morse wires connecting with all the Exchanges and all the principal cities of the country; the leased wires to brokers, newspapers, etc., and the Wheatstone Automatic System. Besides these the Book-keeping Department and the Superintendent's office are located on this floor, the former at the rear end, and the latter at the Broadway or front end. The Wheatstone "punchers," over thirty in number, are also on this floor handy to the Wheatstone apparatus, and so are the typewriters used in copying the messages from the tape as it comes from the Wheatstone receiving instruments.

On the eighth floor are the wires to Southern, Eastern and Western points; also the city, Long Island and suburban wires, and on this floor alone there are accommodations for over 1,000 operators and other employés of this department. There are six elegant large switchboards on this floor and four on the seventh floor. The Eastern board has accommodations for 200 wires; the Western board 200; the Southern 300; the city 250, and the Long Island board 75. The two latter boards are located in the annex. The Western Electric Company constructed all these boards with the exception of two which were made by the Interior Conduit and Insulation Company, of New York.

A good many new features are noted in the installation of this wonderful plant. Not a wire runs into the building above ground; everything comes in under the ground into the basement, and the wires are led up to the operating-rooms through a shaft 9 feet square, which runs to every floor from the operating department to the basement. In the basement is located the test-board, which will accommodate about 3,500 wires. The underground wires are connected with this test-board, and from it they run in 100-wire cables to the operating department through iron pipes placed within the shaft above referred to. They are then taken to the switchboards through fireproof trenches under the floors. These trenches are 10 inches wide by 3 to 5 inches deep, and their combined length is about one mile. From the switchboards to the instrument tables the wires are laid in similar trenches, which are closed with a removable cover, thus rendering them readily accessible at all points. A valuable feature in connection with this trench system is the filling up of the trenches with sand, thus completely covering the wires.



GEN. T. T. ECKERT.

This, however, is not the object of the use of the sand; it is to prevent the spread of fire in case a short circuit should occur, or through any other cause a wire should become dangerously heated. This simple, yet extremely effective method of preventing the spread of fire is the invention of Mr. A. S. Brown, the company's electrical engineer, who has had the entire supervision of the electrical and general work in connection with the fitting out of the operating departments. The trenches themselves are, strictly speaking, iron troughs placed in the concrete floors, with slate coverings which when in place, are flush with the floor itself, and being fireproof, besides being filled with sand, there is no possible chance for the spread of fire from an overheated wire.

The weight of the cables and wires in these trenches is about 5 tons, and the combined length of wire in these cables is about 200 miles.

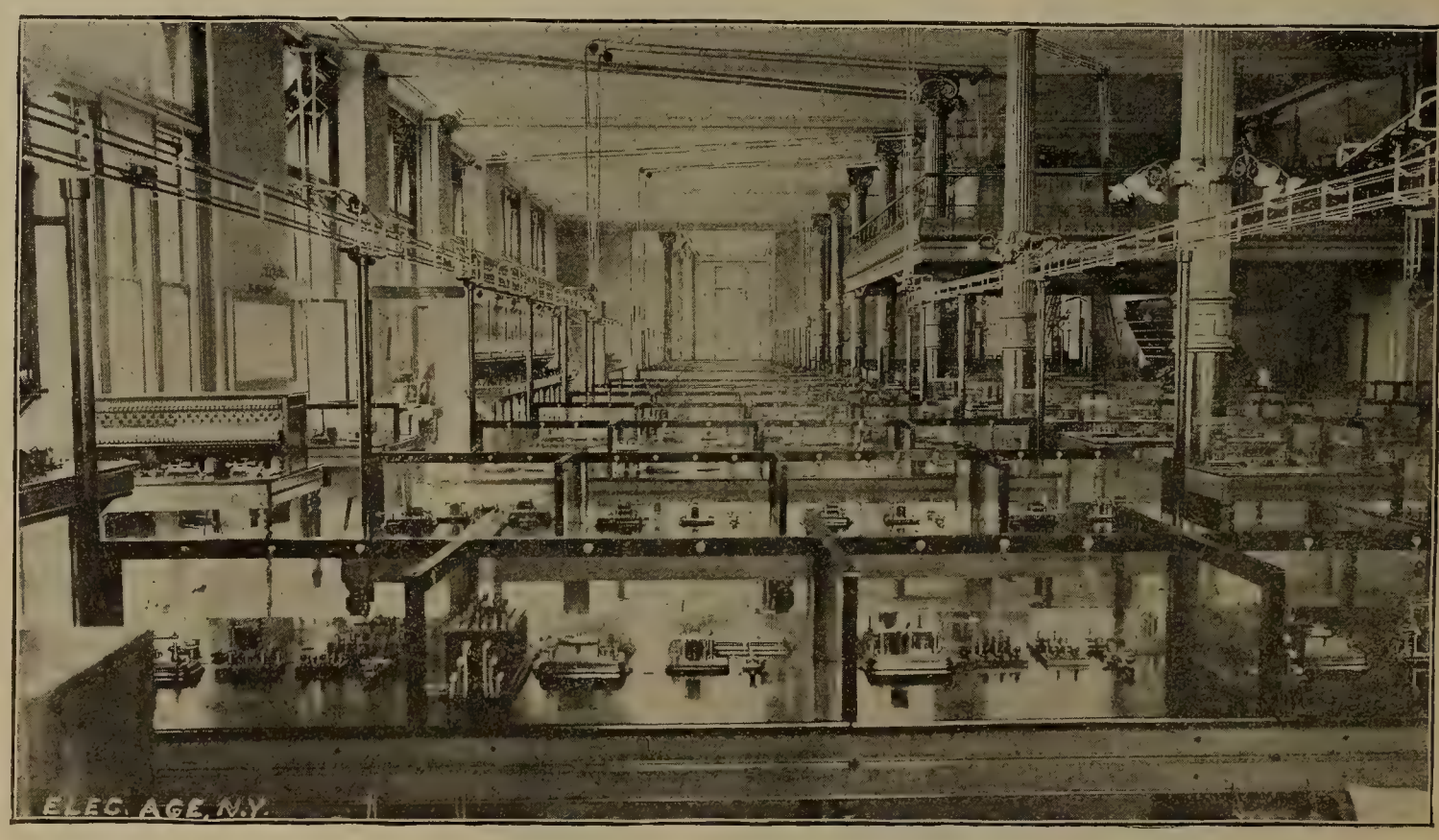
Currents for all purposes are generated by dynamos—there is not a cell of battery in the building. In all there are 41 dynamos, including several small machines which are used as "intermediate batteries," that is, to reinforce the normal working current for extraordinary requirements. These small machines give a current of from 110 to 115 volts. The large machines, *i.e.*, those used for generating the current for the regular wires, are all of the Edison No. 2 type, each of 5 K. W. capacity. They are separately excited by a 60-volt current taken from one of the 5th potential dynamos. Fifteen of the machines are wound to give 60 to 70 volts each, 2 for 45 volts, 2 for 23 and 2 for from 6 to 8 volts. The latter are used for the operation of the sounders, and take the place of "local batteries." The potentials of the other machines vary in proportion to the length of circuits they are intended to operate. The dynamo plant includes ammeters and voltmeters of the best patterns and makes, including Edison, Walker and Weston ammeters and Weston voltmeters, of which latter 8 are used.

Kerite and Safety Insulated wires were used throughout the entire installation; there is not a foot of cotton-wrapped or any other inferior insulated wire in the building. There are 15 leads from the dynamos to the switchboards. The size of the main-wire leads is 250,000 circular mils, and those for the locals are of 450,000 c. m.

About 3,000 incandescent lamps are used as resistance to modify the current for various purposes, and most of these are placed above the switchboards, in plain sight of the chief operators, and where they are readily accessible.

Another valuable feature in connection with the handling of the immense business of this office is the cable-carrier service which conveys the written messages between the seventh and eighth floors and from any section of one floor to another section. The carriers travel at a speed of 750 feet a minute, and are said to be unfailing in their duty. The carrier system is distinctly shown in the general view of the new operating-room which accompanies this article. The power to run the cable-carrier system is furnished by a 5 H.P. automatic Crocker-Wheeler electric motor, which runs at a speed of 1,150 revolutions a minute. It takes a current of 40 ampères and 115 volts. The power is transmitted to the carrier system by countershafting, and the motor is located under the gallery stairs at the east end of the gallery.

On the north side of the room, midway along its length, is located the gallery where the entire business of the two floors is handled by an efficient corps of assorters and distributing clerks. The carrier system centres at this gallery and the messages as received are sent by the cable-carrier to the gallery, from whence they are distributed to their proper wires in the case of through messages, or sent to the delivery department in the basement in the case of messages to be delivered from the general office. On this gallery are also located the pneumatic tubes connecting the operating-room with the receiving and delivery departments on the basement floor, the



NEW GENERAL OPERATING-ROOM OF WESTERN UNION TELEGRAPH CO., NEW YORK.

several offices and floors of the building, the down-town exchanges and the 23d street building and intermediate offices. There are also on this gallery two revolving belts to facilitate the passage of business to and from the pneumatic tubes and carriers.

Referring to the Wheatstone system, it will be of interest to state that there are three circuits worked on this system in regular operation, viz.: one to New Orleans, one to Chicago and one to St. Louis.

In the space at our disposal it is impossible to do this subject justice. There are so many novel features in the installation of this elegant office, that to go into details in each specific case would require an incalculable amount of labor and time for preparation and a volume for description. We will, however, from time to time take up these subjects separately and give our readers the full benefit of what is new and interesting of this model office.

Before closing this article it will be quite appropriate to give a few statistics regarding the wonderful development of the business of this immense corporation.

When the company moved from 145 Broadway to its present quarters, February 1, 1875, there were about 150 employés in the operating department; in 1878 there were 319, and in 1881, 721; now there are no less than 1,200, about one-third of whom are females. In this department the present daily average of the number of messages handled is 100,000; in 1875 it was 20,000.

Referring to our illustrations, the first one shows the features of General T. T. Eckert, to whose wonderful executive and administrative ability this model institution is a monument that will stand and be admired for many generations to come. General Eckert, with good reason, feels proud over the result of his work. He daily and closely inspected progress, and insisted on having everything done right at the start.

As stated above, Mr. A. S. Brown, the Electrical Engineer of the Western Union Telegraph Company, had personal supervision of all the electrical work and of fitting out the offices, and, as is well known, there is no more competent person in the telegraph service than he to carry to a successful completion a work of so vast magnitude as this.

Our second illustration is more interesting because it gives our readers an excellent view of the new operating-room on the eighth floor. This photograph was taken by our special artist, and shows very distinctly many of the important features of this room. At the right hand will be noticed the gallery already described, and running in every direction will be noticed the skeleton structure of the carrier system. The main switchboards are ranged along the side of the building at the left of the picture, and the long rows of desks seem interminable.

Our third illustration gives a partial view of the operating-room as it appeared before the disastrous fire of July 18, 1890. The picture shows the switchboard and the pneumatic tubes. The latter came from below through the floor, and described great circles, reaching nearly to the ceiling. The switchboards in the old office were all together, whereas in the new office they are scattered, the board of each division being by itself and separated from the others.

The fourth illustration is an interesting one. It was taken on the day after the fire, and it shows with remarkable clearness the ruin wrought by the fiery demon. This was the only photograph made of the ruins, and was taken by our special artist and used exclusively by us in the issue of the ELECTRICAL AGE of July 25, 1890. It will be noticed that every vestige of woodwork and furniture has completely disappeared. Even the metal parts of the instruments were melted into shapeless masses and fused together with glass and other substances, showing the intense heat of the fire.

The fifth illustration gives a partial view of the dynamo plant, which is located in the cellar at the Broadway end of the building. The Edison dynamos are driven by upright engines and countershafting, all of which are shown in the view.

Mr. W. J. Dealy, the manager of the operating-room, naturally feels proud of his new office, and with new surroundings and plenty of fresh air there is no doubt that the immense force of employés under his efficient management will render better service in the interest of their employers.



VIEW OF WESTERN UNION OPERATING-ROOM, NEW YORK, BEFORE THE FIRE.*



VIEW OF WESTERN UNION OPERATING-ROOM IMMEDIATELY AFTER THE FIRE.

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CORRESPONDENCE.

PRIMARY BATTERIES.

EDITOR OF ELECTRICAL AGE: In your issue of 16th inst., on page 31, in your editorial upon accumulators, I find the following remark: "It must not, however, be supposed that a good primary battery may not one day be forthcoming, for it is quite within the bounds of *possibility*."

Professor Crocker remarks upon the same subject that "the *possibilities* of chemical electricity are very great * * * the fault is in the apparatus." These statements express the views generally prevailing—but they are, of course, spoken in reference to batteries of strong and constant current. Now, if there is a *possibly* useful battery, and the "fault is in the apparatus," it would seem worth the efforts of inventors to construct one that would be free from the principal faults now known to exist.

It is worth while to inquire why this has not been done.

We wish at this time to state some of the reasons for failure in producing the desired apparatus in the efforts that have been made in that direction. In two essential things I believe most inventors and experimenters have been misled by instructions found in all, or nearly all, the "books." I do not undervalue the treatises that have appeared from time to time; they are indispensable; and what the inventor must do to perfect a primary battery is clearly stated by Niaudet in the following words: "The principal aim and effort of inventors worthy of that name has been to depolarize the electrode." How is this to be accomplished—by what means? Three are mentioned by Thompson in his work upon "Electricity and Magnetism—Chemical, Mechanical and Electro-Chemical." But he mentions no mechanical means that are at all practical, unless we include under

that head the *enlarging*, proportionally, of the conducting electrode, and this is the uniform instruction given as one of the means of suppressing polarization in a primary battery.

Here I affirm there is an important and very costly error.

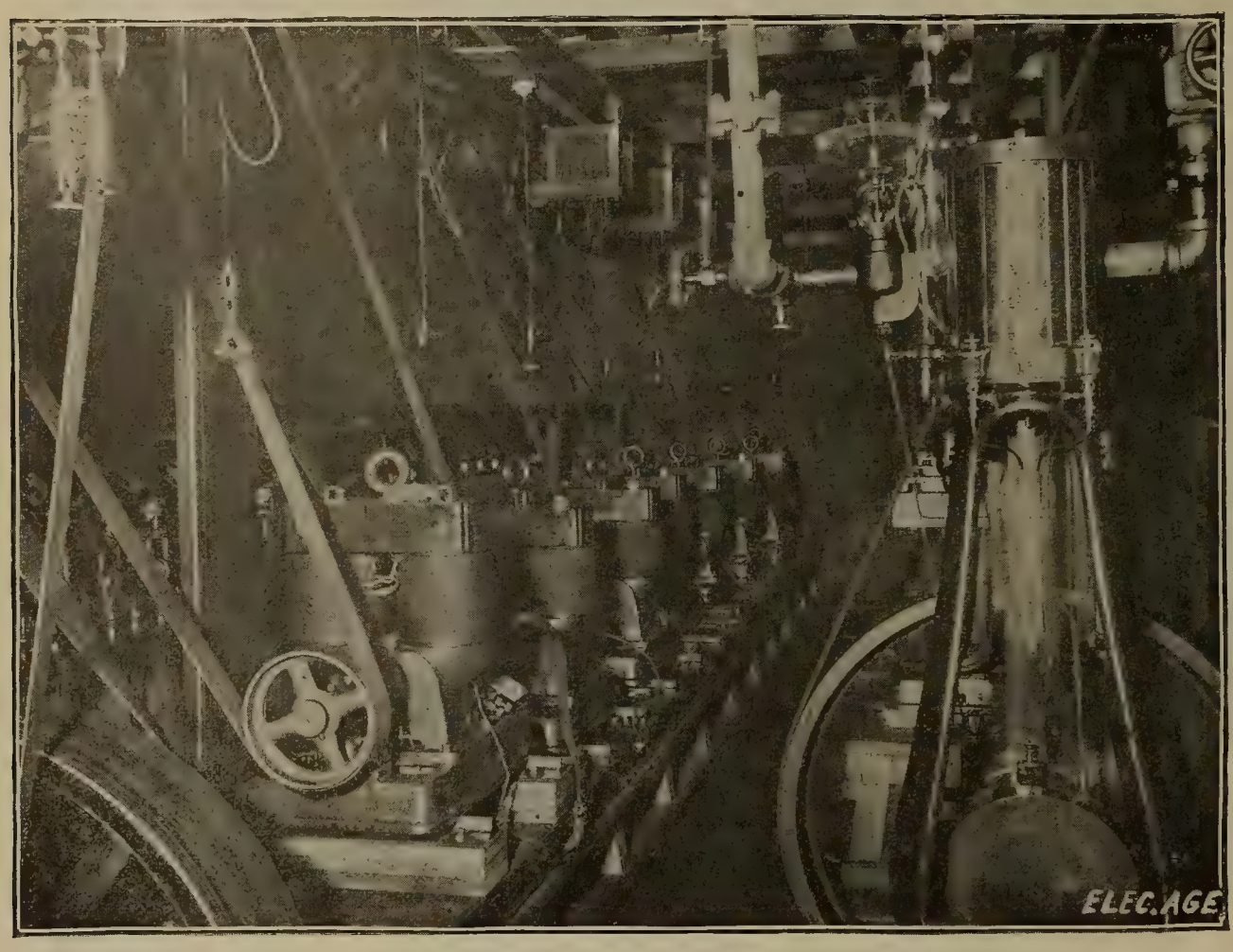
Batteries have been and are being constructed under this direction, and so firmly does this error seem to be fixed in the minds of even practical electricians that it is uniformly insisted upon. Open almost any illustrated catalogue of supply stores that contain directions how to choose and operate a battery, and you will find about the following: "The rapidity of this polarization will, *of course*, depend upon the *extent of surface* to be covered with bubbles (hydrogen), so that of two batteries equal in other respects, that one which has the greatest *carbon surface* will be the slower to polarize. In selecting a battery, therefore, it should be seen that the conducting electrode is *as large as practicable.*" Every one will see that in these sentences are condensed the uniform teachings of the authorities upon this vital part of the primary battery, and how implicitly they have been and are being followed can be seen in the construction of almost every battery that has been offered to the public. We will mention two or three of those that have been held to be the best, all things considered, in which this very great error of construction is conspicuous.

I have no wish to detract in the least from their real merits.

First, Mr. Mason's battery; size of outer jar about 9x13x12 in. deep. Porous cup in which the carbons are placed contains 6 pints of solution and exposes 400 sq. inches of carbon surface to the liquid.

Second, the Ward & Sloan battery of Boston, so highly recommended by Professor Dolbear, has carbon surface about double the zinc surface—both cylindrical in form, 25 zincs—50 carbons about same size. Now, all this excess of carbon surface is more than useless. In fact, I affirm that the zinc surface should largely exceed that of the carbon by about four times, and that internal resistance will not be increased by the change, but very much lessened thereby if *properly constructed.* It will be asked what is the error underlying the use of such excess of carbon—for if a lesser amount will secure better results there must be an error lurking somewhere, and it is important in many ways that it should be discovered and avoided; it adds very considerably to the cost of cells, which is important. A new carbon for the battery first named costs the user two dollars—whereas for cells of equal capacity in current it should not cost one-quarter of that amount. To say that a larger pathway for the passage of current is a good reason for the large carbon surface is not satisfactory, nor will it do to say that longer time would be required to cover the larger surface with hydrogen bubbles, and thus that polarization would be much slower, nor does it quite satisfy one to say that the liquid depolarizer is enabled more effectually to dispose of hydrogen bubbles while being given off at the surface of the carbon electrode; although this is more reasonable than the former explanations. But all are unsatisfactory and certainly erroneous to a degree, though not wholly so, perhaps.

We are prepared to affirm this: that while we do not say that a single-carbon pencil in the Ward & Sloan battery would answer for the conducting electrode of one of their 12×12 cells, yet we will affirm that 60 square inches of surface is quite sufficient for the carbon electrode in the battery first named, and will afford as good results as 400 square inches as now used. Now if what we assert is true an entire change in respect to the use of the usual large carbon surface should be made. What I have affirmed in reference to the matter is the result of experiments that leave no room to doubt.



PART OF THE DYNAMO PLANT OF THE WESTERN UNION TELEGRAPH CO., NEW YORK.

Another serious error in operating primary batteries for strong and constant current is this: that in the depolarizing of the conducting electrode chemical means must be relied upon almost entirely; that the "depolarizer" must be a solution or compound so charged with oxygen as to dispose of the hydrogen bubbles by forming water.

A battery can never be cheaply depolarized if the hydrogen must be disposed of by this means. It must be largely done by mechanical means, and only *partly* by chemical means, or the cost will be much greater than it should be. But the books are almost dumb upon this matter, barely mentioning the fact that such means exist, giving no practical directions of any value.

This use of chemical means to dispose of the hydrogen, which is almost entirely relied upon for the kind of batteries under consideration, must be classed with that of the necessity for the large carbon surface. In a commercial point of view it is far more serious, as the added cost is continuous, whereas the other is added to the cost of apparatus only. How depolarization is largely effected by mechanical means cannot be told here, as it is subject for patent.

By way of emphasizing its importance, I will refer to a battery recently patented that is provided with a receptacle to receive the overflow from the porous cup as the volume of fluid is increased by the chemical action of the battery by the oxygen of the depolarizer uniting with the hydrogen and forming water. Now there never should be and never need be any such increase of volume of the fluid in the porous cell. While there must be a degree of chemical action, it never will, in a properly constructed battery, cause any perceptible increase of the fluid of the porous cell.

The question then is can a cell or has there been a cell so constructed that polarization has been suppressed without the large carbon surface above referred to and with mechanical means that will do half or more of the work of disposing of the hydrogen? We can answer this in the affirmative, and that a high E. M. F. is secured and very low internal resistance also.

Much more could be said that would perhaps interest many of your readers, but too much space has been used now, and I desire to add in closing that the cell referred to, besides what is stated already, will not polarize when placed in short circuit, so that *practically* it operates like a storage cell. Is this the battery we have been looking for?

The two great errors then are these, we claim: 1, that large carbon surface is needed or desirable; 2, that the work of depolarization must be chiefly done by chemical means; both expensive errors and now experimentally demonstrated to be errors.

New York, Jan. 20, 1891. D. N. K.

CABINET BATTERIES FOR PHYSICIANS.*

For a number of years the medical profession generally looked upon the electro-therapeutist very much in the same light as they do to-day on an advertising quack, and it is only within the last few years that electricity has been brought into general use as a remedial agent by the profession at large. But when we look at the batteries with which the last generation had to content itself we do not blame them, for electricity as administered at that time was practically an unknown quantity. They had no sensitive milliampèremeters; no switchboards handsomely mounted with faradic coil, fast and slow vibrators, pole-changer, commutator and everything necessary ready at hand, and last but not least they did not have the Edison-Lalande battery. This cell is said to be the only one in which the voltage remains absolutely constant during the whole life of the battery. Very few doctors ever stop to realize how indispensable this constancy is in medical work. A good many, when patients say they do not feel a certain number of cells as strongly as they did at the last sitting, will immediately say that the patient is getting used to it. This is not so. It is the battery running down, and that kind of treatment must have about the same effect as any other remedy taken, regardless of quantity.



PHYSICIAN'S CABINET BATTERY.

This company has now completed its already extensive assortment of batteries by giving the profession an office outfit for general medical work which fulfils all the requirements called for in a phy-

*Edison Mfg. Co., New York.

sician's perfect battery. The cells, 50 in number, are contained in two trays, which are lined with galvanized iron and can be removed entirely from the cabinet for convenience in re-charging.

The cabinet is made of black walnut, handsomely finished.

The switchboard of hard rubber is mounted in the centre of the top, and contains 50 buttons, commutator, pole-changer, current selector, a faradic coil with both fast and slow vibrators, which can be thrown into circuit with any number of cells, and the necessary binding posts and switches. The whole cabinet presents a very handsome appearance, and the company has taken, as usual, special pains to ensure the cabinet giving the fullest satisfaction in all its appointments. With ordinary every-day use this battery would last a year or more with absolutely no attention whatever, and could then be re-charged at a small cost, and as the battery will remain absolutely constant during its whole life it does away with the necessity of a rheostat. For instance, if a physician wanted to use, say, 30 volts he has simply to divide it by the voltage of 1 cell, *i.e.*, $\frac{1}{10}$, and the result will be the number of cells he must use—that is, 43 cells.

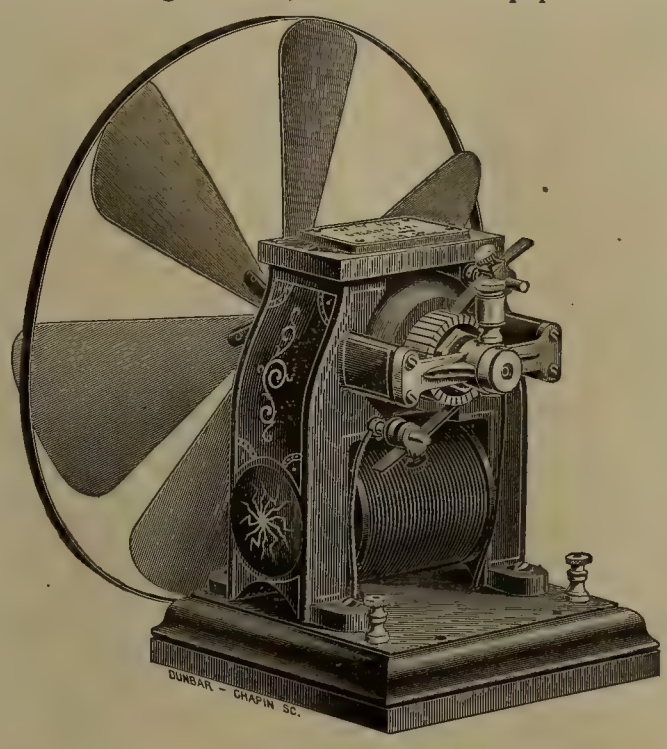
"H. C." FAN MOTORS AND MOTOR-DYNAMOS.*

The Fan Motors which the Holtzer-Cabot Electric Co. delivered last season met with such an enthusiastic reception as to warrant the manufacture of a small fan motor wound for high voltages. The accompanying cut shows the $\frac{1}{4}$ H. P. motor (500 volts). It is of very handsome design and is made in the most substantial and thorough manner. As much pains have been taken in the construction of this machine as in the larger sizes. Its speed is about 1,800 revolutions a minute, and the armature is of the Gramme ring type and is neatly covered. Either carbon or copper brushes are furnished. The motor is almost noiseless, and will create such a current of air as to render one machine sufficient for rooms of large size. The fan is 15 inches in diameter and is supplied with a guard, if desired, at a slight additional cost. While its actual cost is much greater than motors of 110 and 220 volts, its selling price has not been greatly advanced. This company expects a very large sale in its variable speed $\frac{1}{8}$ H. P. Fan Motor the coming season.

The "H. C." Motors and Dynamos possess many distinct advantages, a few of which are: Single Field-Magnets, core of wrought Norway Iron with pole pieces cast onto and around it: self-centering pillar blocks with self-aligning bearing; double oil lickers on journal and shaft, absolutely preventing the oil from getting on the commutator or armature; armature wire completely imbedded below the surface of the core and connected directly to the commutator segments; armature is positively driven throughout its length and not from one end; rocker-arm and brush-holder free to swing around the entire circle, enabling the armature to run in either direction.

These machines, wound as desired, are now ready in the $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ and 1 H. P. sizes. Larger machines will very soon be ready.

It is claimed no motor at present on the market surpasses it in efficiency and beauty.



"H. C." 500-VOLT FAN MOTOR.



"H. C." MOTOR-DYNAMO.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The following communication explains itself:

NEW YORK, January 19, 1892.

TO THE COUNCIL: About three years ago I had under consideration a plan by which I proposed to arrange for the holding of more frequent meetings of the institute outside of New York City. At about this time electric clubs were being organized in different cities, and fearing that the proposed plan might not be attended with success I deferred presenting it until such time as the conditions should be more favorable to its consideration.

Since that time one general meeting has been held in Boston, which was well attended and successful in every respect. The location of the next May meeting has not yet been decided upon.

Although the institute is practically an international organization, an impression has been fostered to some extent that it is a New York society. It is for the purpose of counteracting this feeling that I now briefly outline my plan for holding meetings in other cities, first calling attention to the practice of other similar societies in the United States.

The American Society of Civil Engineers, headquarters in New York City, holds meetings at its house in N. Y. City every two weeks during the season for the reading of papers and election of members. These meetings are usually followed by a collation, provided at the expense of local members. The annual meeting is usually held outside of N. Y. City, the last three years at Seabright, N. J., Cresson, Pa., and Lookout Mountain, Tenn.

The American Society of Mechanical Engineers, headquarters in N. Y. City, holds meetings twice a year, usually outside of N. Y. City. Their last meetings have been held at Scranton, Pa., Erie, Pa., Cincinnati, O., Richmond, Va., Providence, R. I., and N. Y. City. Last winter, social reunions were held at their N. Y. house, which were attended by ladies and gentlemen, but no formal papers were read. The practice will be resumed this month. The spring meeting is to be held in San Francisco.

The American Institute of Mining Engineers, headquarters, N. Y. City, also holds two meetings per year, usually outside of New York City. Meetings have been held during the past three years at Washington, D. C., N. Y. City, Cleveland, O., and Glen Summit, Pa.

I have given very careful attention to the practice of other societies, and have attended many of their meetings, and so far as the character of papers is concerned, the interest in the meetings, and the participation in discussions, it appears to me that the meetings of the institute as now conducted are equal to, and in some respects superior to those held by the societies named.

In a large country like this, it appears to me practically impossible to hold meetings in different parts of the country which will satisfactorily accommodate every section, especially when they are held no oftener than once or twice a year. As a matter of fact there are usually a regular quota of members who attend these meetings wherever they may be held, while others are present who may live in the immediate vicinity.

The above societies are organized upon practically the same lines as the American Institute of Electrical Engineers.

The American Institute of Architects, now a national body, has local chapters in various cities.

In general engineering, local societies have been formed which are virtually independent of any national body. Some of these, as the Engineers' Club of Philadelphia, print their proceedings. Those at Boston, St. Louis, Chicago, Cleveland, Minneapolis, St. Paul and Kansas City unite in printing their proceedings in a monthly issue similar to our own.

The plan I would suggest to the institute has in view the following points:

1. That all meetings held should be regular meetings of the institute.
2. That the papers and discussions should be printed in the Transactions.
3. That the meetings be held at such dates as not to conflict with each other. Not oftener than once a month.
4. That they be held only in such cities as have a specified number of members.
5. That they be inaugurated gradually in order that the failure of the plan would not react upon the prosperity of the institute.
6. That so far as possible a vice-president be placed on the board to represent each city where such meetings are held.
7. That a paid local secretary be appointed to look after the details of meetings and applications for membership.

There are other details to be provided for, which it is unnecessary to consider at this time. I would recommend the advisability of holding meetings at Boston and Philadelphia, to alternate with those held in New York City. It is my impression that the standing of the institute is such that it would give a character to these meetings such as they would not attain as meetings of a mere local society; that any extra expense incurred would be met by an increase in membership; that the members we now have in those cities would form a nucleus which would assure the attendance of a sufficient number to give interest to the proceedings.

It would doubtless be advisable at the outset to invite all persons interested in electrical matters whose names could be secured, and let it be understood that the meetings were to be supported by the institute and continued if sufficient local interest was shown in the plan. It might also be well to announce that upon the securing of a certain number of members in a city, meetings would be held as frequently as might be thought advisable.

I respectfully recommend this subject to the consideration of Council.

Very respectfully yours,
RALPH W. POPE, *Secretary.*

PHILADELPHIA ELECTRIC CLUB.

A movement is on foot in Philadelphia with a view of organizing and establishing an electric club in that city. Several gentlemen engaged in the electrical trade are in favor of such a society, which they think would be of great benefit to the trade in general. As yet the society has not assumed definite shape, but judging from the feeling that exists there is no doubt but what an organization of this character will come into existence very shortly.

With a view to ascertaining the sentiment in the electrical trade in Philadelphia we have obtained a few expressions of opinion on the subject from several well-known individuals and firms. These opinions, briefly stated, are as follows:

Mr. Pedro F. Salom, Secretary of the Consolidated Electric Storage Company, thinks that "the organization of an electrical society in our city would be of great advantage to the electrical fraternity, not only here but elsewhere."

J. W. Queen & Co.: "Judging from the success of similar organizations in New York and Chicago, we should think that something of the sort would be an excellent medium for generating and sustaining a friendly feeling among those interested in electrical matters here."

Otis K. Stuart, dealer in electrical supplies: "An electric club, in my opinion, can have any one or all of the following reasons for existing, but if none of these exist, then neither should the club: 1. The mutual interchange of opinions and information amongst the electrical men of a community. 2. The social intercourse of the members of various branches of the business. 3. The entertainment of out-of-town electrical men while in the community."

H. M. Sciple & Co.: "We think it would be a grand scheme, as it would bring the electrical people much nearer to each other, and views could be exchanged which would be beneficial to every one, and our best interests would be promoted."

G. H. Fisher, Philadelphia agent of Charles A. Schieren & Co., the well-known belt-makers of New

(*Continued on page* 56.)

* Holtzer-Cabot Electric Co., Boston.

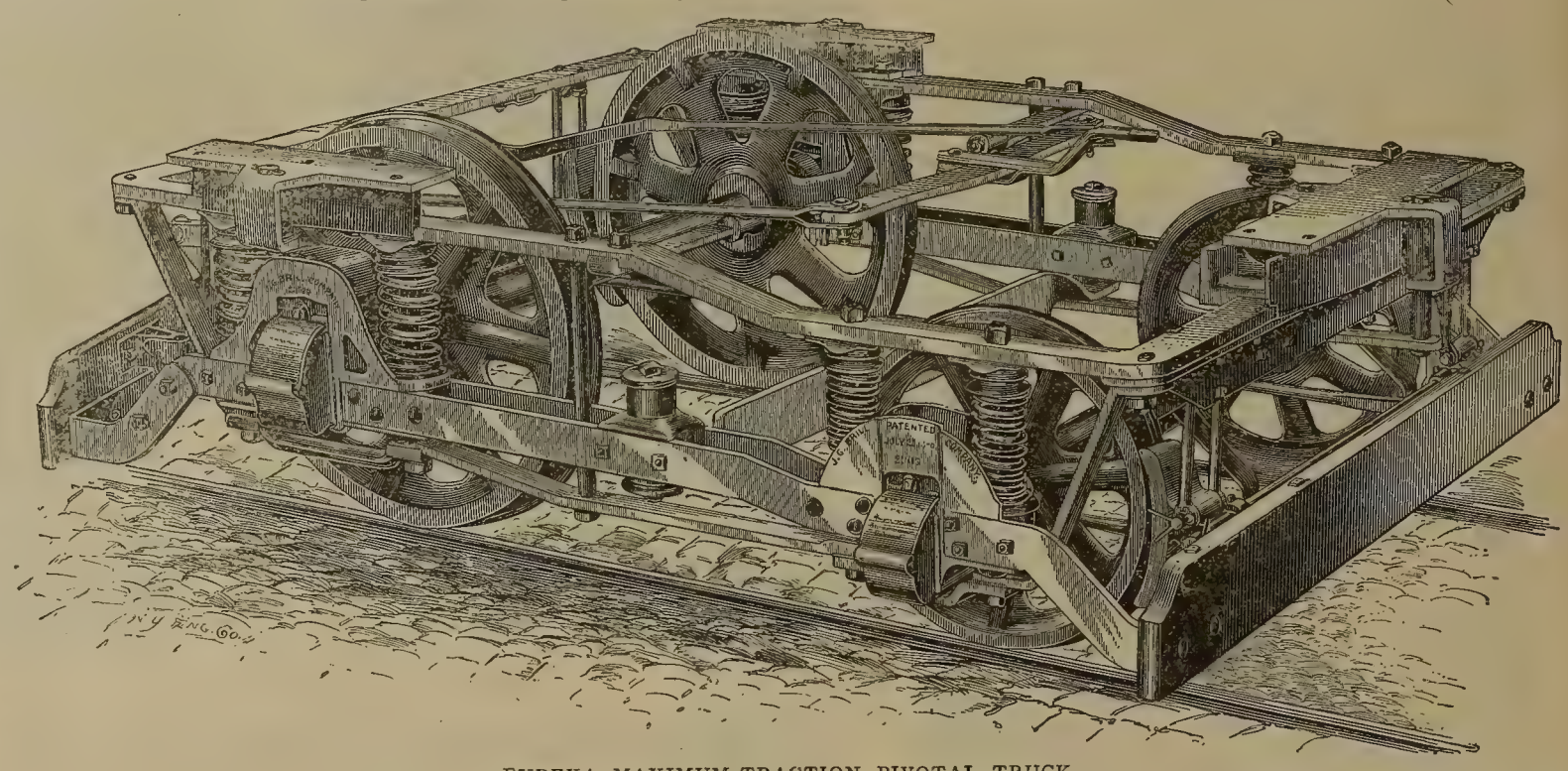
EUREKA MAXIMUM-TRACTION PIVOTAL TRUCK.*

The Maximum-Traction Truck of John A. Brill for electric car propulsion is claimed to be the greatest invention ever made in pivotal trucks. In it all of the disadvantages of other pivotal trucks were overcome and a gain made of 42½ per cent. in traction; a reduction in height of car body ten inches, and thus the necessity for double steps was obviated; a shortening of wheel base and also reducing the amount of power required by as high as 30 per cent. The only objectionable feature, and not a serious objection, was that the pivotal centre or drawing point which came over the axle was in the way in removing the motor and had to be taken off, which trouble was solved by use of the movable spider.

But being the pioneers and still leading the van in the great field of electric trucks this company determined not to stop in improving until it had approached more nearly to perfection. This point it claims to have reached in its new model, appropriately named the Eureka Maximum-Traction Truck.

In this truck the above-named objection has been overcome. It has no mechanical pivot, and is especially adapted for the "water-proof" and "iron-clad" types of motors which have their upper portion hinged so that they can be raised when it is necessary to get at the armature or other parts of the motor. The space above that occupied by the motor is free and clear, so that when the trap-doors in the car are raised the whole of the motor can be reached and the armature taken out without removing or disturbing any part of the truck. A further reduction of height of the car is obtained to the extent of one and a half inches, and the weight of the truck reduced by 150 pounds.

The pivoting in this truck is accomplished by the combination of rollers on the side of the rub plates on the upper part of the truck. The drawing (draught) of the truck and car body is done from the small end of the truck, and this feature affords additional means of keeping the small wheels from climbing the rails. Since the introduction of the Maximum-Traction Truck several hundreds of them have been sold and are in operation.



EUREKA MAXIMUM-TRACTION PIVOTAL TRUCK.

ELECTRIC POWER IN THE MAIL SERVICE.

Postmaster Collins, of Brooklyn, is making an effort to establish some system by which the mails between New York and Brooklyn may be transferred with greater rapidity, and from all reports it looks as if success will result. As a step in this direction a bill making an appropriation for improving the mail service between the cities of Brooklyn and New York was introduced in the National House of Representatives on the 18th inst. The following is the text of the bill:

"For the purpose of facilitating the rapid transmission of mail matter between the cities of Brooklyn and New York, the Postmaster-General be, and hereby is, authorized to have constructed such route as will meet all requirements of the service, whether by pneumatic tubes, electrical or other appliances; and for the purpose of such construction as the Postmaster-General may designate the sum of $95,000, or so much thereof as is necessary, be, and hereby is, appropriated out of any money in the Treasury not otherwise appropriated, which shall be expended under the direction of the Postmaster-General."

Postmaster Collins' idea is to send the mails through tubes on the elevated railroad structures throughout the city, and to use a square tube 14 x 16 inches in size, to convey the mail matter across the Bridge. It is proposed in this system to use a diminutive trolley to propel a small car, with a carrying capacity equal to that of an ordinary mail bag.

We acknowledge the receipt from the American Electrical Works, Providence, R. I., of a copy of its elegant souvenir of the National Electric Light Association Convention in Montreal last September. This souvenir is in the shape of a photograph of a group of prominent gentlemen in attendance at the Convention. Many well-known faces are seen in the group.

* J. G. Brill Co., Philadelphia, Pa.

LAST YEAR'S BUSINESS.

During the year of 1891 the Thomson-Houston Electric Company installed in the United States 63 new electric railways. Among the largest were: The City Passenger Railway Company, Altoona, Pa., 8 cars, 6 miles of track; City Electric Railway Company, Little Rock, Ark., 28 cars; Minneapolis, Minn., Street Railway Company, 66 cars and 20 miles of track; Buffalo, N. Y., Street Railway Company, 49 cars and 48 miles of track; Atlanta, Ga., Street Railway Company, 28 cars and 17 miles of track; Birmingham, Ala., Railway and Electric Company, 24 cars and 15 miles; San Francisco and St. Mateo Street Railway Company, San Francisco, Cal., 30 cars and 30 miles; Worcester, Leicester and Spencer, Mass., Railway Company, 10 cars, 12 miles; St. Louis and Suburban Railway Company, St. Louis, Mo., 45 cars, 28 miles, and Oakland and Berkeley Rapid Transit Company, Oakland, Cal., 8 cars, 12 miles. The Thomson-Houston Company has orders for five hundred 25 horse-power water-proof street-railway motors unfilled.

PRODUCING IRON BY THE AID OF ELECTRICITY.

It is reported in Westphalia, says *Iron*, that the experiments of several experts have resulted in the invention of a process of manufacturing pig iron which will revolutionize the iron industry. The simultaneous application of the electric current and the use of an easily made acid for extracting the iron from the ore are said to be the chief characteristics of the new method. The experiments were confined to the raw material forming the blast-furnace charge, and are said to have proved completely successful, the separation of all metallic substances being rapidly and perfectly effected, and the iron left in an absolutely pure condition. The process is stated to be 80 per cent. cheaper than the present blast-furnace method. The invention has been patented in all countries, and it is proposed to form a company with a capital of 50,000,000 marks ($12,500,000).

INCORPORATION LAW IN NEW YORK STATE.

For the information of those contemplating the organization of companies in New York State to engage in electrical pursuits, or in business involving the use of electricity, we give below the text of the amendment to chapter 564, laws of 1890, which has become a law:

Sec. 1. Section 30 of chapter 564 of the laws of 1890, entitled "An Act in relation to stock corporations, constituting chapter 38 of the general laws," is hereby amended so as to read as follows:

Sec. 30. *Annual Report.*—Every stock corporation, except moneyed and railroad corporations, shall annually, during the month of January, or if doing business without the United States, before the 1st day of May, make a report as of the 1st day of January, which shall state: (1.) The amount of its capital stock and the proportion actually paid in. (2.) In general terms, the nature of its existing assets and debts. (3.) The amount of its debts or an amount which they shall not exceed. (4.) The amount of its assets or an amount which its assets shall at least equal. (5.) The names of its then stockholders. Such report shall be signed by a majority of its directors, and verified by the oath of the President or Vice-President and Treasurer or Secretary, and filed in the office of the Secretary of State, and in the office of the County Clerk of the county where its principal business office may be located. If such report is not so made and filed, all the directors of the corporation shall jointly and severally be personally liable for all the debts of the corporation then existing, and for all contracted before such report shall be made. No director shall be liable for the failure to make and file such report if he shall file with the Secretary of State, within thirty days after the 1st day of January, or the 1st day of April, as the case may be, a verified certificate, stating that he has endeavored to have such report made and filed, and that the officers or a majority of the directors have refused and neglected to make and file the same, and shall append to such certificate a report containing the items required to be stated in such annual report, so far as they are within his knowledge or are obtainable from sources of information open to him, and verified by him to be true to the best of his knowledge, information and belief.

Sec. 2. This act shall take effect immediately.

ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.

All the preparations for the Electrical Exhibition at the Crystal Palace, London, show the importance attached to it in the electrical world. The screen in process of erection right across the end of the North Nave is expected to have a marvellous effect with its ten thousand colored incandescent lamps, arranged in the design of a fountain, which will be lit up by an elaborate system of switching. The Post-Office has brought from South Kensington a number of its most interesting specimens of instruments used in the public telegraphic service during the last fifty years, while the great firms of Siemens, the Brush Company, and Crompton's have set up immense installations, exhibiting in full work all the various forms of applying electricity to lighting, motive-power and traction. One of the most interesting features of this exhibition as showing the development of telephone enterprise, will be the concert-room of the National Telephone Company, where, on payment of a small fee, the public will have the opportunity of listening to the music which is being performed at theatres in London, Birmingham, Manchester and Liverpool.

NOTES ON POWER PLANTS.

Westinghouse, Church, Kerr & Co. have just issued a neatly gotten-up pamphlet entitled "Notes on Power Plants for Electric Railways, Electric Lighting, etc." The information contained in these notes will no doubt be found very valuable to operators of plants of these classes. The pamphlet was gotten up in response to an imperative demand for something of this character. These notes are not put forth, however, as being complete, and it is the intention of the firm to prepare a careful digest of the most intelligent practice in the department of engineering. In the meantime the firm hopes that the contents of the pamphlet, which outline facts of vital importance to the investor, shall receive careful attention.

STRENGTH OF IRON AND STEEL POLES FOR STREET-RAILWAY WORK.*

It has long been a question among engineers building electrical street railways as to what is the best form of pole to use, giving the greatest strength and least deflection. The question of strength and deflection are of the greatest importance, for the reason if the trolley and guard wires are not tight and are not kept tight they will sag, and not only become dangerous but will need constant attention. What is wanted is a pole that will act like a bow or spring, and keep a tension on the line at all times and of sufficient amount to hold the trolley and guard wires in position at a fixed height above the tracks. A pole which at first may seem strong enough, but which is strained beyond its elastic limit, will bend and continue to bend after each adjustment, when sooner or later the pole will fail entirely and come down. People who are owners of street railways and who are not directly acquainted with the amount expended for adjustment of improperly constructed line work, would be surprised at the sum. It is a well-known fact that there are roads to-day that would pay dividends which do not, owing to the fact that their line construction is either cheap or is put up carelessly by persons who do not understand their business. With this idea in view, this firm has sought to establish, by careful tests, the relative strength of various poles, and to see if possible any improvements that they could make on their poles. The tests were made by Prof. R. H. Thurston, Director of Cornell University at Ithaca, N. Y.

The first tests were made on February 2, 1891, on a side pole as first made by Milliken Bros., *i.e.*, with the lacing in the centre extending only to a tie-plate at ground level.

The tests showed that the strain revolved around the tie-plate at ground level and buckled the segments. It proved that by continuing the lacing to the butt of the pole and filling same with concrete, that the pole would develop considerably more strength and at the same time add little to its cost. This form of construction was therefore adopted for standard work. In order to get at the exact strength, and to compare them with other poles, 5 Milliken poles and 3 pipe poles were furnished to Cornell University for testing, and they furnished a chestnut pole. The following is an extract from the report of the test, dated June 24, 1891:

REPORT OF TESTS OF SEVERAL BUILT-UP IRON POLES DESIGNED FOR ELECTRIC STREET-RAILWAY SERVICE.

The object of the tests was to determine the behavior of the said poles when subjected to a pull at the end in a direction normal to the axis of the pole and of sufficient magnitude to cause permanent deformation or "set."

The poles for this test were furnished to the department by Milliken Bros., of New York City, and were as follows: 5 Milliken poles, 3 pipe poles.

These poles are generally used in pairs, on opposite sides of a street, as supports for "span wires," and are subjected in service to transverse stress of amount equal to the tension in the span wire.

The Milliken poles were of the same general type as that tested and reported previously by the Department for Milliken Bros., but differed among themselves in weight and the arrangement of the "lacing" and the various "gusset-plates" used in the construction.

No. I., like pole previously tested, but without the gusset-plate at the surface of the ground. Nos. II., III. and IV. measure a foot shorter than No. I. from the middle gusset-plate to the top.

The "pipe" poles are made by uniting three sections of steam or hydraulic pipe of different sizes, telescope fashion. The joints are made in two ways according to the relative sizes of the pipes jointed; (*a*) by shrinking or forcing the large over the smaller, or (*b*) by driving a "liner" of proper thickness into the annular space between the two pipes.

The method of test adopted was that described in the previous report, except that the legs of the tripod rested on these platform scales, thus giving a direct measure of the force exerted in bending the poles. With this arrangement the scale-beam of the anchor machine was used only as an indicator in applying the load, it being impossible to cause the beams of the three small scales to tip in unison. The final recorded load was in each case the sum of the three weights, less the combined predetermined tare.



VIEW SHOWING MILLIKEN POLES MARKED 0, 1, 2, AFTER TEST.

Poles numbered I., II., III., IV., and A, B, were tested in this manner. An attempt was made to test No. V. in like manner, but the capacity of the chair block and that of the testing machine used as anchor were reached before permanent deformation of the pole could be produced.

No. V. was then placed in a larger machine as anchor, and was bent by a hydraulic jack acting against the "boss" on the cap of the pole through which the eye-bolt passes, by means of a piece of gas-pipe of proper size. The jack was placed on the testing machine used in the previous tests, which thus served to weight the force exerted in bending the pole. The first attempt to bend the pole with this arrangement did not prove successful, but a slight change in the disposition of the anchor machine overcame the difficulty, and the pole was finally "set."

Poles I., III., IV., and A, B, C were tested as received. Poles II. and V. were filled in with Portland cement from the butt to a point of 6′ from the butt. In all of the poles the unsupported length was from the eye to a point 6′ from the butt. This point was the ground line. Pole C was received while test on V. was in progress, and was, as a matter of convenience, placed in the machine used to hold V., and tested in a like manner. At the conclusion of the above tests a chestnut telegraph pole about 30′ long over all was tested to rupture in the same apparatus used for V. and C.

The data of the several tests were taken by Messrs. Jenkins, Kress and MacGregor, students, under the supervision of Prof. R. C. Carpenter. From the data curves have been plotted from which the elastic limits were taken and recorded in tabular form in a separate sheet.

Pole No. II. the elastic limit was 1,540 lbs.; corresponding deflection, 10″.

Pole No. V. the elastic limit was 3,340 lbs.; corresponding deflection, 14″.

Pole No. A the elastic limit was 675 lbs.; corresponding deflection, 12.2″.

Pole No. B the elastic limit was 920 lbs.; corresponding deflection, 16.5″.

Pole No. C the elastic limit was 1,420 lbs.; corresponding deflection, 13.6″.

Pole Chestnut the elastic limit was 960 lbs.; corresponding deflection, 37″.

"When tested to destruction, Pole No. II. broke by fracture of segments about 1′ 8″ in front of fulcrum. The segments were fairly pulled in two; plane of fracture at right angles to axis. Pole V. gave a slight permanent set at fulcrum, preceded by cracking of cement near fulcrum. All pipe poles bent in second joint from one foot to three feet ahead of first joint or section of pipe. Chestnut pole yielded by opening slightly on under side, near fulcrum."

Referring to the tests, the pipe pole marked "A" is what is known as a 5″, 4″ and 3″ standard weight pipe, and is now not generally used in street-railway work, as it is too light. Pole marked "B" is what is known as a 6″, 5″ and 4″ standard weight pipe, and is the one generally used in side-pole construction of street railways. Pole marked "C" is what is known as a 6″, 5″ and 4″ extra strong pipe pole, and is used for pull-off poles. A graphic chart shows to the eye the advantage of the Milliken Standard Side Pole, as well as that for the pull-off. Further it will be noted that the Milliken Side Pole is even stronger by 120 pounds than the extra heavy pipe pole, and the deflection of which is over 30 per cent. more than the Milliken. The Milliken Standard Side is 620 pounds stronger than the standard side pipe pole, and the deflection of the pipe is 65 per cent. more than the Milliken.



VIEW SHOWING PIPE POLES MARKED A, B, C, AFTER TEST.

The Milliken Pull-off Pole is 2⅓ times as strong as the pipe pull-off pole, and the deflection of same only measures $\frac{4}{10}$ of an inch more. This shows how far superior the Milliken Pole is, not only as regards absolute strength, but stiffness. The joints are, without question, the failing point in the pipe pole. The loads are all taken at the elastic limit, and are not the breaking loads.

The conclusions deducted from experiments are best stated in Prof. Carpenter's own words, which are as follows (referring to the Milliken Standard Pole): "We now have a pole as of as nearly homogeneous

* Milliken Bros., New York.

structure as possible, and for a given weight of iron of maximum strength." Referring to the Milliken Pull-off Pole, he states: "I reiterate my statement that the pole is stronger than can possibly be required for any work ordinarily connected with the carrying of wires."

THE TROLLEY RESOLUTIONS BECOME LAW.

Mayor Boody, of Brooklyn, permitted the trolley resolutions to become a law on Jan. 23, by not taking any action upon them. In explanation of his position in the matter Mayor Boody said:

"I do not consider it my duty to take any further action in the matter. I have once vetoed the resolutions, and they have been passed over my veto, with only two dissenting votes. I have, since they came before me the second time, done all that was possible to ascertain the workings of this system in other cities and to learn the wishes of our own citizens.

"Such information as I have gained has thrown no new light of importance upon the subject, and no new reason for action appears, so far as I am able to see. And the fact that the question rests with the State Railroad Commissioners is an important factor in the consideration of this subject. Another veto of the resolutions might easily be regarded as simply a useless obstruction to the inevitable; therefore, I have come to the conclusion that there is nothing for me to do beyond what I have already done in the premises."

It is reported that the engineers are now preparing plans for the changing of the Atlantic Avenue Railroad to the electric system.

ELECTRICAL SOCIETIES.

(*Continued from page* 53.)

York, says he "personally believes that there is a very broad field for such an organization here, and having heard some ideas suggested as to such a club, have made inquiries among friends associated with electrical industries, and find them all heartily in accord with such a project."

W. S. Griffith & Co.: "We believe it will be of great benefit to the electrical fraternity, not only from a social point of view but also for business. We have long recognized the necessity for an organization of that kind here, and have been waiting to have the matter taken up by some of the leading gentlemen connected with the business."

M. S. Shapleigh, agent of the Electrical Supply Company, Chicago: "I consider that the organization of an electrical society in Philadelphia would be a great benefit to those interested in electrical matters."

A. H. Chadbourne, of the Thomson-Houston Company, is "heartily in favor of the organization. * * * Let us have an electric club, where we can all get together, discuss subjects of mutual interest, meet our friends, make new ones, and so broaden our lives that we can keep pace with the growth of the electric business."

Henry B. Cutter is of the opinion "that a society of electricians properly organized and constituted would be a great source of benefit as well as pleasure to the electrical fraternity here."

James J. Murrray & Company: "We would be glad to see the electrical people of this city organize a society. * * * With the present large proportions of the electrical industries in this city, and the certain steady growth, we see no reason why a sufficient number could not be interested in the movement to make it a success."

J. G. Brill Company: "No doubt it would be of great benefit to the electrical trade."

Camden Thread Company: "We are heartily in favor of it, and will be among the first subscribers.

Vallee Bros. & Co.: "We desire to express our approval of the formation of an electrical club in this city, as such an organization, if properly established, would be a great benefit to the electrical fraternity and a credit to the city we represent."

On the 20th inst. about a dozen persons met at a prominent electrical establishment and chose 50 gentlemen prominently connected with the electrical industry and educational institutions to act as a committee on organization with a view to the establishment of a club. Another meeting will be held on Thursday, January 28. There is a committee of 12, which is working zealously for the organization of the club, and there is no doubt but that the society will soon be one of fact.

CLEVELAND ELECTRIC CLUB.

The Electric Club, of Cleveland, Ohio, opened its new and elegant rooms in the new Gas Building on January 5, last. On this occasion a large crowd was present, which admired the elegant appointments of the club's quarters. This organization starts out under most favorable auspices; it is free from all debt and has money in the treasury. On the opening night Mr. C. W. Wason, the treasurer of the club, gave an elegant banquet in the club-rooms, entirely at his own expense. Great enthusiasm prevailed, and the affair was a success. The officers are: C. W. Foote, President; C. W. Wason, Treasurer, and S. D. Nesmith, Secretary. The membership of the club is rapidly increasing, and it bids fair to rival like clubs in larger cities.

THE PITTSBURG ELECTRIC CLUB.

President Morris W. Mead, of the Pittsburg Electric Club, has appointed the following committees for the government of the club. House Committee: N. H. Byam, Chairman, H. F. Albright and F. H. Ketchum. Entertainment Committee: E. H. Heinrichs, Chairman, W. MaC. Ramsey and E. B. Thompson. Membership Committee: John Campbell, Chairman, D. W. Dunn and H. McL. Harding. At a recent meeting of the Board of Directors, Mr. Ernest H. Heinrichs, of the Westinghouse Electric and Manufacturing Co., was elected Librarian and Historian of the club.

NOVELTIES IN LAMPS.

Mr. J. L. Somoff, of No. 1 Ann street, New York City, is out with the second part of his lamp catalogue, which contains a number of styles of fancy incandescent lamps of low voltage.

The demand for such lamps is steadily growing, and the after-Christmas trade is as brisk as it was in December.

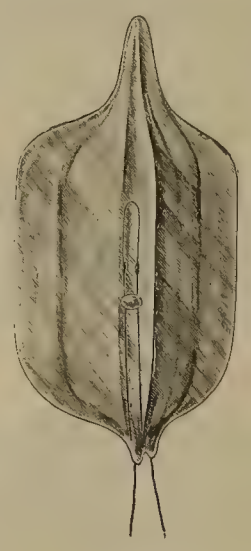


FIG. 1.

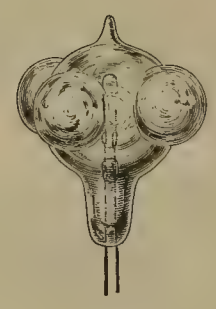


FIG. 2.



FIG. 10.

There are many wealthy residents in New York and other cities who, not satisfied with the existing pear-shaped lamps, of 16 C. P., have been importing fancy lamps from Germany and France. Many of them have now placed large orders with Mr. Somoff for his lamps, and much attention is paid in selecting proper styles.

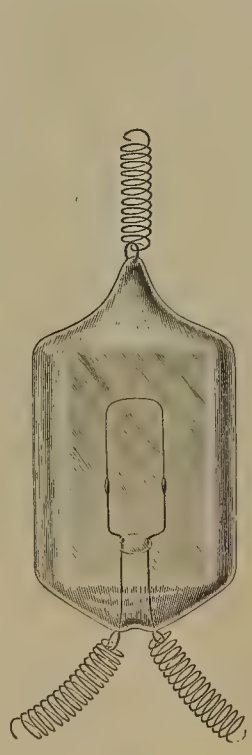


FIG. 3.



FIG. 4.

We illustrate some of these novel lamps.

Fig. 1 is one of the "Prisme" lamps, mounted upon a chandelier and lit. This lamp produces a most beautiful display of rainbow colors. The effect is incomparably superior to that of the prisms suspended from a gas chandelier.

A "Torch" lamp (Fig. 2) is another one, also designed by Mr. Somoff, for purposes of theatrical display, etc. It has four lenses fused on to it and all the surface around them is frosted. The effect of this combination of a true spheroidal form of the globe with frosting and lenses is to project the light



FIG. 5.

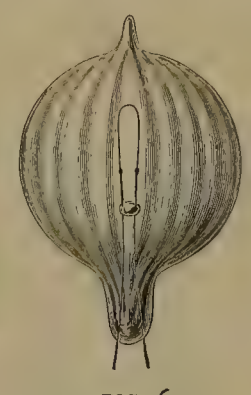


FIG. 6.



FIG. 8.



FIG. 9.

in the form of four condensed beams. Last December 450 of these lamps were shipped to the order of a theatrical company to be used in the production upon European stages of the opera "Robert le Diable." The lamps were mounted on torches, which contained small storage batteries. Little vanes at the bases of the lamps revolved with the least motion of the air and revolved the lamps, the beams of light striking in every direction. This lamp is also most suitable for models of the Statue of Liberty lighthouse, and for locomotives, as head-lights, etc.

Fig. 3 is a "Lantern" lamp, English pattern. The storage-battery lanterns as made and extensively used in England and in large numbers imported into the U. S. have a very shallow reflector and the bull's eye quite close to it. There is no room for any other but a flat lamp. The lamp is suspended from three springs, two of which constitute the terminals. This method of mounting lamps in lanterns, is, as practice shows, to be far preferred to any other.



FIG. 11.

Fig. 4 shows a "Candle" lamp, the design of Mr. A. de Khotinsky, of Berlin. A large number of them are yearly imported into the United States to the order of some wealthy New Yorkers. Mr. Somoff adopted this style to supply the growing local demand, as the new protective tariff makes importation of them expensive.

Fig. 5 is a "Miniature Candle" lamp whose globe is of corrugated and gently twisted glass.

Fig. 6 represents a "Corrugated Sphere" lamp, the corrugations of the globe producing a singular and pleasing effect of distorting the rays of light. This lamp is also made with the channels of the globe plated with silver, so that it presents a large number of alternate strips of crystal glass and mirrors, and looks as if thousands of filaments are enclosed within the globe.

Fig. 7 is a miniature wall bracket, one-third actual size. Until the present time there were no brackets on the market suitable for miniature lamps; and it was a difficult job to attach them, especially those intended for artistic display, in a way that insures the best artistic effect. The bracket is cheap, simple, neat and effective.

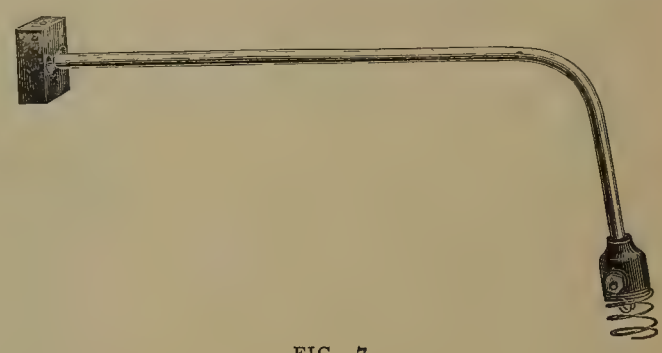


FIG. 7.

Figs. 8 and 9 are "Striped" lamps, the stripe being alternately red, blue, milk-white and crystal. These lamps are especially suitable for flower bouquets, flower baskets and flower decorations in general. Placed in the centre of a flower the lamps assume the color of the latter, the colored stripes greatly adding to the effect.

Fig. 10 is a surgical lamp of English design. For its neat shape and effect, which all incandescent lamps of very small size have upon people of limited electrical knowledge, it is rightfully called by the English a "Fairy" lamp.

Fig. 11 is an antiseptic surgical lamp, which, since a year ago, came into very extensive demand by physicians and hospitals, principally those for infectious diseases. It is made wholly of glass; the part surrounding the filament of crystal, and the rest, serving as handle, of opaque, milk-white glass. Any uncleanliness that might prove infectious, can thus easily be seen and washed off with water or acids.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Secretary Porter, of the National Electric Light Association, is sending out a letter to central stations throughout the country which are not members, urging them to join the association. The following is a copy of the letter:

"Gentlemen: Great interest is being taken in the coming fifteenth convention of this association, to be held in Buffalo, N. Y., February 23, 24 and 25 next. Knowing you to be interested in central-station management, I take the liberty of calling your attention to the great benefits accruing from attending these meeetings.

"The papers to be read at Buffalo are from men high in the science, and will treat on every valuable subject from 'How to Fire a Steam Boiler' to 'Electric Lighting from a Financial Standpoint,' including the Steam-Engine, Dynamo, Switchboards, Overhead and Underground Wiring, Motors, etc.

"We would be pleased to enroll you among our already large membership, and hope to welcome your representative at Buffalo.

"Very respectfully,

"GEORGE F. PORTER, *Secretary.*"

C. R. Huntley, President of the National Electric Light Association, states that it is very probable that at the Buffalo meeting in February it will be voted to discontinue the mid-summer meetings of the association, and that only annual instead of semi-annual meetings will be held thereafter. The constitution declares that the association shall have its annual meeting in February, and a meeting *may* be held in August. It therefore rests with the meeting to adjourn until the following February.

There will be no extensive display or exhibit at this convention, but all the parlors in the Iroquois have been engaged, and many light samples of goods will be shown in these.

New York Central road will undoubtedly be selected, and a day run made with a special train from New York to Buffalo with convention delegates. At Albany a Boston coach will be attached to the train.

A Western man will without doubt be selected as the next President. The West is now entitled to recognition, and will surely receive the same by both securing the next convention and the President.

ELECTRIC LIGHT STATION BURNED.

The Ferdinand Street station of the Boston Electric Light Company was destroyed by fire on the morning of January 23. The property destroyed included twenty-four dynamos, five 150 H. P. engines, one 100 H. P. engine and one 300 H. P. engine. The fire was so intense that the main floor fell within ten minutes after it broke out, carrying with it all the valuable machinery. The loss is estimated at $150,000.

QUICK WORK.

During the late storm which prostrated the wires of the electric light companies on First avenue and elsewhere in this city the Safety Insulated Wire and Cable Company of New York did some phenomenally quick work in filling orders for lead-covered cables to replace the pole wires. Orders aggregating several hundred thousand feet were received from the Manhattan Electric Light Company, Mount Morris Electric Light Company, East River Electric Light Company, and the United Electric Light and Power Company.

By running its factory until midnight the company was enabled to keep all these companies continuously busy in their underground construction until the whole work was completed.

NEW INCORPORATIONS.

Clinton County Electric Light, Heat and Power Company, Lock Haven, Pa., was incorporated January 14, with a capital stock of $25,000. Incorporators: Charles M. Blanchard, Philadelphia; Charles M. O'Connor, E. B. Shoemaker, both of Lock Haven, Pa.

The Amethyst Water Works and Electric Light Company, Monte Vista, Col., was incorporated January 18, with a capital stock of $100,000. Incorporators: George P. Wilson, Edward E. Eversole, W. B. Manderville, Eugene J. Renner, John McArthur, John Hecker, J. D. Mahen, W. W. Reilly, George W. Southery and Thomas Eversole.

The Waterloo-Cedar Falls Construction Company, Waterloo, Ia., was incorporated January 20, with a capital stock of $200,000, to build an electric railway between Waterloo and Cedar Falls. Incorporators: D. B. Lyons, G. S. Polk, W. E. Stotts, W. T. R. Humphrey, all of Des Moines, Ia.

The Salem Electric Light and Artificial Ice Company, Salem, Washington Co., Ind., was incorporated January 20, with a capital stock of $15,000. Incorporators: C. C. Hauger, D. H. Cravens and Leo E. Sinclair.

CONTRACT VOID.

The Court of Appeals in Montreal rendered an opinion a few days ago declaring illegal the contract which the Northwestern Telegraph Company prints on its message blanks. The case was a suit against the telegraph company brought by Lionel Laurence, who, through an error in a dispatch received in New York, was compelled to make an unnecessary trip to Montreal, and sued the telegraph company for $200 damages. The first court awarded $30 damages, but the company appealed from this decision. The appellant set up the plea that the dispatch was sent under the contract, but the court declared the contract on the message blanks to be contrary to public policy and was illegal. The judgment was confirmed.

ROCKLAND'S NEW ELECTRIC LIGHT PLANT.

An electric light plant has just been completed at Rockland, Mass., to furnish light for Rockland and Abington.

The main building, which is 115 x 50 feet, is of brick, with a gravel roof. There are two rooms, an engine-room, 66 x 48 feet, and a boiler-room, 45 x 42 feet. In the engine-room are two engines, a McIntosh & Seymour of 250 horse-power and a Ball of 125 horse-power. Two dynamos furnish the power, one a 650-light Thomson-Houston, and the other a Thomson-Houston arc dynamo. The chimney of the building is 100 feet high. The office and store-room of the company is located near the main building.

A third dynamo has been ordered, as more current is required. Over 2,000 incandescent lamps have been ordered, and are placed as follows: Abington, 500; North Abington, 300; Rockland, 1,200. There are 22 arc lights, located as follows: North Abington, 5; Abington, 7; Rockland, 10. Over 600 poles have been set and about twenty miles of wire strung.

The capital stock of the company is $40,000, which was raised by subscription. The officers of the company are: President, E. P. Reed, North Abington; Secretary and Treasurer, George W. Kelley, Rockland; Superintendent, William Davis; Superintendent of Lines, Frank L. McKinney; Engineer, Lewis McCarthy; Foreman, Frank Moriarty. The lights were first turned on at 3:25 P.M., December 24. No charge will be made for street lighting until the annual town meeting, when it is hoped that the towns will take some action upon the matter.

ANSWERS TO INQUIRIES.

Is there any physical change in a steel bar when it is magnetized? W. H. A., ALBANY, N. Y.

A steel bar becomes slightly elongated when magnetized, and its other dimensions are correspondingly reduced—that is, it becomes slightly thinner. This is supposed to be due to the fact that under the magnetic influence the molecules of the metal are arranged end to end with reference to each other. When in their natural condition, or unmagnetized, the molecules are supposed to lie in all directions, and consequently occupy greater space than when their lengths are arranged in an orderly manner.

What is the principle of the construction of the Cardew voltmeter, and is it adapted to the measurement of alternating as well as direct currents?

J. H. S., ELIZABETH, N. J.

The principle of the Cardew voltmeter is the expansion of metal by heat. A long wire is used, which becomes heated by the passage of the electric current, and the consequent expansion is measured on a dial. When the instrument is calibrated the readings on the dial indicate the strength of the current. This instrument measures both direct and alternating currents, since both develop heat in a wire.

What is the reason for the apparent increase of energy in a partly discharged accumulator after it has lain idle for a brief period? I have often noticed this phenomenon in using my cells and cannot account for it. R. M. S., YONKERS, N. Y.

This action of accumulators is accounted for on the hypothesis that when the discharge is rapid some of the sulphate formed on the anode from the dioxide is reconverted into dioxide by the excess of oxygen developed, producing a proportional reduction of potential difference between the plates, and that during a short repose this dioxide is again reduced to sulphate and the potential difference is restored.

There is some difference of opinion among several students of electricity here as to the action of the carbon button in the Blake telephone transmitter in the production of currents. Can you enlighten us? Also please inform me if the Blake transmitter is used on long-distance telephone lines, and what kind and size of wire is generally used for long-distance lines. H. M., SPRINGFIELD, ILL.

Heat reduces the electrical resistance of carbon, and it is believed that the variation of heat generation in the carbon produced by the variation of pressure due to the loose contacts, produces a corresponding variation of resistance and hence of current strength. The Hunning transmitter is used on long-distance lines, not the Blake. No. 12 copper wire is used for long-distance telephone lines.

I have read recently that Page, as far back as 1851, had an electric railroad in operation in this country. Will you kindly inform me where it was and what he accomplished?

T. W. S., BATON ROUGE, LA.

In that year Page propelled a car on the Washington and Baltimore Railroad at a maximum speed of 19 miles an hour with a 16 H. P. motor of his own construction and a grove battery of 100 cells.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Jan. 23, 1892.

F. W. CUSHING, of the Central Electric Company, Chicago, Ill., was in town this week.

AMONG the callers at the ELECTRICAL AGE office during the past few days were Col. L. W. Burnham, of the Electric Gas Lighting Company, Boston, and A. P. Brayton, Jr., General Manager of the Pelton Water Wheel Company, New York and San Francisco.

COBB, DANBY & KNOTT, the well-known electrical engineers and contractors, Electrical Exchange, 136 Liberty street, have secured the agency for Riker electric motors, Hart's switches, and other specialties, and for C. D. K. line wire and railroad supplies.

THE ALUMINUM BRASS AND BRONZE COMPANY, Bridgeport, Conn., and 53 Chambers street, city, reports large sales of its well-known Silicon-Bronze span wire for electric railroads. Its new grade of wire No. 2 is taking well with street-railway people. It is sold at an extremely reasonable figure, as its conductivity is not as high as the company's regular Silicon-Bronze wire, this feature not being essential to span wire.

THE ELECTRIC ENGINEERING AND SUPPLY COMPANY, of Syracuse, N. Y., manufacturers of electric light and railway supplies, has opened an office in Room 511, 18 Cortlandt street, this city, which will be in the charge of Mr. F. C. Timpson, formerly of the Empire City Electric Company. Mr. Timpson will keep a full line of samples on hand, and will take orders to be filled at the factory. He will keep on hand a small stock of supplies to meet immediate wants.

MR. C. A. HUSSEY has completed a series of experiments with his specially constructed storage battery which he recently invented, the plates of which are horizontal. During the tests a battery of four cells gave 2.78 volts each, and one of three cells gave 2.84 volts on a Weston voltmeter. A Perret motor was connected to each cell separately, and the armature could not be stopped by any hand pressure on the shaft. There are points in this battery which it is said will be of great advantage in street-railway service.

AT the annual meeting of stockholders of the Crocker-Wheeler Electric Motor Company the following officers and directors were elected for the ensuing year: S. S. Wheeler, president; F. B. Crocker, vice-president and treasurer; D. H. Jeffery, secretary; R. N. Peterson, S. S. Wheeler, F. B. Crocker, David Crocker, A. F. Higgins, W. B. Baldwin and F. M. Jeffery, directors. This company is pushing the manufacture of its goods vigorously in order to have a large supply of motors in stock for the spring trade.

W. J. BROADMEADOW, formerly superintendent of the Asbury Park Electric Railway, is in town, and any letter to him will reach him at the office of STREET RAILWAY NEWS. Mr. Broadmeadow is an expert electrician. This gentleman built the Lancaster (Pa.) West End Railway (electric), the Sunbury and Northumberland Street Railway, the Gloucester Street Railway and the Asbury Park Electric Railway. He is now open to engagement as superintendent or will contract for complete electric railway plants, from the steam plant to the trolley wire.

THE EASTON ELECTRIC COMPANY has just completed the successful installation of two thirty-light Easton arc dynamos, with forty Easton arc lamps and forty Bernstein, series 25, C. P. lamps on seven circuits, for the Diamond State Iron Company, of Wilmington, Delaware. The extensive new mills are built upon the site of those recently destroyed by fire, and are now brilliantly lighted throughout. Work is carried on there by night as readily as by day. The Iron Company are as proud of its purchase from the Easton Company as it is of its new mills.

IN the handsome private hotel known as the "St. Lawrence," near Madison ave., New York City, built by Messrs. J. W. Weir & Son, are to be installed two 55 H. P. Ideal Self-Oiling Automatic Engines. This work comes through W. R. Fleming & Co., the New York office for the Harrisburg Foundry and Machine Works, at 174 Fulton street. The absolutely smooth and noiseless running of these engines is the essence of contracts in public buildings of all kinds where noises and vibrations from electrical machinery are the usual state of affairs. There are now about twenty of these engines running in New York City, and all are among concerns of the highest standing in the community.

THE PELTON WATER WHEEL CO., 143 Liberty street, this city, and San Francisco, Cal., has recently issued a new edition of its catalogue which embraces a vast amount of tabular and descriptive matter relating to the means of utilizing water-powers by the Pelton system, making quite the most valuable contribution to modern hydraulic literature that is now available. Much attention is given to the generation of power for electric transmission, which is now the absorbing question in electrical science. The system here described, makes possible the utilization of this source of energy under a wide range of conditions and with a degree of economy, simplicity and efficiency never before attained. Engineers as well as parties interested in the development of water-powers will be furnished a copy upon application.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	60 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone. N. Y..	50,000	100 00	98 00
American Telegraph and Cable...	14,000,000	100 00	80 50
American Telephone Co., D. C....	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	207 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light..	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light.	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto..	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto..	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s....	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E....	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s...	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	150 00
Complete Elec. Con. Co., N. Y...	50,000	100 00	175 00
Cons. Electric Light Co., N. Y...	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y....	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	102 00
Cons. Gas & E. Co., Batavia, 6s..	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s. S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y..	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*101
Edison Elec. Ill., Lebanon, Pa....	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila..	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	92 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	45 50
Excelsior Electric Co. 6s, N. Y...	300,000		par
Fargo Gas & Elec. Co. 6s, Dak...	100,000		*95
Fidelity Trust Receipts	25,000,000		60 00
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	23 00
Laclede Gas pref	2,500,000	100 00	62 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s....	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa..	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y..	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	19 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co....	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s..	1,500,000		489
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	42 00
N. Y. Phonograph Co	20,000	100 00	*90 00
N. Y. Storage Baty. Co	100,000	100 00	85 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio..	50,000		*95
North American Railway Co....	39,767,200	100 00	15 75
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E.L.& Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	4 25
Saginaw E. L. & P. Co. 6s, Mich..	50,000		*98
San Diego Gas & Elec. Co. 6s. Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y..	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y..	100.000	100 00	105 00
The Ongley Electric Co.. N. Y...	250.000	100 00	90 00
The Railway Impt. Co., N. Y	10,000.000	100 00	100 00
The Washington Water Power Co	1,500 000	100 00	80
Thomson-Houston Electric Co....	6,000,000	25 00	51 00
Thomson-Houston pref	4,000,000	25 00	26 50
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y....	50,000	100 00	100 00
Twin City Rapid Transit, N. J...	20.000,000	100 00	100 00
United Elec. Light and Power....	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	1 00
Universal Arc Lamp Co	100.000	100 00	75 00
Vine Street Motor Co. 6s, Colo..	100,000		*95
Western Union	86,188.852	100 00	82 00
Westinghouse Electric Co	7,000.000	50 00	13 00
Westinghouse Elec. Co. pref. 7s..	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Concentration of capital is the order of the day in a great many different ways, and more so now than at any previous time, while trust companies have by legislative action become unpopular, as for instance the Sugar Trust, Lead Trust and kindred associations. The capital has been held together by the simple dissolution of the trust and the organization of a company with the same objects and officials, and the capital stock increased to a sum greater than that previously represented by the trust certificate or script. Next to the trust, which all had become acquainted with and imagination could outline a limit for, comes the great unknown, intangible indescribable concentration of capital and brain called the syndicate, differing from the trust broadly, as having no alliance with any specialty; formed usually to purchase with a view to carrying until a boom in the market enables them to unload at a large profit, with never a thought of improving the interest in which the aggregation of cash or credit has been used. This is speculation, pure and simple, with the certainty of a favorable result. Below these two elements all concentration may be legitimate centres for actual development and production of projects of any considerable magnitude, and the more of these the better for the public. The greater the financial distance between the local industries and the parent organization which by a greater concentration of capital and talent rendered their existence possible the manlier will be the exertion displayed by each sub-company to produce the best mercantile results. Still another legitimate concentration of money, and one which shows the actual decision of the people acting on their individual belief, untrammelled and free, is shown by the fact that in the city of New York of the $446,000,000 of deposits $130,000,000 are concentrated in five institutions, The Park National, Importers and Traders', Chemical, First and Fourth National Banks, each of which have over $24,000,000 concentrated in their vaults in some shape. These deposits are not like the Lincoln National, where no doubt the largest single amounts in the country are handled, but are a conglomerate mass of small active accounts.

The financial condition of the Columbian Exhibition to be held at Chicago has reached that point from which continuous, tireless exertion is imperative from this time until the fall of the curtain. For the same reason or lack of reason that men to-day vote for Jackson, twenty years hence others in New York will be found swearing that the Fair must be here or they won't support it. With the exception of the electrical exhibit we know of no New York industry stepping up with money and men to win the grand prize in their special line. It is just possible while all this bickering is going on that some whole-souled Westerner will buy the space allotted to New York and surround it with a red fence; meantime the world moves on. Thirty-nine nations and twenty-four colonies have made, or finally proposed appropriations for their exhibits, aggregating about $5,000,000. It is estimated the total expenses of the Fair by the Exhibition Company will be about $30,000,000. They have paid out to date about $2,800,000, and the current expenses are about $1,000,000 per month. The government has appropriated $1,500,000; the company has raised $5,721,230; Chicago has given a $5,000,000 loan; and the States and Territories have so far appropriated $2,695,000, and it is confidently believed this will be raised to $5,000,000. There are those in Chicago who begin to flatter themselves they can make a bigger show than the world ever saw, even if New York does not take first rank, as from her condition she is expected to. They even boast of their ability to get out a few Whalebacks and bring in the majority of the foreign exhibts direct to Chicago *via* the canal. There is good money at stake on this problem in the immediate future, and the possibilities of an aluminum vessel run by electricity are worthy of calculation. The cost of such a boat, assuming that the requisite amount of aluminum is available and at say seventy-five cents a pound, would certainly prove a commercial success. That an electric launch, if not yacht, constructed of the new metal will be one of the exhibits on the lake at the Fair is positive.

As so many of the companies generally supposed to have their home in New York are actually New Jersey corporations, organized under the laws of that State, the financial portion of Governor Abbett's annual message was not only interesting but of personal importance to a great many of our readers. One, more enthusiastic than the others, no doubt, on account of his being a director in several New York-Jersey companies, remarked that if he had a bank in Trenton with a capital of $1,000,000 and a loan and trust company in Jersey City with an equal capital, managed by any fairly known people, he would not leave a corporal's guard of public companies east of the Hudson river. There is no good reason why rum and real estate should pay all the taxes, but there is no doubt that the business of corporations capitalized at $100,000 or less would be worth more to us at home than foreign incidents. Mr. Henry Clews in a late interview reminded the questioner that cotton was no longer king, or in fact scarcely a member of the royal family, the largest crop produced, just prior to the war, reaching only 4,000,000 bales. Last year the crop was 8,500,000 bales; under free labor it has more than doubled its annual production by slaves, but the market price has been cut in two. The present price of cotton is less than the cost of raising it; the fall has been from 11 to 7 cents per pound. It is found that 7,000,000 bales will supply the market, and all over that simply tends to reduce both the price and the profit.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
CHICAGO, Jan. 23, 1892.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports that although it is very early in the season, it is nevertheless having a demand for the Swinging Ball Lightning Arrester and requests for information in regard to the same, that promises a big business in them when the season gets further advanced. The Swinging Ball Lightning Arrester has had a test of nearly three years practical service in stations in nearly every part of the United States, and has a wonderful reputation, as it has never been charged with a single failure to do its work.

THE STREET ELECTRIC SUPPLY COMPANY, Cleveland, O., was burned out on the morning of January 13. The company's loss is estimated at $50,000. N. D. W.

H. WARD LEONARD & CO.

Among the prominent plants now being installed by H. Ward Leonard & Co., of this city, as contractors, are the following: Mail and Express building, New York City; Catherine Bradley building, New York City; Geraldine building, New York City; Germania Insurance building, New York City; Du Vivier & Co. building, New York City; F. O. Du Lous building, New York City; Franklin Trust building, Brooklyn; Fifth Avenue Theatre, New York City; Columbia Theatre, Brooklyn; Graham Hotel, New York City; Mr. John H. Inman's residence, 5th avenue, New York; Curtis' residence, Greenwich, Conn.

Among the leading concerns for whom this firm is acting as Consulting Engineers are the following:

Otis Elevator Co., New York City; Wm. Sellers & Co., Philadelphia; Ingersoll-Sergeant Drill Co., New York City; Eastern Electric Co., Limited, St. Johns, N. B.; Providence Journal Co., Providence, R. I.; Middletown Music Hall, Middletown, Conn.; Rock Hill Electric Light Co., Rock Hill, S. C.

OF INTEREST TO APPLICANTS FOR PATENTS.

To those persons contemplating making applications for patents we take pleasure in calling attention to the Patent Bureau which is carried on in connection with our regular publishing business.

This department of our work is looked after by our counsel, John Henry Hull, whose office is Room 165, Times Building, this city, and to whom all communications on this subject should be addressed. Mr. Hull, like the persons in charge of other departments of our business, has had long experience in his particular line, and the past year's record of this work most conclusively proves his ability to procure for any who apply to him the issuance of patent papers, or to most satisfactorily execute any legal business which may be intrusted to his care.

This bureau during the last year was most generously supported by our friends at large and particularly in the electrical trades, and in every instance our clients have expressed themselves as being perfectly satisfied with the results attained.

As the science of electricity is one in which much new apparatus, etc., is needed—and these of course will be patented—we feel confident of a large increase in this branch of our business for 1892.

We thank our clients of the past for their kind patronage, and bespeak for our Patent Bureau a small share of the patronage of those who have as yet not made the acquaintance of Mr. Hull.

BUSINESS NOTES.

The Ries Electric Specialty Company, of Baltimore, Md., was awarded the first premium and medal at the electrical exposition, recently held at Augusta, Ga., for its well-known regulating socket for alternating-current incandescent lamps. This company is deserving of this honor, as it is said that its Regulating Socket will do more toward making incandescent lighting universally popular than any invention ever yet produced. The Ries Regulating Socket is being generally adopted throughout this country and abroad.

The Pelton Water Wheel Co., of New York and San Francisco, has recently furnished the Anaconda Mine in Montana with three wheels of capacity of 175 H. P. each, to run under a head of 130 ft. The power thus afforded is to be used in an enlargement of the works.

We learn that the new type of electro-dynamometer, which the enterprising firm of Queen & Company, of 1010 Chestnut street, Philadelphia, recently placed on the market, has met with great favor. By the adoption of the agate bearing instead of fibre suspension as formerly used, the element of torsion is eliminated, and greater accuracy obtained in consequence. These instruments are extensively employed as absolute standards in measuring both direct and alternating currents, and are especially suited for use in central stations as checks for the ordinary commercial ammeters.

UNEQUALLED SERVICE.

The Royal Blue Line between New York, Philadelphia and Washington, *via* the Reading Railroad, has attained a world-wide reputation, owing to the high standard of excellence it has maintained ever since it was inaugurated, and its success, although unprecedented, is fully deserved. The trains are the finest and safest in the world and vestibuled from end to end making each train a practically solid and continuous structure throughout. They are equipped with Pullman's anti-telescoping steel frames, rendering injuries from collision impossible. They are heated by steam and lighted by the Pintsch gas system. Each train is equipped with palatial day coaches, the finest Pullman cars on all day trains and sleeping-cars on night trains, and an unequalled dining car service. The speed attained by this line is the fastest ever made between New York, Philadelphia and Washington, and it is a service which, taken as a whole, is unequalled by any through line in the world.

IT DOES WELL.

LEONARDSBURGH, OHIO, Sept. 1, 1891.

Jerome Kidder Mfg. Co.

DEAR SIRS: Please send to A. C. I.——, * * *
My battery does well. I prize it highly.

Respectfully yours, E. F. POTTER.

PEKIN (ILL.) LIGHT AND POWER COMPANY has been granted franchise to construct and operate an electric light plant. The company has made arrangements to have installation completed by May 1.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued January 19, 1892.

467,153. Automatic Damper-Controller. Ferdinand E. Chatard, Baltimore, Md. Filed May 5, 1891.

In combination with a thermostat and an electric motor controlled thereby, a valve operated by a motor and consisting of a fixed cylinder provided with ports and an internal rotary cylinder sustained by a central axis and having ports arranged to register at the top and bottom alternately with the ports of the outer cylinder.

467,160. Holder for Telephone-Receivers. Richard Dent, Grand Rapids, Mich. Filed April 13, 1891.

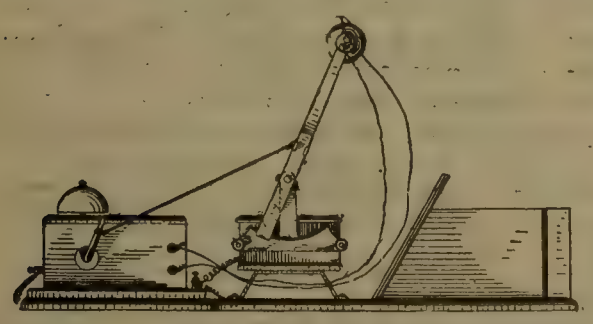
In a telephone, the combination, with a transmitter-box and a switch-arm, of an arm and a ratchet-plate secured to the transmitter-box, a vertically-swinging and laterally-movable receiver-holding lever pivoted between its extremities to the arm and having its inner extremity provided with teeth which engage and disengage the ratchet plate by laterally swinging the lever, and a connection between the switch arm of the transmitter-box and the lever.

467,169. Filament for Incandescent Electric Lamps. Philip Hickley, Evanston, assignor, by mesne assignments, to Robert D. Sheppard, Cook County, Ill. Filed Aug. 21, 1890. Renewed June 8, 1891.

A filament for incandescent electric lamps of the carbonized root of the *Oryza sativa* or rice-plant.

467,192. Electric Elevator. Norton P. Otis and Rudolph C. Smith, Yonkers, N. Y., assignors, by mesne assignments, to the National Company, Chicago, Ill. Filed July 31, 1891.

The combination, with an electromotor and with the controlling device thereof, of means for automatically moving the controlling device from the extreme position in which it is set in throwing the full current into the motor toward a



467,160.—HOLDER FOR TELEPHONE RECEIVERS.

mid-position where less than the full current will be supplied.

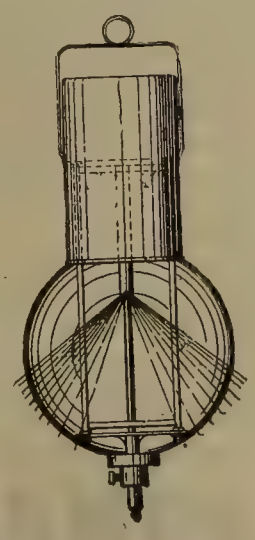
467,199. Electric-Arc Lamp. Josef Riedel, New York, N. Y. Filed May 23, 1891.

In an arc lamp, the combination of a supporting-frame having slotted upright guide-tubes, upper and lower carbon holders guided by the tubes, cords connected to the ends of the lower-carbon holder and the centre of the upper-carbon holder, guide-pulleys for the cords, an electro-magnet located in the main circuit, and a spring-supported armature above the electro-magnet, one of the guide-pulleys being attached to the spring-supported armature and rising and falling therewith, whereby the arc is produced when the armature is attracted and the lower-carbon holder lowered on the switching in of the current.

467,215. Commutator. Henry P. White, Kalamazoo, Mich. Filed Feb. 13, 1891.

The commutator consisting of a revoluble circular head having on its surface alternating conducting and non-conducting paths on opposite halves and an unbroken conducting-path, the alternating paths jogging by each other at their termini.

467,230. Method of and Apparatus for Controlling Electric Motors and Generators. Cary T. Hutch-



467,199.—ELECTRIC ARC LAMP.

inson, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed Nov. 11, 1890.

A method of regulating or controlling two or more motors or dynamos connected electrically, one or more of the motors or dynamos having extra field-magnet coils, which consists in increasing or diminishing the magnetic field of the machine or machines the current in which is too small by passing the current of each of such machines through one of its own extra field coils and at the same time oppositely affecting the field or fields—that is, diminishing or increasing the same—by passing through another extra coil or other field-coils the standard current.

467,233. Process of Electric Metal-Working. Hermann Lemp, Lynn, and Walter S. Moody, Chelsea, Mass., assignors to the Thomson Electric Welding Company, of Maine. Filed April 23, 1891.

The improvement in electrically heating a piece of metal, consisting in subjecting it to the compound action of heating-currents flowing in the metal at an angle to one another, one of the currents being a continuous and the other an intermittently-reversed or alternating current.

467,239. Battery-Zinc. Charles B. Schoenmehl, Waterbury, Conn. Filed April 25, 1891.

A battery-zinc consisting of a hollow zinc stick, a connecting-rod screw-threaded into the stick, a glass tube surrounding the rod and forming a continuation of the zinc stick, and means for holding the parts in assembled position.

467,240. Electric Battery. Charles B. Schoenmehl, Waterbury, Conn. Filed April 25, 1891.

In a battery, the combination, with a top provided with holes and constructed of non-conducting material of carbon rods, a drawn sheet-metal cap or shell fitted and secured upon the top of each rod, and a connection above the battery-top whereby the rods are secured together mechanically and electrical connection established between them.

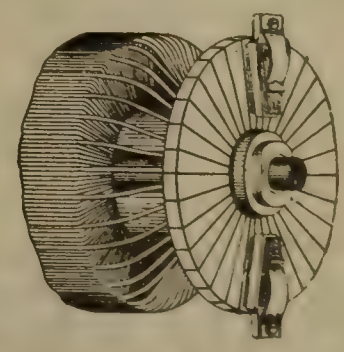
467,243. Electro-Magnetic Brake. Henry E. Walter, London, England. Filed April 3, 1891.

An electro-magnetic brake for railways, composed of electro-magnets carried by the vehicles, with the magnet-poles in close proximity to a fixed longitudinal conducting bar, plate, or rail, but retained by spring-stops on the vehicle from coming into contact with them, and a dynamo for supplying the coils of such magnet or magnets with electrical current when the speed at which the vehicle is travelling has to be diminished.

467,250. Trolley for Electric Railways. Edwin R. Harding, Winthrop, Mass. Filed Jan. 3, 1891.

The combination, with a pivoted trolley and an impelling spring therefor, of an arm affixed to the trolley-base, a lever pivoted to the arm, a yoke or spring-support pivoted to the lever and engaged with the outer end of the trolley-spring, the lever and spring-support being arranged so that when the lever is in its normal position it holds the spring-support in position to maintain the spring in a state of operative tension, and a connection between the lever and the trolley-arm, whereby when the trolley-arm rises above its normal position the lever and spring support are displaced.

467,255. Liquid Rheostat. Hermann Lemp, Lynn, Mass., Assignor to The Schuyler Electric Company, of Middletown, Conn. Filed March 22, 1889.



467,318.—COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES.

The combination, with a tube of insulating material containing a liquid resistance and communicating at its lower end with an exterior body of liquid, of a circulating-tube connected at one end to the first tube at a level below the level of the liquid therein and at its other end with the exterior liquid body at a lower level.

467,259. Electric Railway-Brake. Edmond Verstraete, St. Louis, Mo., assignor of one-half to Peter M. Kling, same place. Filed Aug. 8, 1890.

In a car-brake, the combination of a frame, the magnets secured to one of the ends of the frame, a sliding metal cross-head fitting in slots made in the sides of the frame, cores secured to the cross-head, a rod passing through a suitable perforation in the other end of the frame and also secured to the cross-head, and a pair of brake-levers, one of

which is pivotally connected to the rod and the other through the spring.

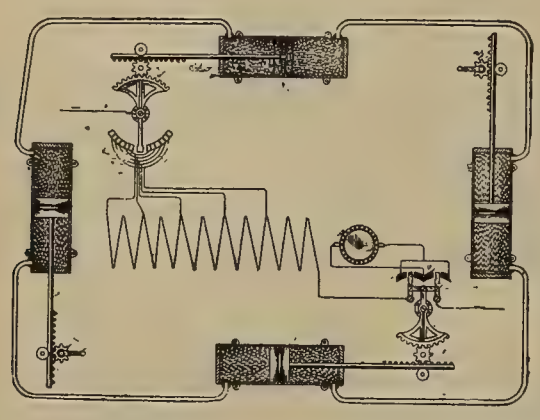
467,270. Incandescent Electric Lamp. Charles H. Wilkins, Chicago, Ill. Filed June 19, 1890.

The combination, with a bulb and filament of an incandescent lamp, the bulb being provided with an interior glass socket integral with the bulb and opening into the interior of the latter, of a reflecting body or core of lime or other refractory non-transparent white substance, the body or core being sustained in position within the bulb by having one of its ends inserted and secured in the socket.

467,276. Incandescent Electric Lamp. John L. Curtiss, Grand Rapids, Mich. Filed July 24, 1891.

An electric motor provided with a socket at one end adapted to receive an incandescent lamp and electrodes at the other adapted to fit the lamp-socket, and electrical conductors from the electrodes to the lamp.

467,318. Commutator for Dynamo-Electric Machines and Motors. Elihu Thompson, Swampscott, Mass. Filed Jan. 31, 1891.



467,449.—CONTROLLING APPARATUS FOR ELECTRIC MOTORS.

The combination of a disc commutator having sector-shaped contact-surfaces on the side of the disc, with a tapered or wedge-shaped brush engaging the surfaces.

467,338. Rheostat. Charles Willms, Baltimore, Md. Filed Sept. 30, 1891.

A rheostat having a body of resistance material forming a path for the current and divided into sections by a series of collecting-sectors, each of the same area as the cross-section of the resistance material required at the plane of the sector.

467,350. Electrolytical Plant. Otto Stalmann, Anaconda, Mont. Filed June 8, 1891.

An electrode consisting of a plate of refined material and a plate of crude material with insulating material interposed between the plates and metallic connection between the plates.

467,358. Regulator for Electric Generators Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 2, 1890.

The combination, with a dynamo-electric machine, of an electro-motive-force regulator therefor and a controller for the regulator depending upon the output of the machine and set to act only at the point of maximum output.

467,372. Galvanic Battery. Fernand Gendron, Bordeaux, France. Filed May 14, 1891.

An electric battery comprising a series of cells containing exciting and depolarizing liquids, in combination with an electric motor actuated by a portion of the battery elements, pumps driven by the motor and adapted to produce a circulation through the cells, and an automatic regulator of the number of cells in use.

467,448. Electric Railway. Charles J. Van Depoele, Chicago, Ill. Filed June 22, 1885.

In an electric-railway system, a suspended conductor in continuous contact with a vertically and laterally movable grooved contact, the contact carried by a vehicle and so arranged that it shall rise and fall with the varying level of the conductor during the motion of the car or vehicle.

467,449. Controlling Apparatus for Electric Motors. Charles J. Van Depoele, Lynn, Mass. Filed March 19, 1891.

A hydraulic controlling apparatus for electric motors, comprising a plurality of cylinders connected in continuous series by pipes extending from the front end of one cylinder to the rear end of the next and filled with liquid, a piston for each cylinder normally located at the centre thereof and provided with an outwardly-extending piston-rod, mechanism for imparting motion to one or other of the pistons, thereby displacing the liquid and actuating all the pistons simultaneously, and mechanical connections between the pistons of the actuated cylinders and work to be performed.

467,450. Electro-Magnetic Reciprocating Pumping-Engine. Charles J. Van Depoele, Lynn, Mass. Filed March 19, 1891.

An electro-magnetic reciprocating pumping-engine comprising a plurality of sets of motor-coils, a magnetic plunger adapted to be reciprocated therethrough, a coil for magnetizing the plunger, and means carried by the plunger for alternately shifting the current from one set of end or motor coils to the other.

467,451. Reciprocating Electric Engine. Charles J. Van Depoele, Lynn, Mass. Filed July 10, 1891.

A reciprocating electric engine comprising a motor coil or coils in circuit with the terminals of a source of continuous current, in combination with a coil or coils connected alternately in derivation from the continuous-current coils, and means for supplying the shunt coil or coils with current having a defined rise and fall and of alternating character, and a magnetic plunger adapted to be reciprocated within the coils under their combined influence.

467,465. Electric Lock. Frederick S. Holmes, Boston, Mass., assignor to James W. Torrey, Philadelphia, Pa. Filed Feb. 3, 1891.

The combination, with an electrically actuated combination-lock arranged within a safe or other receptacle and comprising a series of tumblers, a ratchet-wheel to operate them, and an electro-magnet located in the safe to rotate the rachet-wheel, of a switch located outside of the safe and connected in circuit with the electro-magnet, an electric generator connected to the magnet through the switch, a circuit-breaker to control the operation of the magnet, and an electric motor to produce movement of the circuit-breaker.

467,478. Electric Railway-Signal. William F. Z. Desant, New York, N. Y. Filed Sept. 26, 1890. Renewed Nov. 27, 1891.

In a block-signal system, a series of electrically-divided blocks, a series of semaphores or visual signals, electrical conductors joining the blocks, and electro-magnetic means for controlling local circuits, one at each signal, with batteries and electrical motors in the local circuits, the motors being geared to the signals, circuit connections being had through the adjoining ends of one pair of rails and the car-wheels as they pass successively over the ends, whereby the signals are continuously vibrated or moved as the train enters each block.

467,484. Electrolytical Process and Apparatus for Carrying Out Said Process. Otto Stalmann, Anaconda, Mont., assignor to Marcus Daly, same place. Filed Oct. 1, 1890.

The method of separating from copper and like metals foreign matter which may be incorporated with them, which consists in arranging in an electrolytic bath an initial anode connected to the positive pole of the source of current-supply and a terminal cathode connected to the negative pole, securing together by conductors intermediate anodes and cathodes in independent pairs, each pair consisting of an anode of crude material and a cathode of refined material, interposing the independent pairs between the initial anode and terminal cathode of the bath, and passing an electrolyzing current from the initial anode to the terminal cathode through the bath and paired plates.

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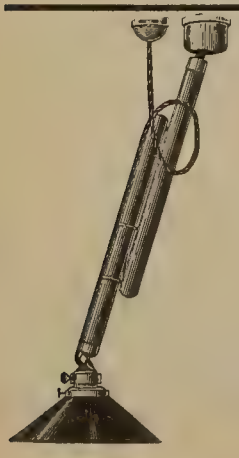
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THE ELECTRICAL AGE.

VOL. X. NEW YORK, FEBRUARY 6, 1892. No. 6.

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NEW YORK, FEBRUARY 6, 1892.

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OBSERVATIONS.

There is every indication that there will be a large attendance of members at the Buffalo Convention of the National Electric Light Association. The headquarters of the association and the meetings will be held at the Iroquois Hotel. Business of considerable importance will be presented to the members assembled for consideration, and for this reason alone there should be a large attendance. There is a disposition among the supply men to have as large an exhibit of their wares as the circumstances will permit.

Several electric-light stations have been destroyed by fire lately. The buildings should be built in the most substantial manner; they should not be built of wood, as they frequently are. An electric-light station is an important institution in the community in which is located, and should be built in a manner that will insure immunity from damage by fire. The people depend upon it as much as they do a gas plant, and how often are gas factories destroyed by fire?

Why don't the New York street car companies show as much enterprise as those in Brooklyn in the matter of using electricity on their lines? There are several underground systems in the market if they object to the overhead trolley system. Certainly no one will ever know what these underground systems are worth unless they are practically tested. Most of them have features of merit, and probably would work well in practice; but how are we going to find out if they are not put to the test? Some road should make a start, and no doubt good results would follow.

NO EXHIBITION AT BUFFALO.

The National Electric Light Association has decided not to undertake an exhibition in connection with the Convention to be held in Buffalo on the 23d, 24th and 25th of February, and manufacturing concerns and supply houses will be glad that this matter has been definitely settled.

It seems but a few short weeks since the Montreal Convention was held, and the exhibition there, it will be remembered, was the best and largest ever held in connection with the meetings of the association. It was made successful at a cost of great trouble and outlay on the part of exhibitors, and it is quite likely that a majority of them do not care to again undertake a similiar task so soon after.

In all probability the semi-annual meetings of the association will not be held hereafter. This, no doubt, will be more satisfactory to the supply men, as they will put forth greater efforts to hold one exhibition a year than they would for two. It takes much time and money to made a satisfactory display of goods, and we think the exhibitors will be better satisfied to have annual meetings, for this reason. They are a busy lot of men, and their time is valuable to them.

While there will be no exhibition under the auspices of the association, it is probable that many supply houses will have a display in their own quarters of small goods. They are constantly bringing out improvements in small apparatus, and it will be an advantage to them to make a display of the same and bring them to the attention of station managers.

Outside of exhibits the Convention promises to be an extremely profitable one in the matter of papers read.

AN ELECTRIC RAILROAD OF MAGNIFICENT DISTANCES.

An electric railroad of gigantic proportions is projected in the West, for the purpose of building, which a company was organized in Illinois a couple of weeks ago. If the plans are carried out as they are developed on paper, visitors to the World's Fair next year will likely see an enterprise that will be startling in its magnitude.

The idea is to build a railroad between St. Louis and Chicago, to be operated by electric power. The general details of the scheme have been widely published, and, according to one report, rails for this road have already been contracted for. If this is the case, it looks as if the promoters meant business.

A good deal of talk and speculation has lately been indulged in concerning the possibility of operating a long line of railroad by electricity, and there are many well-known engineers who thoroughly believe in the practicability of such a scheme. Up to the present time, however, no definite move has been made anywhere to carry the idea into practical execution, until the organization of the company above referred to. Its scheme, indeed, is a grand one, and it is said that many prominent and influential citizens of St. Louis are back of it.

The plans contemplate the building of three distinct routes from St. Louis to Chicago, all three merging into one as they approach the latter city, and it is stated that the larger part of the right-of-way has been secured and subsidies have been granted.

The road is to be operated under the patents of Dr. Wellington Adams, of St. Louis, and the plan is to carry on the passenger service during the daytime, as the trip will be made so quickly that business men will not object to the short ride.

The cars will run at a speed of 100 miles an hour, and the plan is to run them right through without stopping. The road will be divided into 25 sections of 10 miles each, and each section will represent a "block." Trains will be in constant communication with each other by telephone, and electricity will be made to do everything pertaining to the operation of the road.

The style of car intended to be used will be rather unique in appearance. It will have a wedge-shaped front, which is designed to cleave the air so as to reduce the resistance to the rapid motion. It is thought that this cleaver will answer a valuable purpose when the trains get into the Chicago and St. Louis atmospheres.

The cars will be equipped with two motors, one at each end, each operating a set of driving wheels. The drivers will be six feet in diameter, and they will be capable of revolving at a speed of 500 revolutions a minute.

It is hardly necessary to say that the cars will be heated and lighted by electricity.

One central-power station will operate the entire line, and, according to the plans, the trip between the two cities will be accomplished in two hours and a half.

Incidentally the company will make every endeavor to build up a continuous town along the line of its road. It proposes to open streets on both sides of the line, from one end to the other, and sell building lots.

These lots will, no doubt, be sold like the proverbial "hot cakes," and it will be the height of happiness to live along the line of this wonderful road.

One very serious question arises in connection with this scheme, however. If the railroad company succeeds in populating the streets along its line, the two terminal cities will naturally be joined by a common tie, and this, we think, will likely lead to a revival of the old jealousies between the two cities.

The burning question under the new conditions will likely be: "Shall St. Louis be annexed to Chicago, or Chicago to St. Louis?" This is a point that has evidently been overlooked by the promoters of this new line.

We hope that the new line will be made a "go" before the World's Fair opens, then we will have something to show foreigners that will astonish them.

MOUNT MORRIS ELECTRIC LIGHT COMPANY.

The accompanying illustration from a photograph of the interior of the engine-room of the Mount Morris Electric Light Company, of New York, shows the disposition of the engines and the method of transmitting the power.

As originally intended, this was to consist of three Green Improved Corliss engines alone, side by side, belted to the dynamos on the second floor through a counter-shafting. Only two of these engines were installed, however, and the third foundation will probably never be occupied.

Since then three high-speed engines have been added, and the cut serves incidentally to compare the two systems of subdivided and centralized power.

At present the power consists of 2 Green improved engines, 26″ x 48″; 2 Ball high-speed engines, 12″ x 13″; 1 Westinghouse compound, 18″ and 30″ x 16″.

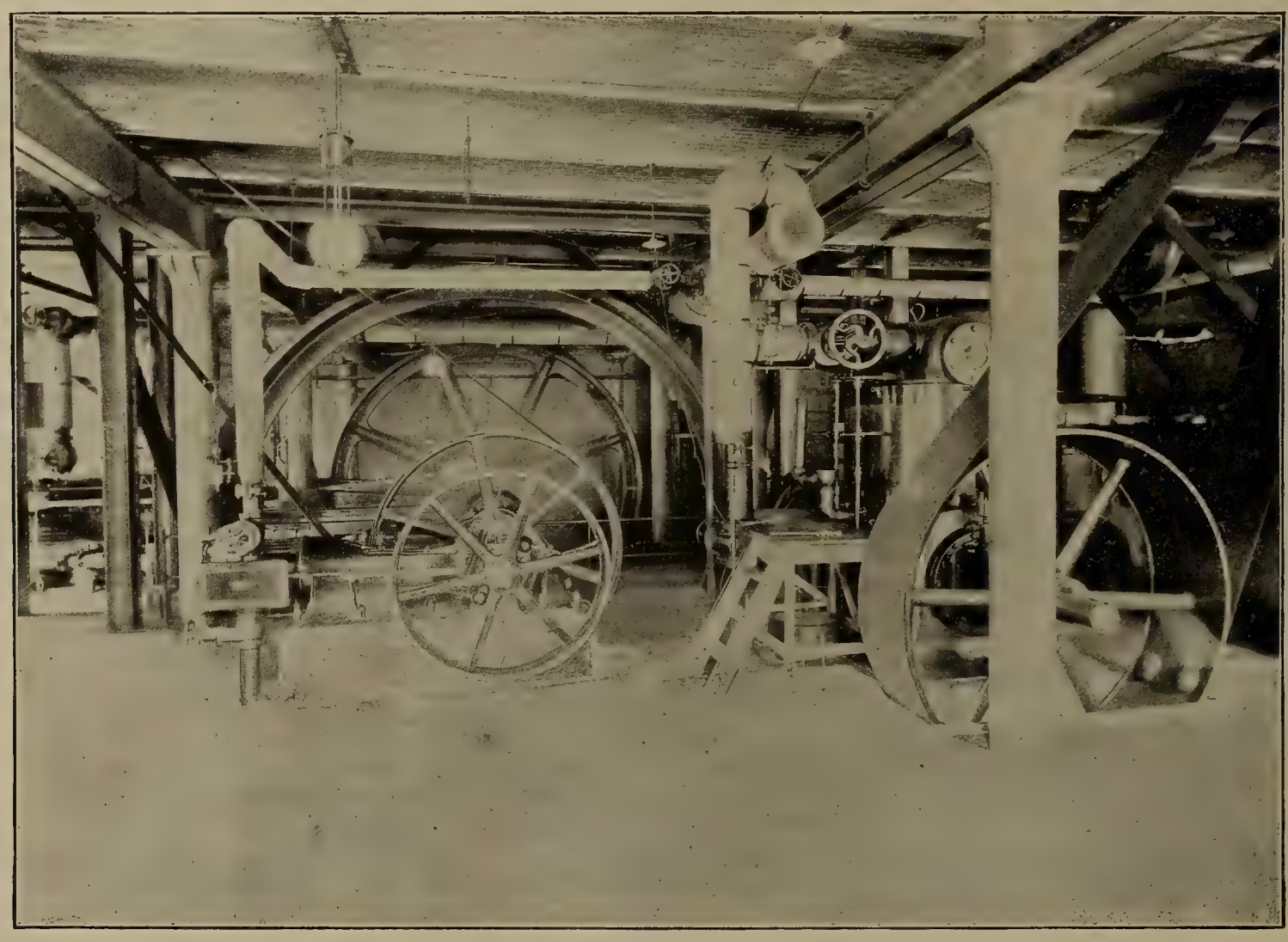
These engines drive dynamos for supplying 11,000 Westinghouse alternating-current incandescents. 600 Schuyler arcs; 100 Wood arcs; 150 Excelsior arcs.

Steam is generated in five Climax boilers, rated at 300 H. P. each, which at a recent test evaporated 12.26 pounds of water per pound of coal, from and at 212, while the boilers were worked at an overload of 35 %, and a calorimeter test showed a slight superheat in the steam during the trial.

HIGH-SPEED ENGINE AND DYNAMO.

At the Royal Agricultural Society's show at Doncaster, a high-speed dynamo, constructed by Messrs. Eaton & Anderson, of London, attracted considerable attention. This plant was used in testing the machinery in he dairy, and constituted a distinct innovation, as well as an improvement on the appliances previously employed for the purpose. The separator, or whatever might be the machine under trial, was driven by an electric motor fed by a current from the dynamo. A record was made of the volts and ampères used, and from this the power expended was deduced, the motor having been previously carefully calibrated by means of a brake. So delicate was the test that the observers could detect the presence of a warm bearing in the separator from the change in the readings of the ammeter. The engine is carefully balanced to enable it to run at the very high speed of 500 revolutions per minute. The cranks are opposite each other, and the moving parts connected with the two pistons are of the same weight. The result is complete absence of vibration and exceedingly quiet running. Very liberal lubricating arrangements are fitted to provide for long runs, while uniformity of speed is provided for by a Pickering governor.

The dynamo is designed to feed 60 lamps of 16 candle-power each, the current being 60 ampères at 50 volts. The armature is of the drum type. The peculiar feature of it is that grooves are planed in the laminated core from end to end, and in these grooves the conductors, which are of ribbon section, are laid. Slips of insulating material are laid between the coils and the dove-tailed mouths of the grooves are closed with bone or vulcanized fibre, or other dielectric. At each end of the core there are fitted non-magnetic covers. At the commutator end the cover is like a truncated cone, and incloses the connections completely. One end of the cone is supported on the end plate of the armature, and the other end on a ring on the commutator. A bell-shaped cover incloses the conductors at the other end of the armature. The result is that the conductors are completely encased, protected from all mechanical injury, and positively driven. They can neither be displaced nor abraded. The conductors on the magnet coils are likewise carefully protected from harm by metal coverings. These dynamos are made in 16 sizes, of which seven sizes are designed to feed more than 100 lamps, the largest serving for 600 lamps. Messrs. Easton and Anderson are showing machinery of this type at the Crystal Palace Electrical Exhibition.—*Engineering*, London.



ENGINE-ROOM OF MOUNT MORRIS ELECTRIC LIGHT CO. PLANT, NEW YORK.

At the present stage of development of the electric motor, it will be interesting to know that this company furnishes 45 H. P. in motors on the same day circuit with 52 arcs from excelsior arc generators.

Lest it be inferred that the Green engine has been a failure in this station, we correct the impression in advance since there is really no objection whatever to it. No trouble has been experienced with it, and the company considers it an excellent engine of its kind; but the inevitable result of a competitive trial of a Corliss and a high-speed direct-belted engine in a light station is the defeat of the Corliss on all points. As a power supply of electric stations the Corliss engine is hardly in the race, and is often replaced with advantage by high-speed engines even of a recognized lower economy.

Extensive additions will soon be made at this plant with several more high-speed engines to be belted each to a single dynamo, and the general choice seems to be in favor of the Westinghouse high-duty compound. When it is considered that a maximum economy and efficiency in regulation is combined with a high rotative speed and such simplicity, it is not strange that this engine should prove so great a favorite in electric work. In the present case it is especially valuable as it is quite probable that no other form would permit the necessary concentration of power in the limited space.

A COMPANY with $100,000 capital has been organized at Connellsville, Pennsylvania, to build 7 miles of electric road. John L. Gans is Secretary.

ELECTRO-PLATING.

Before the proper and successful process of electro-plating can be effected on any articles, great care must be used to remove all surface impurities. In order to insure that a coating of pure silver shall firmly adhere over the whole surface on the articles thus prepared for electro-plating, they are dipped into nitrate of mercury, which covers them with a thin film having a great affinity for the nickel-silver and the pure silver. They are now ready for immersion in a vat made of wood, earthenware, or other non-conducting substance, in which is a solution of cyanide of silver (varying in strength according to the work to be done) in cyanide of potassium. Plates of silver are hung at each side of the vat, and are connected with the positive pole of the dynamo. The articles to be plated are suspended by wires to metallic rods connected with the negative pole. The solution completes the circuit.

The thickness of the deposited surface of silver is regulated by the time of the immersion, and the coating is practically (not absolutely) uniform over its whole surface. The exact weight of silver on each piece is determined by its difference in weight before and after the plating process.

When removed from the vats each article has a white frosted surface; suitable and desirable finish is then given by means of the revolving metal brush, and if required, they are burnished by the use of a hard steel tool in the hands of skilled workmen, or polished by ordinary methods. A satin finish can be given through the use of a revolving iron wire brush. Electro-gilding is effected by practically the same method.

THE UNIVERSITY OF PENNSYLVANIA.

The courses in mechanical and electrical engineering in the University of Pennsylvania, Philadelphia, for 1891–92, are set forth in a little catalogue just issued by the University.

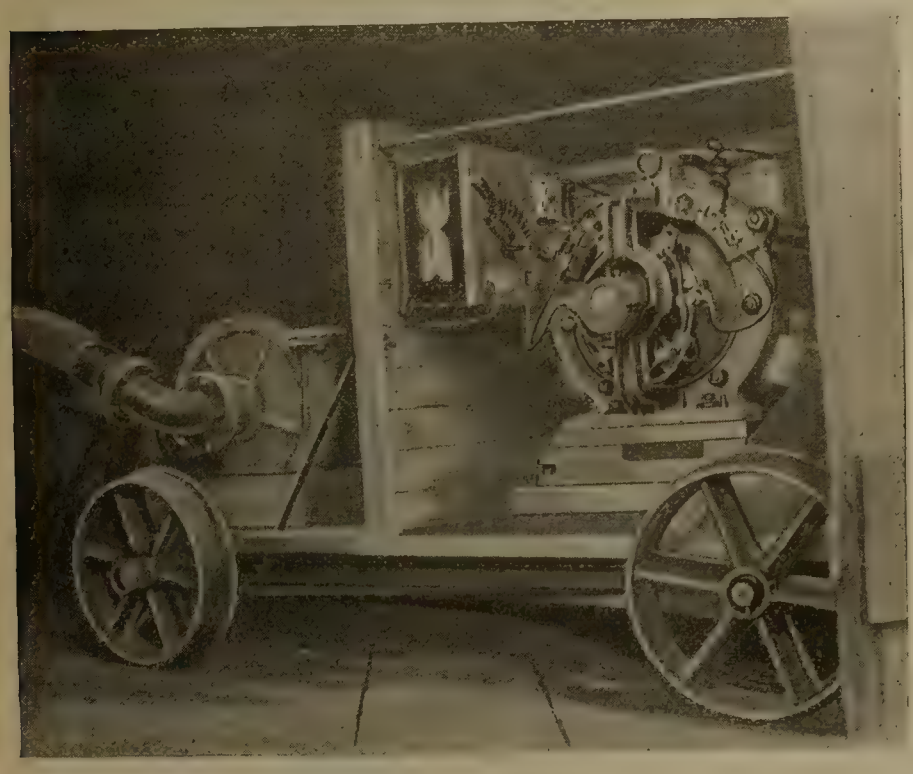
This institution offers to young men desiring to enter the profession of mechanical or electrical engineering instructions in the subjects forming the basis of those professions. The course in electrical engineering begins in the Freshman year, and for the first two years is identical with the four years' course in mechanical engineering. After the end of the second year the class devotes more time to electrical work. The degree of Bachelor of Science in mechanical or electrical engineering is given to students who complete the four years' course in mechanical or electrical engineering; and a technical degree will be conferred on all such graduates after three years' successful practical work in any branch of the profession.

Clayton W. Pike, B.S., is the instructor in electrical engineering.

AN INTERESTING ELECTRIC MINING PUMP.

We illustrate herewith an extremely interesting application of electric power to mine pumping, which has some novel features.

Some time ago Mr. H. S. Sands, electrical mining engineer of Fairmont, W. Va., obtained from the Elektron Manufacturing Company, Springfield, Mass., a motor for the purpose of adapting it to mine pumping. Mr. Sands mounted this motor on a truck with a centrifugal pump, and the outfit was placed in the pit of the Manaugah Coal and Coke Co., in West Virginia, and, owing to its great flexibility, is now accomplishing the work of three steam-pumps. He



PORTABLE ELECTRIC MINING PUMP.

uses about 25 feet of discharge hose, and all that is necessary is to connect this hose to the pipe leading out of the mine and throw the suction hose in the "sump;" in this way a complete and very serviceable pumping plant is obtained.

The novel feature of this outfit is its portability, rendering it a matter of great facility to move the pump from one place to another in the mines, and it is easily handled by a boy and a mule.

From tests made by the best Weston instruments this motor has at no time drawn more than 8 ampères, and the pump, which is worked 12 hours a day, has delivered 300 gallons of water a minute against a lift of 30 feet. Its speed is 700 revolutions.

Mr. Sands is very enthusiastic over this apparatus and challenges the world to pump as much water a minute with a given horse-power as a Perret motor and a centrifugal pump. He considers this the best and cheapest pumping plant for all mines where the lift and suction do not exceed 40 feet.

NEW BRUNSWICK'S NEW ELECTRIC LIGHT STATION.

A new electric light plant has been established at New Brunswick, N. J., by the Edison Electric Illuminating Co., and we give here a few interesting facts in connection with its installation.

The lot on which the building stands has a frontage of 100 feet on Liberty street by 250 feet deep. The building, a brick structure 50 x 200 feet, was erected in 1885, and is complete in all its details. The meter-room, 16 x 20 feet, is on the left on entering, and is in charge of Mr. William Redshaw.

The dynamo-room is 50 x 75 feet, at the southern end of which is a raised platform about six feet above the level of the floor for the dynamos. On it there are five No. 20 dynamos, with a capacity of 800 16-candle-power lamps each, while on the floor, level with the engine, are two No. 10 dynamos, with a capacity of 400 16-candle-power lamps each, and one arc dynamo, capacity 50 arc lamps (2,000 C. P.).

Two Wetherill Corliss engines, each of 160 H. P., 18-inch cylinders, 36-inch stroke, are used. The fly-wheels are 14 feet in diameter and make 89 revolutions a minute. They are belted to a 5-ft. pulley on counter-shaft, and then to a 20-inch pulley on the armature of the dynamo, which makes 900 revolutions a minute. The weight of the fly-wheels is 8 tons each. An 85 H. P. engine, with 12-inch cylinder and 12-inch stroke, is used for running the "arc-light" dynamo during the evening. The pressure indicators, 12 in number, are attached to the roof beam. The boiler-room, 30 x 30, is located in the basement. Four boilers (3 Wetherill and 1 Keeller), 85 H. P. each, of the horizontal tubular type, 5 x 16, containing 44 four-inch tubes, are used. The officials of the company are: President, C. J. Carpender; Vice-President, John Waldron; Secretary, Prof. F. A. Wilber; Treasurer, Theodore B. Booraem. The head foreman is E. F. Britton.

COMMUTATING ALTERNATING CURRENTS.

The simplest armature consists of a single conducting-circuit cutting lines of force. The currents it yields are undulatory and alternating in direction. For many purposes the undulatory currents are unsuitable, especially if the rise and fall of the current-wave be slow. If, however, the waves occur with great rapidity, or many hundreds to the second of time, such an undulatory current may find many uses. The alternate direction of the current is a less serious objection. It may be easily commuted to a uniform direction. But alternating-direction currents of rapid recurrence are in common use for feeding incandescent lamps. It is clear that, in order that the to-and-fro current shall not be observable in the light emitted by the lamp, its wave or "phase" shall be rapid. This "periodicity" is frequently as high as 200 alternations per second of time.

Continuous currents are yielded by several descriptions of armature. But a large number of machines give off alternating currents. It is generally required to commute these to take a constant direction with respect to the exterior (or useful) portion of the circuit. The most usual arrangement to meet this consists of a divided copper sleeve insulated from, but rotating with, the shaft of axis. The coils have their extremities connected to the several segments of this sleeve, and the currents are taken from the surface by devices commonly known as brushes, bearing upon its opposite diameters.

If the armature consists of two parts, or only one complete circle, as in our first example, the commutator will be in the form of a copper tube, split into two equal portions, longitudinally. These are insulated from the shaft and from each other. The brushes are fixed in such a position that at the instant the current experiences a reversal the two half tubes will exchange springs. It will thus be clear that one of the springs must always receive the positive current (as we may for the moment term it), while the other invariably receives the negative current. This simple device was one of the earliest improvements made in this class of machines after their first invention.

If the armature were to consist of two loops instead of one only, the commutator would then have four separate parts to receive the four extremities. But such commutators are only of the simplest kind, and are no longer used in dynamos. The connections of the wires and loops involve no problem. In many machines the arrangement of the wires forming the circuit of the armature are very complex.

AN INTERESTING ELECTRIC-LIGHT PLANT.

The electric plant of Mr. Henry V. Parsell at Taylor's-on-Schroon, Warren Co., N. Y., possesses some novel and interesting features. It was installed early in 1891, and has been running through the season with great success. It is run by one of the new high-speed "Otto" electric-light engines, using gasoline as fuel, this being the first electric plant in the United States to use this improved form of "Otto" engine. It is belted to a countershaft, from which the dynamos are run by "Moore & White" friction clutch-pulleys.

The dynamos are of the standard Edison type. The larger one, size 5 K. W., is in use in regular lighting, while the smaller, of 2½ K. W., is used to charge a battery of 12 Electrical Accumulator Co.'s 23 M cells for running low-volt night lights; but for special illuminations both dynamos are run in multiple on the 100-volt lighting circuit. The plant also comprises a Gould's Triplex pump, which supplies the hotel and cottages with water from a spring and reservoir near by.

The engine-house is about eight hundred feet from the hotel; the wires are run on poles, and the lamps are located not only in the hotel and Mr. Parsell's private cottage, but also along the paths, drives and lake-dock.

The lights are steady and brilliant and the cost of running is small. A little distance from the engine-house is a machine-shop for repair and experimental work. It contains a lathe, tool-grinder and a forge, with their accessories, furnished by the Peter A. Frasse Company, New York. This shop is operated by a 5 H. P. Crocker-Wheeler motor taking current from the main plant.

A fine effect is produced by three powerful lights on a tower located on a hill back of the hotel. These lamps are placed behind large lenses, which direct the beams of light to different points on the lake. The tower also carries Mr. Parsell's new electric vane, which indicates the direction of the wind at an instrument in the cottage.

Mr. Parsell is now connected with A. C. Manning & Co., the New York agents of the "Otto" engines, to contract for the installation of electric plants of any capacity or description.



ELECTRIC PLANT RUN BY GAS-ENGINE.

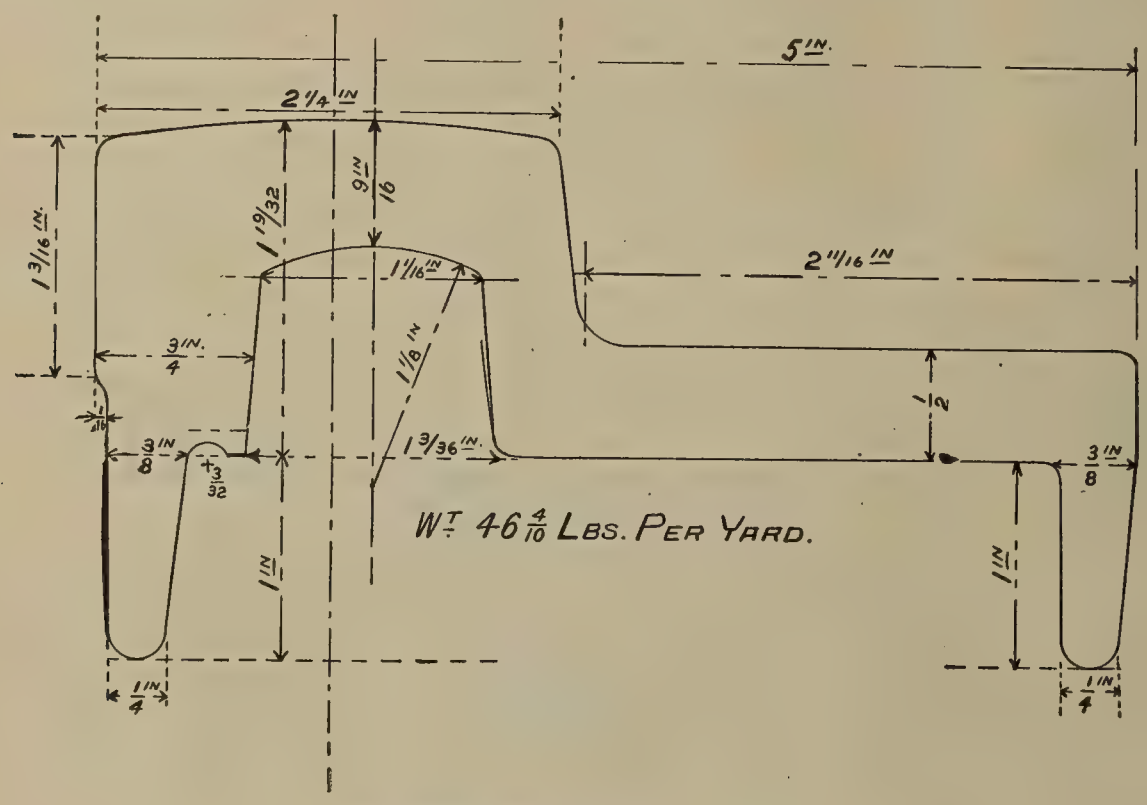
MESSRS. J. W. PARKER & CO., Philadelphia representatives of the Ball Engine Co., Erie, Pa., are setting up a 200 H. P. Ball engine at the Columbia Electric Light Co.'s station at that city. A number of new improvements are embodied in this engine.

PRICE'S HOLLOW RAIL.*

We present to our readers in this article a new section of street rail.

The obvious purpose is to reduce ultimate waste in scrap to a minimum, while according to the track the same elasticity and steadiness which are so marked characteristics of the inventor's first rail in combination with a wooden sleeper, faced its entire length on each edge with steel plates, pierced by a double row of horizontal spikes. Through the upper row, which is coincident with elongated holes in each flange of the rail, the spikes are driven which retain the rail in its place. The lower series of spikes attaches the plates firmly to the sleeper. In this way a flat-bottomed rail is supported its whole length and its entire width by a wooden sleeper which it covers like a roof, while the plates protect the wood from floods of water and from the action of the air.

It will be observed that the flange to the left, or under the outside edge of the head of the rail, is flared or slanted outwardly. This permits a base to



SECTION OF PRICE'S HOLLOW RAIL.

the sleeper wider than its top, and throws the position of the car wheels nearly over a vertical line striking the centre of the base, adding to the steadiness of the construction. The chairs upon the outside of the rail, seated upon the cross ties, are slanted to fit the sleeper. But all ordinary chairs in the various Price constructions are so much less in height than the lower edge of the plates as permanently to forbid concussion. There is, however, a heavier, taller chair which rises between the ends of the plates in a six-inch space left at that point between them, nearly to the flanges of the rail, so as to act as braces in lieu of the rods.

The heaviest "Girder Rails" are said to yield at last to the "scrap" heap about 85 to 90 per cent. of the original rail. We are pleased to note in this new section that that objectionable excess will probably be reduced to one-half of that percentage. Electricians will no doubt perceive the use which they can make of the hollow of the arch in this rail as a pipe to carry electric wires. To the back of that cavity there is a groove to take the upper edge of the plate, and so assure permanent support at the rear of the head of the rail.

All things ultimately wear, but it will be observed that as the sleeper thickens from top to base, this rail will never rattle, but simply tighten as the supports wear.

OBITUARY.

PROF. R. SHIDA.

Rinsaburo Shida, M.E., one of the Professors of the Imperial College in Tokio, Japan, died in that city recently, of consumption, at the age of 38 years.

Professor Shida had the native title of Kogakuhakushi, which, in English means "Doctor of Engineering in Japan." He studied for several years under Sir William Thomson, of Glasgow, Scotland, and was Chief of the Government Telegraph Service in Japan. Under his administration the telegraph service was greatly improved. He was the founder of the Japanese Electrical Society, and filled the office of president from its organization until the time of his death. He was for many years president of the Council of the Tokio Engineering Society, and was also foreign secretary of the English Institute of Electrical Engineers.

Professor Shida was one of the leading spirits in Japan in electrical progress, and had the distinction of being the first student to enter the Imperial Engineering College, Tokio, at the time that institution was established. He read several valuable papers before the scientific bodies of his native country, and was highly esteemed by his contemporaries. At the time of his death he also held the position of Controlling Engineer of the electrical plant of the Parliament Buildings, Tokio.

EDWIN S. RIGGS.

Mr. Edwin S. Riggs, a director and assistant treasurer of The E. S. Greely & Co., this city, with which concern he had been associated for the past twelve years, in the capacity of city manager and purchasing agent of the railroad department, died at his home, 309 Lafayette avenue, Brooklyn, last week. The funeral services were held at the house on Friday, January 29, and the interment took place at New Haven, Conn., his former home, on January 30.

THOMSON-HOUSTON SPHERICAL ARMATURE.

The spherical armature of the Thomson-Houston dynamo is one of the most unique devices used in electric apparatus. It is unique both in its design and winding. The coils are three in number, but they are so curiously combined that they may be regarded as forming one coil.

Into the surface of the core are driven wooden pegs to facilitate the winding. The core is then carefully covered by an insulator. Three wires are taken, and their extremities connected together, and the whole carefully insulated. Commencing near the axis of the core, the winding of the three wires is taken in turns by sections. Half of the first wire is wound around the core. This is carried out in the form of a wide, flat coil. Half of the second coil is wound in the same way at an angle of 120 degrees with the first. The third coil is then wound at a still further angle of 120 degrees. Then the remainder of the second wire is wound on, and finally the latter half of the first coil. All the ends finish off near the axis upon the side of the core opposite to the commencement. The free extremities are insulated and carried through a hole drilled longitudinally through the shaft, and so carried out to the collector. The object of this curious winding is to give the three coils equal distance from the iron core, and their arrangement at angles of 120 degrees is intended to distribute the turns all over the effective area of the core. The windings are secured by bands of steel wire, as in other armatures.

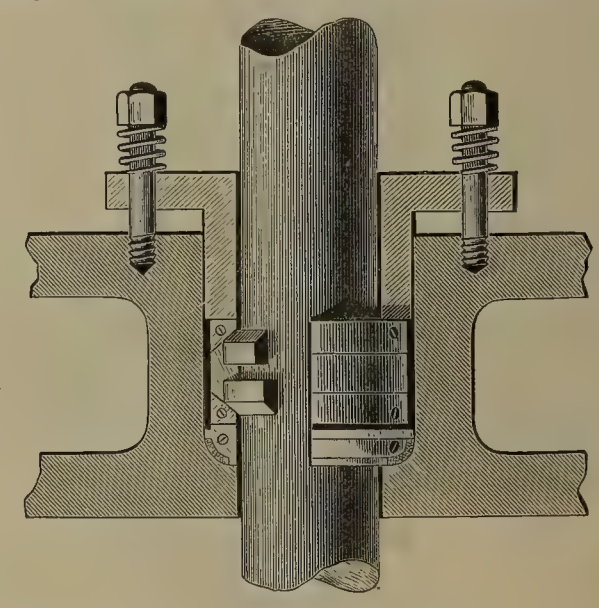
The collector consists of three parts only, to which the three-coil extremities are connected. Two pairs of brushes are employed, the individual brushes of each pair being about 90 degrees apart; but the pairs are situated as usual, diametrically opposite. The effect of this arrangement is to cut out the sections of the coil that are idle, and to admit those that are active, as in Brush's armature. The field-magnet poles intended to receive the spherical armature are of cup form, and embrace between them two-thirds of its entire surface. In the ordinary sized dynamo the armature complete is 23⅛ inches in diameter, and the gauge of wire used in winding, .081 inches. The armature resistance is 10.5 ohms.

SILVER BRONZE PACKING.*

During the past two years the Silver Bronze Packing, which is the invention of H. E. Forrest, of New York, has been subjected to such severe and continuous tests under most trying conditions of high temperature, pressure, velocity and also of excessive vibrations as to prove conclusively that it far excels all other metallic packing. So sure are the manufacturers of this, that they agree to pack any engine on one month's trial, at the end of which time they will remove the packing if it does not do all they claim it will.

The illustration shows the packing which forms a valve at the bottom of the stuffing-box by which the steam or water is prevented from escaping around the outside of the packing and closes around the rod, and also prevents leakage from the inside of the packing. The whole packing is held intact on the rod and kept seated by the gland, which is actuated by springs placed on studs outside of gland, maintaining a uniform pressure and following up the wear automatically.

In the bottom of the stuffing-box, the first brass ring is the seat-ring, and which is put in independently. It is fitted to the bottom and walls of the



SILVER BRONZE PACKING.

stuffing-box neatly, and grooved out on the bottom to hold the Usudurian gasket, in which it is imbedded to make it tight. The brass ring next to it is ground on the seat-ring, in this way making a tight valve joint. This ring is made from one-eighth to one-quarter of an inch smaller in diameter than the stuffing-box, so as to admit of lateral motion without touching walls of the stuffing-box.

The rest of the packing is of the same outside diameter, and moves freely in accordance with the vibrations of the rods. The outside next to the gland is of same shape as the bottom ring-valve ring, but it is not necessary to be tight to the gland. This gland slides on the gland laterally in the same manner as does the valve-ring on the seat-ring, to accommodate the vibrations of the rod.

The two inner rings next to the rod are made of silver bronze and take all the wear, and when worn out they can be renewed, making the packing as good as new without the necessity of procuring any other of the parts which last indefinitely.

The Silver Bronze rings are held against the rod by a case made of soft, yellow metal, placed so as to break joints; are provided with suitable dowels to prevent registering, and may be put in and taken out in less time than any other packing.

This company makes many claims for the superiority of its packing, which are contained in circulars issued by it, and which may be had upon application. It is of interest to note that this packing is being adopted by many electric-light companies.

ELECTRIC RAILWAY IN PROVIDENCE.

On January 19, electric cars were put in operation for the first time in the streets of Providence, R. I.

The power for the cars is supplied by the Narragansett Electric Lighting Co., but it is reported that the Union Railroad Co. will erect a power station of its own.

HIGH TELEPHONE LINES.

The highest telephone lines in the world are probably those connecting five mining camps near the summit of the Peruvian Andes. These camps are located near Galera, all belonging to one concern, and are connected by telephone lines which are probably the highest lines in the world. They pass over two summits each of more than 17,000 feet above the level of the sea, and the mean height of the lines is 16,000.

* James M. Price, 125 South 5th Street, Philadelphia.

* Forrest Silver Bronze Packing Co., 115 Liberty st., New York.

FUEL ECONOMIZERS.*

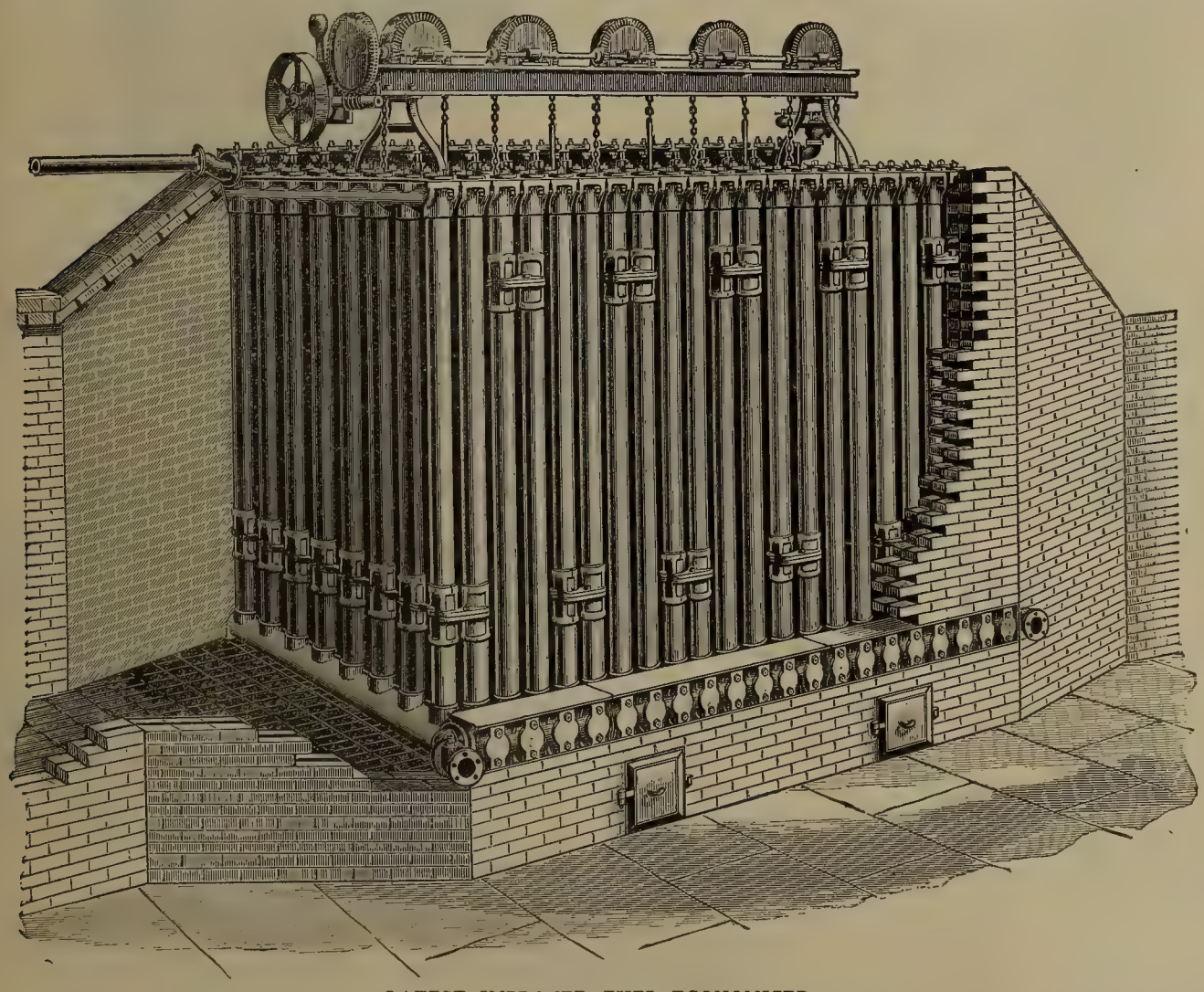
One of the most important points to be considered in connection with feed-water heaters is economy of fuel, and among the many different types now in the market probably none have become more popular than the one herewith described and illustrated. It was designed and patented by Mr. Geo. H. Burpee, a mechanical engineer of great experience in the designing and construction of steam-power plants. The company has just succeeded in securing a contract for three economizers from the Mollenhauer Sugar Refining Company after much fierce opposition from foreign companies.

A contract has also just been closed with Messrs. Marx & Rowelles, of Brooklyn, making the third order received from this firm. Other actual users of these economizers are : Jamestown Worsted Mills, Jamestown, N. Y.; Ling's Spinning Co., Greenville, N. J.; New York Bagging Co., Brooklyn, and B. B. & R. Knight Cotton Mfrs., Providence, R. I.

Electric lighting companies are also manifesting their appreciation of their value by using them in their stations.

Taking all these things into consideration, a brief description will be of interest to our readers.

In the production of the economizer, the objects sought to be attained were : a degree of strength commensurate with the weight of metal used; the use of no wrought-iron parts which might become corroded owing to contact with water; doing away with all flange or made-joints, and the making of all parts interchangeable.



LATEST IMPROVED FUEL ECONOMIZER.

In construction, all the parts subjected to pressure are cylindrical in form ; the various sections of tubes are connected at the top by lateral side openings, which are secured by outside bolts and metal joints; the caps over tops of tubes are seated from the inside, with inwardly tapering ground metal seats, secured from the outside by bolt and cross-bar ; the tubes are secured at both top and bottom by taper metal to metal joints, the upper joint being larger than the body of the tube admits the tube being passed down through the top box and forced into its seat. It is easy therefore to replace any pipe without disturbing the others, and without making any filled joints when occasion requires.

The different sections are connected to the bottom wall-box by taper metal joints, and secured by outside bolts passing through the web of wall-box, securing the hand-hole plates at the same time.

The scraper-driving arrangement is constructed with as few wearing parts as possible, and friction is reduced to a minimum.

The accompanying illustration is of the latest improved fuel economizer of style A.

THE ABINGTON AND ROCKLAND ELECTRIC LIGHT CO., North Abington, Mass., is placing a 100 H. P. Tandem Compound engine built by the Ball Engine Co., Erie, Pa.

*American Fuel Economizer Co., New York.

ADJUSTABLE LIGHT BALL.

This is a simple and ingenious device for the raising and lowering of electric lights, and is manufactured by the Dow Adjustable Light Company, 309 Washington street, Boston.

It consists of a hollow metal ball divided into two sections, to one part of which is attached a spring cylinder around which the cord is wound, being operated in a manner similar to a curtain fixture, allowing the light to be raised or lowered to any desired position.

The ball is made of metal, either gilt, nickel or bronze finish. The mechanism is simple, and warranted against breakage.

SHORT MOTORS IN SNOW.

It appears to be a curious and interesting feature of the Short Gearless motor that it will operate perfectly during snow-storms, maintaining the schedule time, where all other motors fall rapidly behind. The only reasonable explanation of this is found in the fact that the weight of the motor is centred directly over the axle, so that maximum traction is attained.

In support of this theory, it is noticed that the wheels of the Gearless motor rarely or never slip, even under the worst conditions of track. Another reason is probably found in the special controlling device used by the Short Co. which prevents a sudden rush of current through the motors, which frequently starts the wheels to slipping and prevents them from taking a good grip on the rail. That this latter explanation has some weight, is proven by the fact that the Short Double-Reduction motors have operated during the past month under conditions of track and weather where other motors of the same type have completely failed. In Braddock, Pa., two 15 H. P. Short Double-Reduction motors are operating cars on 12 and 13 per cent. grades during heavy snow and sleet storms, and without missing a single trip. The other road in the town, operating also with double-reduction motors, was entirely tied up.

In Cleveland, two Short motors carried a car through four or five inches of unbroken snow, over a disused switch, and started up without difficulty under the same conditions. The Gearless cars in Cleveland are said to be the only ones which can keep on time, and the same is said to be true of the long double-truck Gearless motor car which has now been running for nearly three months in St. Louis, Mo.

In Jamestown, N. Y., the Short Double-Reduction motors have operated right through the heavy snow-storms over a succession of grades varying from 6 to 10 per cent. with sharp curves, and the railway people are surprised and delighted at their performance.

LARGE ELECTRIC POWER PLANT.

Messrs. Fraser & Chalmers, of Chicago, Ill., the great manufacturers of mining machinery and steam-engines, have now shown their readiness to recognize the merits of electricity as a power transmitter, and are about to fit up the foundry and boiler shop and the pattern shop in their Twelfth street works with an electric power plant. This plant will consist of two 80 kilowatt generators, one 25 H. P. motor, eight 10 H.P. and eight 5 H. P. motors, distributed throughout the various buildings. The generators and motors will be wound for a pressure of 250 volts. One advantage which is expected to be derived from the use of this potential is that while the electro-motive force on the motor circuits will be kept down below any possible danger mark, yet by connecting the two dynamos in series a pressure of 500 volts will be obtained, which will permit of testing the various electrical machines the motors for which are usually wound for this higher potential.

Messrs. Fraser & Chalmers have had this plant under consideration for some months, and the competition among the various motor companies has been keen. The "C. & C," Edison, Thomson-Houston, Eddy, Mather, Brush, Westinghouse and several others, eleven in all, submitted estimates. The "C. & C." Electric Motor Company was awarded the contract for this installation.



ADJUSTABLE LIGHT BALL.

It is understood that part of this plant is to be in running order within sixty days and the entire installation is to be completed within ninety days. The plant will be one of the largest as yet installed for general power purposes, and will afford an excellent demonstration of the advantages of electricity under conditions such as exist in Messrs. Fraser & Chalmers' Works.

CONTRACTS AWARDED.

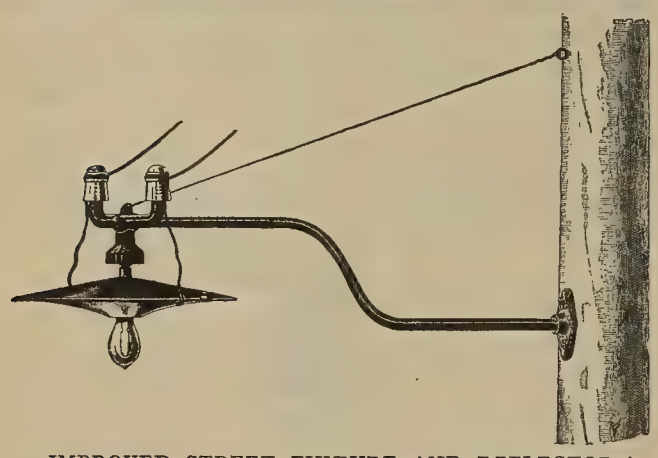
On January 28 the Gas Commission awarded the contract for electric lighting in this city to the Brush Electric Company, the United States Illuminating Company and the Harlem Lighting Company, at 40 cents a night per lamp. The contract with the Brush Company was for 45 lamps, with the United States Company for 66 lamps, and with the Harlem Company for 24 lamps.

THE EDISON LIGHT AND POWER CO., Minneapolis, Minn., recently started a 300 H. P. Ball Engine, cross compound, furnished by the Ball Engine Co., Erie, Pa. The engine gives great satisfaction.

THE HEISLER LONG-DISTANCE INCANDESCENT SYSTEM.

The adoption of the incandescent light has become so universal during recent years in the many different ways with which it can be applied, that the general public are more or less familiar with its merits. Yet, notwithstanding, a brief outline of its most prominent characteristics will unquestionably prove of interest to our readers.

In all the qualities which go to make a perfect light it is prominent, and for brilliancy and economy the Series light is admitted to be superior to all others. This is due to the peculiar construction of the apparatus, which allows the light to be used under varied conditions and over an extent of territory hitherto deemed impracticable. It is the most



IMPROVED STREET FIXTURE AND REFLECTOR.

preferable method of modern illumination, owing to the perfect control over the light combined with the low cost at which it can be furnished.

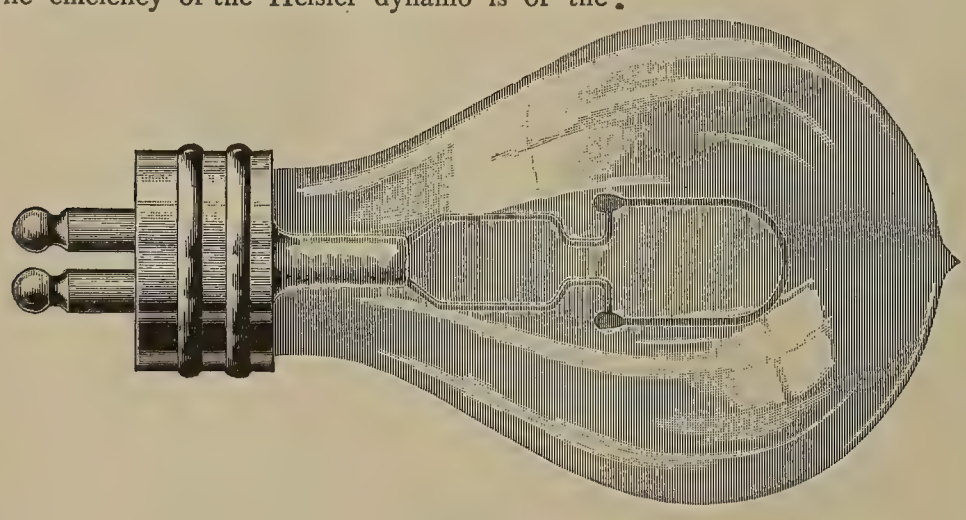
The main feature to be considered is the selection of a system, and this may be briefly summarized as follows: Absolute reliability under severe and continuous service; the light to be of a desirable quality and the candle-power fully maintained; the perfect adaptability of the system to existing conditions; the permitting readily of extension and change of location and lamps, at a minimum cost; the ability to furnish lamps of widely different candle-power, which can be changed either as to number or location at will.

A long and careful study of the subject and the various systems in vogue has led us to the belief that the system of the Heisler Electric Company of Philadelphia is the one best calculated to meet these requirements in their entirety.

The Heisler system, consists of a dynamo of correct design and proper proportions, all the parts of which are easily accessible for inspection and adjustment.

The Regulator automatically adjusts the current for any increase or decrease in the lights. The Lamp is of low resistance, durable and efficient, remaining bright throughout its entire life. An automatic Combination Cut-out and Lamp-Socket is used, that will accommodate any candle-power lamp from 16 to 150 candle-power. The insulation is perfect.

The efficiency of the Heisler dynamo is of the highest description, its general appearance is neat and compact and the construction has been specially designed to withstand continued and severe service, the very best skill and material being employed.



HEISLER SERIES LAMP.

The two smallest machines have a speed of 840 revolutions and the largest sizes 650 revolutions per minute.

The armature, commutator, fan, pulley, regulator, switchboard, etc., are of the most modern design and construction. The minor points, such as lubrication and accessibility, have been admirably studied in detail, and a belt-tightener of a suitable design is furnished, with full complement of tools, wrenches, etc.

Special study has been given to the construction of the Combination Lamp-Socket and Automatic Cut-out, which is one of the most important parts of the apparatus, with the result that its reliability has been demonstrated beyond all doubt.

Due attention has also been paid to the lamps, which are thoroughly tested before shipment. The average life of the lamp, where good care is given to maintain the regulating apparatus in proper condition, is fully 600 hours; and instances are known where they have lasted 1,000 and, occasionally, 1,500 hours. Cases are also on record where individual lamps have been used 8,000 hours.

The street fixtures are perfect in all their appointments, every care being given to the insulation so as to prevent being impaired by snow, sleet and rain storms. The hood is constructed in such a manner as to thoroughly protect lamp and socket. A reflector, which is combined with the hood, is of a form which is designed to give the maximum distribution of light over certain defined space. The wires leading from the main circuit are supported at the fixture on vertical glass insulators before being attached to the socket, which prevents any unusual strain upon the latter. In conclusion and as an evidence of the popularity of the Heisler system it is only necessary to say that the number of electric-light plants which have been installed on this system all over the country are too numerous to mention.

The Heisler Electric Co. has lately started up its 200 32-candle-power light plant for the city of West Toronto, Canada. One dynamo and a Ball engine are used. There was quite a deal of controversy over the installation of this plant among the people, whose scruples have since been virtually overcome, and all are now happy over the successful operation of the lighting. The plant is owned by the municipality, and is used for street lighting only. The subject of street lighting with the incandescent system has ever been a burning question, and the Heisler Company is immensely pleased with the unusual success it is meeting with in competition with the "Arc" system.

The West Toronto plant is the second one installed by it within the last six months in competition with the "Arc" system. Another new incandescent light plant of 400 32-candle-power lamps, operated by one dynamo, has been installed in Bellevue, Ohio, with its system.

NEW BOOKS.

Electric Toy Making. By T. O'Connor Sloane. 138 pp., with 53 illustrations. Norman W. Henley & Co., New York. Price, $1.00.

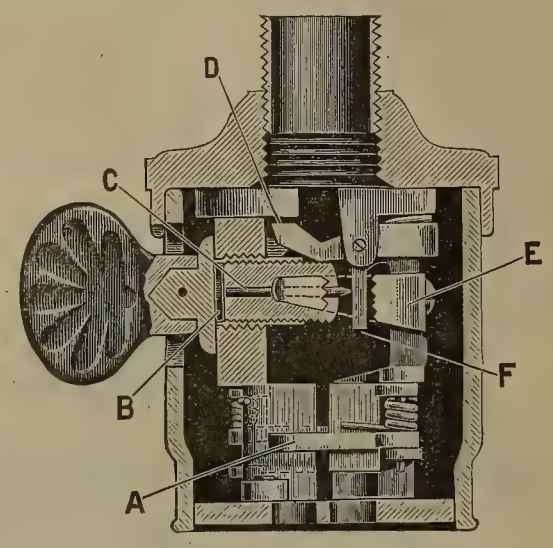
This little work treats of the making at home of electrical toys, electric apparatus, motors, dynamos and instruments in general, and is especially designed for amateurs and young folks. Thousands of young people are daily making experiments of all kinds, and many of them are electrically inclined; for the latter this book will be of great service, and in carrying out the experiments described will aid them in the acquirement of a more practical knowledge of electricity. There is a good deal in the book that is interesting to others than experimenters, and as the language used is as plain as it can be, the little book ought to be of great help in the direction of popularizing electricity.

This book, as well as all others on electrical and kindred subjects, can be obtained at the Electrical Age office, First Floor, World Building, New York.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Mr. C. O. Baker, Jr., General Master of Transportation, announces in connection with the arrangements for the Buffalo Convention of this association, on February 23, 24 and 25 next, that he has received official notification from the Trunk Line Association, Central Traffic Association and Southern Passenger Association, stating that they have granted, from points in their respective territories, a fare and a third rate to Buffalo, on the certificate plan, to cover the time of the Convention.

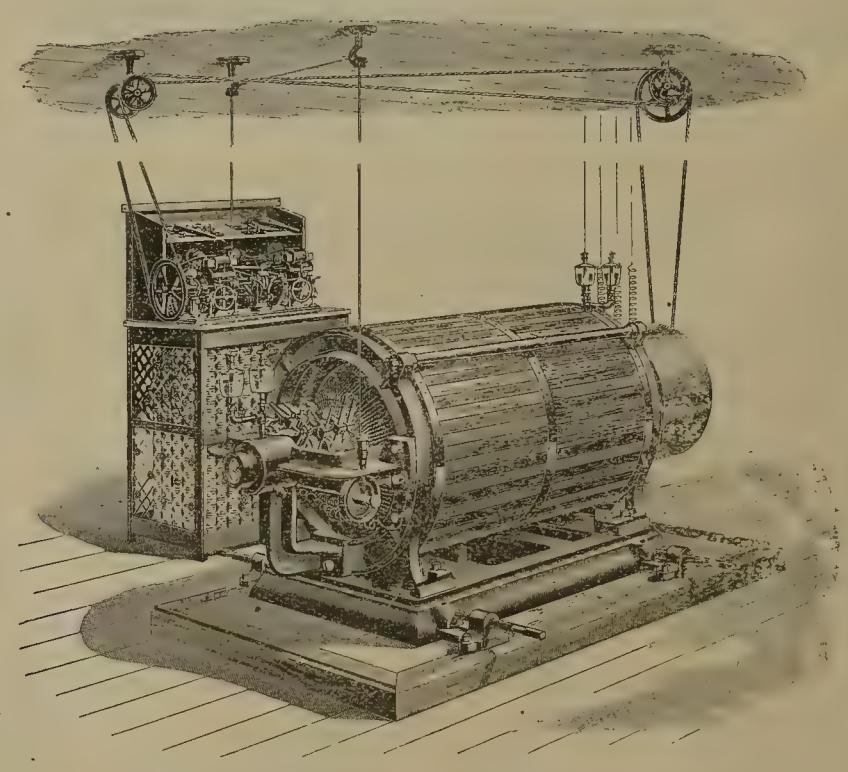
Secretary Porter announces that in compliance with the wishes of a majority of the members, in regard to holding an exhibition in connection with the Buffalo meeting, it has been decided that no exhibit will be held under the auspices of the association. This, however, will not interfere with any arrangements which individual members may wish to make for having a display of goods at the hotel, as has been the custom heretofore.



SOCKET AND AUTOMATIC CUT-OUT.

AN IMPORTANT CONTRACT.

The Short Electric Railway Company has been fortunate in securing from the Minneapolis Street Railway Co. an order for their entire spring requirements. It will be remembered that this road is one of the largest in the country, operating about an equal number of Thomson-Houston and Sprague equipments. In the extensions to be made this Spring, the Minneapolis Company found it necessary to purchase 120 motors, and made a careful investigation of the latest types of motors as made by the leading electrical companies, finally selecting the Short Gearless motor. The motors are to be in operation by April.



HEISLER DYNAMO AND REGULATOR.

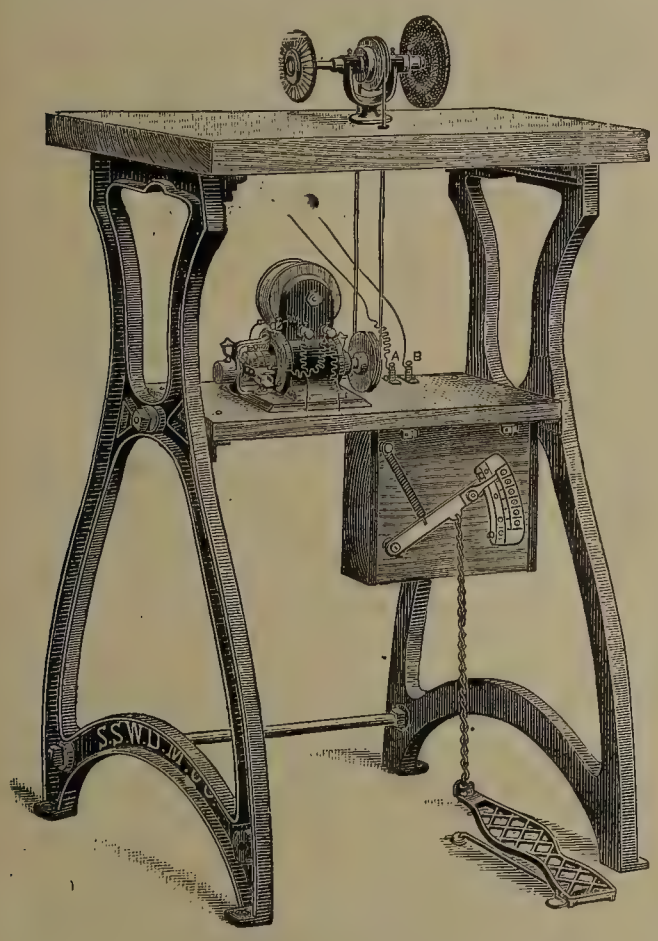
DIRECTORS ELECTED.

The Edison Electric Illuminating Company elected the following board of directors for 1892 on January 26: A. A. H. Boissevain, R. R. Bowker, C. H. Coster, Charles E. Crowell, Thomas A. Edison, J. Buchanan Henry, E. H. Johnson, D. O. Mills, George Foster Peabody, F. S. Smithers, Spencer Trask, Henry Villard and J. Hood Wright.

ELECTRIC LABORATORY LATHES.

Electricity having proved so potent a factor for motive-power in the running of light machinery and power plants, suggested the idea of devising a simple method of adapting the incandescent current to running laboratory lathes.

This idea has been carried into practical effect by the S. S. White Dental Mfg. Co., of Philadelphia, which has constructed an electrical lathe for dental laboratory work. We give an illustration of the lathe operated by an electric motor, which has so far proven itself to be more satisfactory than any other power



ELECTRIC LATHE.

now known to use. The motor used is of ⅛ H. P., and is wound for a 110-volt incandescent current.

In order to permit the lathe being run at different speeds a variable resistance, which is operated by a foot-pedal, is interposed.

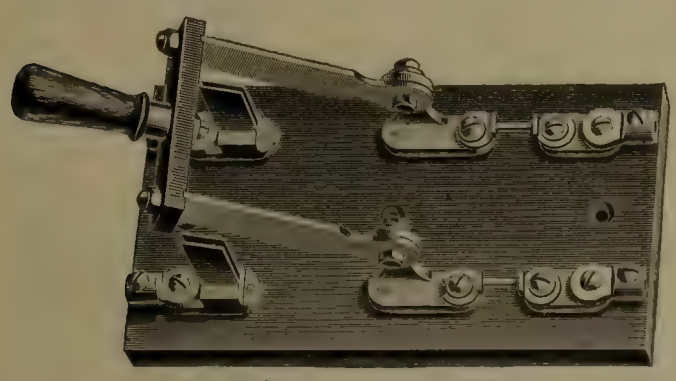
Wires are attached to the binding-posts A B for the purpose of connection with the incandescent current; and the free wires, which pass through the shelf immediately in front of the motor, are attached to the motor binding-posts. The circuit is closed and the lathe operated by pressing the pedal which is pivoted to the floor. Nearly any speed desired can be obtained at will by a varied pressure on the pedal.

The resistance can be operated by hand by placing it under the table top and dispensing with the pedal and the spring of the resistance lever.

The ingeniousness of this device, we are sure, will commend itself to the dental fraternity.

"H. C." JACK-KNIFE SWITCH.*

The switch is made in two sizes, 30 and 60 ampére, is double pole, and is specially designed for motor work and small incandescent plants of any voltage. Its jaws are made of tempered copper, and make thorough contact with the brass blades. It is



"H. C." JACK-KNIFE SWITCH.

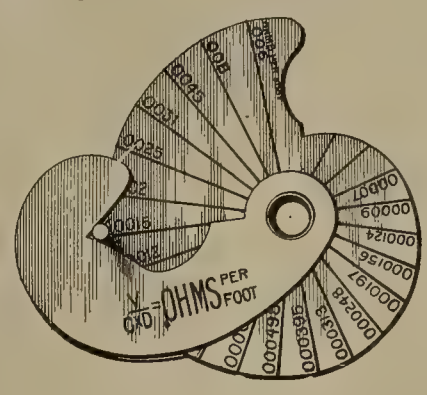
furnished with or without fuse terminals as may be preferred. All its metal parts are mounted on a polished slate base and its general appearance is that of a finely finished switch. Its price is very much lower than any other similar switch at present on the market. Several other switches of new design are illustrated in the latest edition of the electric-light catalogue, just issued by this concern.

* Holtzer-Cabot Electric Co., Boston, Mass.

A HANDY WIRE GAUGE.

The illustrations shown herewith represent the two different sides of a new wire gauge recently introduced by the Novelty Electric Company, of 50 to 54 North Fourth street, Philadelphia.

The wire is placed in the V-shaped opening be-



"NOVELTY" WIRE GAUGE.

tween the edge of the gauge and the movable arm, which is then moved around until the wire is pressed tightly between it and the gauge.

The B. & S. gauge of the wire, ampères of current it will safely carry, and the ohm resistance per copper



"NOVELTY" WIRE GAUGE—REVERSE SIDE.

foot of wire will be indicated by the radial line from the short square of the shoulder.

By the use of this device, it can readily be determined with the aid of a formula stamped on the arm what size of wire it will be necessary to use to carry a given number of lamps any distance required without loss.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRIC CLUB.

According to the announcement sent out Dr. Herman Hollerith, of Washington, D. C., was to lecture on his electrical census apparatus, before this club on the evening of January 8, but Mr. T. C. Martin did so in his stead.

In the front parlor was all the apparatus of Dr. Hollerith's invention, which have been recently adopted for census purposes by the governments of Canada and Austria, and which had never before been exhibited in public. The instruments were fully described by Mr. Martin, and their operation practically shown.

The lecture was interesting, and the novel features of the system critically examined by those present.

On the night of Friday, February 12, Mr. A. B. Chandler, President and General Manager of the Postal Telegraph Company, will relate some reminiscences of Lincoln. Mr. Chandler's remarks will be interspersed with war songs by the Brunswick Quartette. This entertainment will no doubt be of exceeding interest, as Mr. Chandler's relations with the famous President were of such character as to render him eminently qualified to speak authoritatively on this most absorbing theme.

February 12 will be the 83d anniversary of Lincoln's birth.

BUFFALO ELECTRICAL SOCIETY.

This society has just issued a catalogue of electrical books in its library. The list of books is an excellent one, and the library, taken as a whole, is one that few like organizations can equal.

NEW PUBLICATIONS.

We are in receipt of the first number of the *Tramway and Railway World*, of London. This publication is a monthly review of current progress in steam, electric and other traction. It is neatly gotten up and printed in clear type, and seems to be more American in character than it is English.

THE PALACE HOTEL, San Francisco, Cal., has one of the largest isolated plants in the country, reaching the proportions of many central lighting plants. The power is supplied by Ball engines, built by the Ball Engine Co., Erie, Pa., and consists of one 100 H. P. Tandem Compound engine, two 100 H. P. and two 200 H. P. Cross Compound engines.

REORGANIZED.

The Hunt Engineering Co., 126 Liberty st., this city, has been reorganized. The new order of things took effect on the 1st instant.

Mr. J. M. Bowen, of Brooklyn, well known in business circles as an energetic, successful financier and capitalist, has purchased the balance of the treasury stock of the company, has been elected treasurer, and will have control and management of the finances. The other officers of the company, Mr. George W. Hunt retains the presidency, and Mr. Albert E. Rich continues as Secretary and General Manager.

Mr. H. C. Willis, formerly of the firm of T. F. Hunter & Co., 33 Church street, well known to all connected in the electrical supply business as an energetic and pushing salesman, will have charge of the supply department. New quarters have been leased for the manufacturing of the company's many electrical devices, which are meeting with a ready sale, and we bespeak for them a successful year's business.

GEARLESS AND SINGLE-REDUCTION MOTORS.

Experience with the Short Gearless motors in actual service during the past three months has had an educational influence, not only on railway people, but upon the manufacturers of electrical machinery. From a position of "carping criticism" they have begun to realize that the Gearless motor is entirely feasible and economical in operation. The two 15 H. P. Gearless motors which operated a car at the Pittsburg Convention were sent to St. Louis, Mo., immediately after the Convention, and attached to a long 36-ft. double-truck car, which was placed in regular service on the road. During this entire time there has not been a single trip lost through mechanical or electrical defects in the motors. The motors run almost cold, showing that there is no waste of energy. The car is the fastest on the line, especially on grade work. The traction is remarkably high, the car is noiseless, and upon all sides come only the most flattering reports of the motors.

The Lindell Railway Company has been watching its opportunity to make a test of the power consumption of the Gearless motor car as compared with that of other long cars operated by double-reduction motors, but up to the 1st of January it was impossible to get conditions of track, weather, etc., exactly alike at a time when one of the double-reduction cars was in service. On December 30, 1891, and January 2, 1892, tests were made under conditions so closely alike that the results are reliable.

At 4:26 P.M. on Dec. 30 the Gearless car started from the barns on its regular trip, which was one of the heaviest of the day. At 4:55 P.M. on Jan. 2 a double-reduction car started on practically the same trip. On the out-bound trip the Gearless carried 25 passengers, and the double reduction 43, and on the inward trip the Gearless carried 90 passengers and the double reduction 103. The Gearless car, as before stated, was 36 ft. long; the double-reduction car was 44 ft. long; but the difference in the weight of the motors made the cars very closely of the same weight when empty. One-quarter-minute readings were made of both current and voltage on each car.

On the outward trip the Gearless motor car took an average of 17.49 ampères, 459 volts, and 10.76 H. P.; the double-reduction car 21.79 ampères, 447 volts and 13.06 H. P. The Gearless car made the half trip in 29¾ minutes; the double reduction in 32½ minutes.

On the inward trip the Gearless motor took an average of 28.32 ampères, 448 volts, and 17.01 H. P.; and the double-reduction an average of 29.82 ampères, 442 volts and 17.67 H. P. The Gearless car made the half trip in 37¼ minutes and the double reduction in 38½ minutes.

The Gearless averaged 14.19 H. P. for the round trip as against 15.56 H. P. for the double reduction car.

It is worthy of note that the double-reduction motors with which the Gearless motors were compared were said to be of the oldest and most efficient type in the market, and are conceded by all to take less current than any other motor of the kind.

THE BROOKLYN TROLLEY MATTER.

The State Railroad Commission in Albany granted permission Jan. 26 to the Brooklyn City Railroad Company to operate cars on its eighty-five miles of road in Brooklyn by the electric trolley system.

President Daniel F. Lewis of the company on receiving the news said the contracts for the work

would be given out as soon as possible. The Hamilton avenue line would be the first on which the trolley would be introduced, and the Third avenue and Court street lines the next. Two years would elapse before the system could be in operation on all the lines of the City Railroad, and the total expenses to the company would not fall short of $6,000,000.

ST. LOUIS AND CHICAGO ELECTRIC RAILROAD.

If the physical part of the Chicago and St. Louis Electric Railroad Company materializes we may expect to see a railroad of this class that will astonish the world in the boldness of its conception and magnitude of its operations.

This company was organized in Sprinfield, Illinois, a few days ago for the purpose of building an electric road between the two cities named. Among the promoters of the road are several gentlemen whose names are well known and of high standing in St. Louis.

The map and plans of the new company show three proposed routes starting from St. Louis and merging into one upon nearing Chicago. Either of them, it is said, will be at least 33 miles shorter than the shortest existing steam route. Terminal facilities have already been arranged for both cities, and a large part of the right-of-way has been secured and subsidies granted. The patents of Dr. Wellington Adams are those by which the road will be operated, and the standard schedule time will be 100 miles an hour.

As it will not be necessary to travel at night, no through passenger cars will be run after 9 o'clock P.M., the tracks being reserved at night for high-class freight, mail and express matter.

The electric carriage to be used on this line is long, low, compact, light, but strong, having two pairs of driving wheels, each driven by a separate and distinct electric motor. The whole weight of the car with its passengers and of the two electric motors comes upon these two pairs of driving wheels, and is, therefore, all available for traction or adhesion between the rails and the wheels through the agency of which the car is propelled.

The top of the car stands only nine feet from the rail, which is three feet lower than the ordinary street car. This brings the centre of gravity very low and near to the track. The car has a wedge-shaped nose or front for cutting the air, which has the effect of decreasing the air resistance and of helping to keep the car down on the track.

The motorman stands immediately back of the wedge-shaped point of the car, and between his department and the rear wheels is the compartment for the accommodation of passengers. In the rear of this is a separate compartment for mail and high-class express. The driving wheels are six feet in diameter, and are capable of making 500 revolutions per minute. The weight of the entire car with its motors is but 10 tons. These electric cars will be both illuminated and heated by electricity, and will contain all modern conveniences for comfort.

There will be no conductors or brakemen. It will be possible to stop the cars within half a mile by means of the motors themselves and auxiliary brakes. "Through" cars will be run at intervals of an hour or oftener, as the requirements of traffic demand. Accommodation cars will be run every half-hour, stopping at all points along the line. The "accommodation" cars will be differently constructed from the through cars, the same requirements not being necessary.

One central-power station, six or eight miles from Clinton, De Witt county, Ill., will operate the whole road. It will be at the mouth of a coal mine owned and operated by the company by means of electric apparatus. The company will sell the good coal mined and utilize the slack or dust coal for producing power, a most convenient and profitable arrangement.

The road will be divided into 25 sections of 10 miles each, which will constitute a complete block system, making it impossible for two cars to run at high speed upon any single section at the same time, thus making collisions impossible. There will be a complete block signalling system by means of incandescent electric lights, with telephone communication between cars upon the same section, whether running or standing still. At night the road will be illuminated by incandescent electric lamps for one mile ahead and one mile behind every car while running. The road will be built in a straight line, and, as far as possible, avoid grade crossings or other roads.

At first only a double track will be built, but it is the intention to ultimately construct four—the two outside tracks for local traffic and high-class freight, while the two inner tracks will be used exclusively for through passenger traffic, mail and high-class express. The through cars will not stop between the two terminal cities. Spurs will be run to Springfield, Decatur, Taylorville, Joliet and Bloomington, and each of these places will have a through-car service between St. Louis and Chicago without stop.

Ultimately, a street will run along the side of the tracks, along which dwelling-houses and stores will be built. On both sides of the avenues the land will be laid out into building lots, and in front of these will be a fine boulevard with the electric railway tracks, which, at its ends, will merge into Washington avenue at St. Louis and Michigan avenue at Chicago. Nothing is said in regard to the cost of this line.

NEW INCORPORATIONS.

The South Florida Electric Company, Bartow, Fla., was incorporated January 18, with a capital stock of $2,500. Incorporators: C. J. Seegar, F. J. Maywald, W. E. Prince.

The Deposit Electric Company, Deposit, N. Y., was incorporated January 20, with a capital stock of $12,000. Incorporators: C. M. Putman, C. H. Putman and Charles Knapp.

The Everett Terminal Company, Everett, Wash., was incorporated January 16, with a capital stock of $500,000. Incorporators: Wyatt J. Rucker, Bethel J. Rucker, Tacoma, Wash.

The Illinois Electric Lamp Company, Chicago, Ill., was incorporated January 16, with a capital stock of $25,000. Incorporators: John F. Schaefer, O. M. Smith and Frank E. Baker.

The Universal Power Company, New York, N. Y., was incorporated January 21, with a capital stock of $15,000. Incorporators: J. S. Bell, N. H. Tatlor, Brooklyn, N. Y.; W. A. Nicholson, New York, N. Y.

The Sanders Electric Light Company, Portland, Ore., was incorporated January 15, with a capital stock of $200,000. Incorporators: J. F. Sanders, E. W. Allen, H. C. Allen and F. R. Allen, all of Portland, Ore.

The Strohm Automatic Electrical Safety Block System Co., Philadelphia, Pa., was incorporated (in West Virginia) January 15, with a capital stock of $5,000 000. Incorporators: F. W. Sutterle, John P. Mathien and B. S. Wright.

The Logan Telephone, Water and Light Supply Company, Logan, Ohio, was incorporated January 18, with a capital stock of $25,000. Incorporators: S. H. Bright, M. D. Moore, N. W. Hamblin, W. D. Mansfield and William P. Price.

The Creede Amethyst Electric Power and Water Company, Denver, Col., was incorporated January 20, with a capital stock of $100,000. Incorporators: David G. Peabody, Richard T. Root, Robert M. Kennedy, of Denver, Col., and Frank Straub and Ernest G. Miller, of Creede, Col.

The Electric Reciprocating Company, Denver, Col., was incorporated January 25, with a capital stock of $250,000, to manufacture, buy and sell all classes of electrical appliances. Incorporators: Asahel J. Severance, Charles W. Buck, H. William Kirchner, William P. Carstarphen, Jr., and Charles E. Snyder.

The Palomar Mountain Water Company (incorporated in W. Va.), New York, N. Y., was incorporated January 22, with a capital stock of $5,000,000. Among other functions this company will construct and operate electric railroads. Incorporators: F. D. Rounds, E. W. Dewt, New York, N. Y.; T. E. Bond, Oceanside, Cal.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, Jan. 30, 1892.

The Scott Electrical Company is moving its offices and show-rooms to 89 Liberty street, this city.

Mr. Robert A. Keasbey, of the Magnesia Sectional Covering Company, 58 Warren street, this city, covered all of the steam-pipes in the Western Union Building with the well-known Magnesia Sectional Covering.

P. & B. Compound, made by the Standard Paint Company, 2 Liberty street, this city, was used in wrapping all the wire joints in the new office of the Western Union Telegraph Company, which was described and illustrated in our last issue. The Western Union Company uses only the best material and has tried about everything, and the use of P. & B. Compound is an excellent testimonial of the merits of these goods.

The Law Telephone Company, 85 John street, this city, is sending out a neat thing in the way of an advertisement. It is an imitation of a newspaper folded up for the mail, and wrapped with a buff wrapper for the address. On the back of the card is a picture of the celebrated Law battery and some of its parts. This company has taken 100 square feet of space at the World's Fair, and will exhibit a pyramid of batteries 100 feet high.

The Typewriters' Exchange, 10 Barclay street, this city, is meeting with flattering success, although it has been established but a few months. In order to handle the increasing business the store has been nearly doubled in size. The method of this concern was originated by Mr. George S. Hill, the manager. This consists of selling all known makes of typewriters at the manufacturer's price, also on the instalment plan. The Exchange also makes a specialty of renting machines at the low rate of $5 a month, and in this is meeting with much success.

The Elektron Manufacturing Company, of 89 Liberty street, has moved its office from the main floor to the first floor above. The exhibit of its machines remains on the main floor. The company has lately installed a 180-light dynamo in the steamer *John D. Christopher*, of the Merchant's Dispatch line to Florida. At the steamship company's dock in Florida are eight arc lamps made by the Scott Electrical Company, which are supplied with current from the steamer's plant when she is at the wharf. At the steamship company's New York pier four of these lamps are in use.

The Rollason Gas Engine Company has during the past few days sold six of its celebrated gas-engines in New York City, three in Philadelphia, one in Allentown, Pa.; one in Albany, N. Y.; one in Troy, N. Y., and one in Saratoga, N. Y. Among the uses to which these engines are to be put, two are for a mineral-water establishment, two for a carpenter and building establishment, three for machine-shops, one for a clothing-house and one for a gas-generator. Mr. H. W. Harris is the New York manager at 134 Liberty street, and the company is well represented by this energetic gentleman.

The Garvin Machine Co., Laight and Canal streets, this city, is without doubt the largest manufacturer of special lines of machine tools particularly adapted to makers of dynamos, motors and electrical apparatus and appliances of all kinds. Its universal milling-machine, made with overhanging arm and many other improvements lately added, is selling at the low net cash figure, free on board, at any railroad depot east of the Mississippi, for $480, one of the biggest offers ever made for a first-class machine. Every part of the machine is thoroughly finished and sent out ready for immediate use, and all working parts are highly polished. A call at the company's immense salesrooms at the above address would convince the most scrupulous buyer that this company can supply all wants and needs for the manufacture of any electrical apparatus. It carries in stock special machines for all kinds of repair work needed in electric-light stations, electric-railway stations, etc., and we advise our readers to send for a catalogue and price-list.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	64 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Commercial Cable Co	7,716,000	100 00	151 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	104 50
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	18 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 75
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*101
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	97 00
Edwards Manuf. Co., N. Y	10,000	100 00	90 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	46 50
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		60 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00

Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., N.Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo.	20,000		*98
Laclede Gas Co	7,500,000	100 00	22 00
Laclede Gas pref	2,500,000	100 00	62 50
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa.	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co.	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	20 00
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50,000		*95
North American Railway Co.	39,767,200	100 00	16 75
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E.L.& Impt.Co.,Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	4 75
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250.000	100 00	90 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500 000	100 00	80
Thomson-Houston Electric Co.	6,000,000	25 00	52 00
Thomson-Houston pref	4,000,000	25 00	27 50
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co.,Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100.000	100 00	
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	85 25
Westinghouse Electric Co.	7,000,000	50 00	12 50
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

All legal municipal and State requirements having been complied with and consent obtained from the Brooklyn Common Council and the State Board of Railroad Commissioners brings us face to face with the financial necessities involved in the evolution of transmission from animal to electric traction. That the bonds voted by the several roads interested will be taken by the investors of Brooklyn is not altogether certain; $10,000,000, the amount the change will most likely ultimately cost, is a sum which even at 5 per cent. may not be fully absorbed at home, especially as the corporations are abundantly supplied with money to carry the construction far enough to apply the new motor on a great many miles of their routes, and are therefore not exerting themselves to any extent in seeking capital. That the investment is safe and to be recommended to all having funds in hand for which a moral certainty is required, regardless of interest, can be relied on. The bonds are a first mortgage, including all the assets of every nature, and offer an opportunity for investors outside of Brooklyn to purchase in small lots from $50,000 down even to a single bond, and one which can be sold at any time, when circumstances may require, at a fair advance on the price now asked for them. Delay in securing them means a higher price demanded as well as loss of current interest. The roads under the new motors will, as has been proven beyond cavil, vastly increase their earnings; and beside the greater economy and consequent larger profit we must take into consideration the growth of Brooklyn's population which, as shown in the *Eagle* Almanac, has risen from 566,689 in 1880 to 806,343 in 1890. That this will reach the million mark before the end of this decade no one can doubt, neither is there any possibility of any new corporations competing for the surface business. The present companies cover the city, and the only change in this direction lays in the probable consolidation of the four into one on an equitable agreement, which will enhance the value of the security to the utmost limit of reason. Consolidation will also admit of passenger transfer from one route to another, and this will of itself induce the public to patronize the roads to a far greater extent than they otherwise would. The time calculated to effect the change throughout the city is three years; the earnings during that time will not decrease or business cease for a single day, and it is more than probable that once the power-houses or central stations are erected and equipped, improvement with greater efficiency in the main circuit and motor will commence. The present aërial trolley, while acknowledged the best system yet devised, has reached its limit, and Brooklyn will take the lead in introducing a surface system that will cost less than that in present use and capable of infinitely greater power with less loss of current. All of these points make the Brooklyn Electric Street Car bonds better as a safe investment than they have been as horse-car securities, and those who bought them early have reaped regular and generous dividends. There is little doubt but that the accommodation to the Brooklyn public from electric service will create a jealousy in the breasts of the citizens of New York, which will, within another year, secure electric surface roads for this city, outside of Broadway and Third avenue. To our readers outside of New York, who feel inclined to invest in this vicinity, we recommend these Brooklyn bonds and that they be bought at once. One of the companies retired last month $1,000,000 of its old bonds, which is proof positive that it was not in want of funds.

Competition and obstruction in all that concerns the New York City arc electric lighting companies has rendered the declaration of dividends almost impossible. In many cases compulsory payment of large amounts for subway rentals, which are not profitably employed, takes from the treasury money which might otherwise pay the shareholder something in the shape of interest on his investment. The city has just awarded the contracts for the current year at forty cents per night for each two thousand candle-power lamp to be illuminated all night and every night. The expense to a company in a large city, where there is more than one corporation engaged, is considerably greater than in a smaller place. Rents, right-of-way, labor, fuel, oil and other absolute necessities are more costly, while the service is constantly watched and criticised by the people and the authorities, and must be at all times up to the terms of contract and fully satisfactory to the commissioner of city works. The interest on the bonds and other fixed charges are being met, but the companies differ from the Trust Companies in that they are not advertising their surplus in upper-case type on every possible occasion. We shall hail with pleasure the day when we can, in this article, publish to our readers, many of whom are stockholders, that out of the earnings of a New York City electric light company, after paying the coupon on the bond and reserving a reasonable amount as a surplus, a few thousand dollars remain in the treasury which is to pay on the first prox. a dividend of 5 per cent. From six to eight per cent. was paid only a few years ago and stocks raised above par for a short time. There is more money to be made outside of the city just now. I know of several plants in various stages of completion, franchises secured, contracts signed, dozens of arc and hundreds of incandescent lights subscribed for, within sight of the dome of the building in which the ELECTRICAL AGE is published, that are seeking capital to complete their construction. These will pay from the start, and in a very few years will be within the limits of greater New York, which will at once increase their value. A very few thousand dollars will purchase a large interest with a seat at the board and a voice in the management. The investment will double the moment the plant is completed and light turned on, besides making a permanent position for a capable man as superintendent. The price obtained per lamp will be fully up to that paid by the city and no competitor; on the contrary, a friendly and rapidly growing population, and you get in on the very bed-rock.

EASTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET, BOSTON, Jan. 30, 1892.

THE exhibit of the Thomson-Houston Electric Company at the World's Fair will cost $500,000, and it will require 20,000 square feet of space.

THE INDUSTRIAL IMPROVEMENT CO., Boston, Mass., has ordered a 300 H. P. Ball Cross Compound engine from the Ball Engine Co., Erie, Pa.

A LARGELY attended meeting of the New England Electric Club was held in Parlors A and B, Tremont House, Wednesday evening, February 3.

THE HOLTZER-CABOT CO., of Franklin street, Boston, Mass., will issue, about February 20, an elaborate catalogue, containing 100 pages, illustrating its many specialties.

THE EASTERN ELECTRIC CABLE CO., 61–65 Hampshire street (Roxbury District), of which Mr. Henry A. Clark is treasurer and general manager, still continues on its upward and onward course. Never in the history of the wire business has a firm of but a few years' existence made such rapid strides toward the front. The Clark wire has been before the public for over nine years, and as yet not one complaint has been received. The factory is pushed to its utmost capacity, working from 7 A.M. till 9 P.M., and still the company is overwhelmed with orders. The "Clark" specialties include aërial, underground, submarine, telegraph and electric-light copper wire, rubber insulation with braided covering, also flexible or standard cables for electric light, every one of which is guaranteed. It is interesting to note that during the summer months the output of "Clark wire" increased 45 %, while during September and October the increase was equal to 90 % over corresponding months of the previous year. While the works now cover a vast area of ground, it has been found inadequate to supply the demands, and another building is now in the course of erection.

D. L. T.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
245 STATE STREET, CHICAGO, Jan. 30, 1892.

THE Directors of the Great Western Electric Supply Co., Chicago, at the December meeting declared a dividend of 2 per cent., amounting to $7,000, on the $350,000 of preferred stock of the company. This was paid on January 10. It is remarkable to note that the preferred stock of this company has added nearly one hundred names to the list of its holders during the last ninety days.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, is mailing to the Western trade a circular containing a description of the Swinging Ball Lightning Arrester, with a few of the numerous testimonials received. The company reports that judging from the large number of replies received from persons familiar with the merits of the device and who state that they will use a large number of them this spring, it is sure of orders that will test the capacity of the factory.

THE new Board of Directors of the Standard Underground Cable Company met in the company's office, Pittsburg, Pa., January 28, 1892, for the purpose of organizing. Mr. Joseph W. Marsh was re-elected as Vice-President and General Manager, Mr. Frank A. Rinehart as Secretary and Treasurer, and Mr. O. R. Ebel as Auditor, and John H. Dalzell, Mark W. Watson and James H. Willock were chosen as the Executive Committee for the ensuing year. A dividend of 1½ per cent. on the capital stock was declared payable February 10.

TRENTON (N. J.) NOTES.

Trenton, N. J., is celebrated in history by the crossing of the Delaware at this point by George Washington to surprise his enemies. Your correspondent surprised the place in a somewhat different manner last week, using the modern mode of transportation—steam cars—instead of an antiquated boat. There are in this place some active electrical manufacturing concerns, among which may be mentioned the well-known establishment of J. A. Roebling's Sons & Co. This company is among the oldest of wire manufacturers. Some years ago the manufacture of copper wire was added to its business, and within the past two or three years insulated wires of all kinds have also been manufactured by it. The establishment is very large and the facilities for turning out wires are very great.

The Crescent Insulated Wire Company of this place makes a specialty or covering wires with its special compound and insulating material, and it is reported that a large business is being done.

Among the various industries in Trenton is the Electric Light Oil Company, which is making a special line of oil for dynamos.

The Greenwood Pottery Company manufactures a large line of porcelain insulators, and the attention of buyers and users of these goods is called to this concern. The excellence of the goods has been proved by experience, and the company has ample facilities for doing a large trade.

The Trenton Wire Mills is one of the oldest concerns established for the manufacture of galvanized iron wire for telegraph and telephone purposes. The company's works is one of the largest in Trenton. Its New York office is in Burling slip, and the house is known as Cooper, Hewitt & Co.

Mr. F. Dugan, of the Empire Porcelain Works, was found at his hotel. He speaks very encouragingly of trade, and judging from the looks of the company's factory, it is reasonable to suppose that it carries on a large and successful business.

W. T. H.

NEW BRUNSWICK (N. J.) NOTES.

New Brunswick, N. J., is an active little city located on the Pennsylvania Railroad about one hour's ride from New York. This thriving place contains many manufacturing industries, among which may be mentioned the works of the National Water Tube Boiler Co., under the management of Mr. W. A. Kelly, President. This company manufactures water-tube boilers with the steam-drum placed horizontally above the water-tubes, which are placed at an angle of 45 degrees over the fire-box. A great many points of superiority are claimed for this method of constructing boilers. These boilers are used in many electric light and electric railway plants with the greatest satisfaction. Mr. Loretz is manager of the company's New York office, at No. 18 Cortlandt street. He is a gentleman of large experience and thoroughly capable.

The Consolidated Fruit Jar Company is located here, and its New York office, 49 Warren street, is under the management of Messrs. Smith & Wisner. This concern manufactures stamped metal goods of all kinds for electrical purposes, including parts of armature cores, battery cells, covers, in fact every part of electrical apparatus that can be stamped by machinery. The company does a large business for the electrical trade.

New Brunswick is lighted electrically on the Edison system. At the Edison Illuminating Company's station is a 50-arc-light machine, made by the Old American Electric Manufacturing Company. There are 25 lamps on the circuit. In connection with the incandescent system four Ward arc lamps are used. Mr. Britton is the electrician of the company. This company is doing a commercial business only, and it would seem to the writer that if there was a little more of the active spirit the company could control a large volume of business in arc lighting. At the present time it does not supply any lights for street lighting. W. T. H.

PHILADELPHIA NOTES.

Pepper & Register, Provident Building, this city, are making preparations for a large business among street-railway companies. They are expert engineers and contractors, and are fully able to undertake the construction of railway and electric plants in general.

J. Elliott Shaw, 632 Arch street, has one of the most elegantly appointed supply houses in this section. He carries every line of household specialties, small motors, batteries, etc. He also manufactures automatic gas-burners, window-springs for alarm systems, and he was the first to introduce Norway iron in the construction of bells.

The Pennsylvania Electric Engineering Co., Penn Mutual Building, is now fully organized for the introduction of its new incandescent lamp, about which much talk has been indulged in lately. It also carries a full line of electric light and railway supplies, and contracts for the installation of complete electric light and railway plants.

Mr. Charles W. Lord, 316 Union street, this city, is manufacturer of Lord's boiler compound, which is extensively used on steam plants throughout the country. All engineers and steam-fitters who have used this compound speak highly of it. Every electric-light station and street-railway power-house can have a sample by sending to Mr. Lord for it.

Vallee Bros. & Co., 6 North 17th street, are doing a large business, and since Mr. Roberts became connected with the house trade has increased in a most satisfactory manner. Some time ago this concern took the agency of the Buckeye incandescent lamp, and until the present time was unable to keep up with the orders. It is also handling many other incandescent light specialties, and is well known throughout the country.

The Novelty Electric Company, 54 North 4th street, this city, is doing a large business in its new wire gauge. Thousands of them are already in use and the demand is constantly increasing. The company is working on several new specialties for incandescent lighting, among which may be mentioned the half shade for incandescent lamps. This company manufactures a great variety of goods, which are fully and elaborately set forth in its new catalogue.

The American Reflector Company, Fifth and Cherry streets, manufacturer of the new cone-shaped reflector shade, is meeting with excellent success. Several stores throughout the city are fitted up with these shades, and much satisfaction is enjoyed through their use. The piano store of Blaisus & Co., Chestnut street, use two of the American Company's shades, with excellent results. They light up the store very attractively, and display the pianos to good advantage.

J. J. Murray & Co., Trenton, Calvert and Westmoreland streets, manufacture a line of incandescent shades, which are very handsome in appearance. Every electric light man needing arc and incandescent lamp-shades should see what this firm has before selecting elsewhere. The very best material is used in the manufacture of this company's goods, and the help employed in designing and finishing the shades is the very best. The firm has its own designers, who are kept busy getting up new goods.

The La Roche Electric Works, 116 North 6th street, is installing the electric light apparatus in Queen & Co.'s establishment, at 1010 Chestnut street. The company is very busy on a number of contracts for isolated plants, both on the direct and alternating systems, to be used in different places throughout the West. In this section of the country the La Roche system has an excellent record and is much favored. Mr. La Roche, its inventor, is a well-known Philadelphia electrician, and Mr. Cole, the manager of the company, is an old and well-known Thomson-Houston man.

The S. S. White Dental Manufacturing Company, 12th and Chestnut streets, is having a great degree of success with the Partz battery. This battery is always clean and ready for use. The Pennsylvania Railroad Company is using the Partz battery quite extensively in its Philadelphia offices, and speaks well of it. The White Dental Company also deals in other styles of batteries to run small lathes for dental and jeweller's work, sewing-machines and for other purposes where small power is needed. Mr. Teal, of the company, is a very courteous gentleman, and is willing to give all the information in his power concerning the goods of his company.

At a meeting of the organizers of the Philadelphia Electric Club held last week, most encouraging reports were received from the different committees, which had been appointed at previous meetings to call upon the prominent electricians and manufacturers throughout Philadelphia, with a view to obtaining the signatures of those who were willing to become members of the new club as soon as it is completely organized. They have secured nearly 100 signatures to the list already, and it is expected the number will reach 200 in another week or so, when it is intended to hold a meeting at some prominent hotel, and complete the organization.

Patrick & Carter, 125 South Second street, was the first house established in Philadelphia for the manufacture of electrical goods. This firm is well known in the telegraph service, and made a large reputation in the manufacture of telegraph instruments. They manufacture and carry a large line of electric bells, push-buttons, batteries, etc., for household and office use. Their needle annunciators are pretty well known all over the country, thousands of them being used in hotels and private houses. They still continue to manufacture telegraph apparatus of every description. They do not claim, however, to manufacture cheap goods, their aim being to give the best goods for the least money. They carry a large stock of insulated wire, and make a specialty of bells, disque Leclanche batteries, gas-lighting apparatus, bronze goods, etc., etc., for hotel and house work.

Mr. J. M. Price, the well-known inventor of railway appliances, showed your representative his several inventions relating to street rails and street-railway cross-ties and other improvements. His composite girder, in combination with the Price rail, is said to be unequalled in wheel service and economy as to scrap. Mr. Price says that in every other style of rail there is from 75 to 80 per cent. of scrap or waste iron. His rail is laid directly on the girder in such a way as to insure an economic, smooth, elastic and permanent road. He has many improvements, including iron ties and clamps for holding T-rails in position. His iron girders or sleepers are to take the place of the present wooden sleepers. They are so made as to be economical in weight, and there is no waste metal in the entire piece.

H. T. Paiste, 108 South 18th street, Philadelphia, Pa., was called on by your representative the past week, and found in a most happy mood, as he had just returned from an extended trip throughout the West and South. He had been as far West as Kansas City, taking in the principal cities of the Middle and Southern States en route, and reports a most excellent line of orders taken for his switches, cut-outs, incandescent-lamp sockets and porcelain ceiling rosettes. Mr. Paiste is no doubt manufacturing one of the most durable and safe incandescent-lamp circuits and switches in the market. He was among the first, if not the first, to introduce porcelain bases in his switches, cut-outs and lamp-sockets, foreseeing the great advantage of this material. For fire-proof and insulating qualities, the porcelain has no competitor, and the insurance underwriters in the principal cities now demand its use in all places illuminated by the incandescent system. It is a well-known fact that this material insures prevention from fire, especially in the case of wires being crossed. In the construction of Mr. Paiste's specialties, it is an impossibility for the wires to become crossed. Mr. Paiste's factory has loomed up very greatly in the past week in the increase of workmen, and it is a most interesting sight to observe the care with which the work in each department is carried on. New machinery has been put in, and there is a department for stamping out shelves, one for stamping out the parts of switches, another for insulators, another for assembling of the goods, and another for finishing, for inspection and packing, so that the rough material begins at one department, passes through the other departments and finally is turned out as finished goods ready for shipment. This is said to be the most complete factory in existence producing this line of goods. W. T H.

CATALOGUE.

J. H. Bunnell & Co., 76 Cortlandt street, this city, have just issued their general catalogue for 1892. It is replete with illustrations and descriptions of the full line of Telegraph, Telephone, Electric Light and Electric Railway supplies carried by them, and is one of the most complete catalogues we have so far seen.

PELTON WHEELS AND MOTORS.

The Pelton Water Wheel Co. reports the following recent sales of Water Wheels and Motors: Four motors to the London Hydraulic Power Co., to operate under 750 lbs. pressure. Two motors to the Candelaria Mining Co., Mexico, to run electric generators, under 1,100 ft. head, for a Thomson-Van Depeole drilling plant. One 4-ft. wheel and one motor, to run machinery at Hackberry Mines, Arizona, under 1,200 ft. head. Four 3½-ft. double-nozzle wheels, and one 6-ft. triple-nozzle wheel, to run under 24-ft. head, for Limon Electric Plant, Salvador, C. A. One 4-ft. wheel to Georgia Marble Co. Three 8-ft. wheels for Anaconda Smelting Co. Two motors for Backus & Johnson, Lima, Peru. One 6-ft. wheel for Gold King Electric Plant, Telluride, Colorado. One 3-ft. wheel, for running electric transmission plant, Consolidated Mining Co. (Belmont), Telluride, Colorado. Two motors to De Beers Mining Co., Transvaal, S. Africa. One 8-ft. wheel for running a Silver Mill, at Lewis, Nevada. One 5-ft. wheel, to Porte Cortez, Honduras. Four 5½-ft. double-nozzle wheels, for an electric-light station, at Santa Anna, San Salvador, C. A., to operate under 60-ft. head. One 6-ft. triple-nozzle wheel, for Santa Anna Water Works, San Salvador, C. A. One motor and one 6-ft. special wheel, to Nicaragua, C. A. One motor to Ricaurte, Salvador, C. A. One motor for coffee plantation, Esperanza, Guatemala. One motor to Callao, Peru. One 6½-ft. special wheel and one 3¼-ft. special wheel for St. John Del Ray Mining Co., Brazil. Two 5½-ft. wheels for running an electric light plant in Japan. One 11-ft. wheel, one 3-ft. wheel, one 1½-ft. wheel, and six 3½-ft. wheels to the Columbia River Paper Mills, La Camas, Washington.

BUSINESS NOTES.

A letter, a copy of which is given below, has been received by Messrs. Charles A. Schieren & Co., well-known makers of electric and perforating belting, 47 Ferry street, this city, from Mr. J. E. Winslow, manager of the Roundhay Electric Tramway, Leeds, England, which shows that Schieren belts are in favor in England.

"THE ROUNDHAY ELECTRIC TRAMWAY,
"146 Roundhay Road, Leeds, England,
"Jan. 16, 1892.

"*Messrs. Chas. A. Schieren & Co., New York, U. S. A.*

"GENTLEMEN: We are ordering to-day from you a supply of your Electric Belt Stuffing, also a supply of your Belt Cement.

"Will you kindly send us full instructions for splicing your Perforated Belts? It may interest you to know that the two belts furnished by you for this plant are giving every satisfaction, and have elicited considerable admiration from English engineers. Yours truly,

"THE ROUNDHAY ELEC. TRAMWAY,
"J. E. WINSLOW, *Manager.*"

WOULD NOT PART WITH IT.

REMINGTON, JASPER CO., IND., Jan. 14, 1892.

Jerome Kidder Mfg. Co.

GENTLEMEN: Will you please to forward me * * * * *? I have one of your five-post Tip Batteries, purchased some two years ago, which no amount of money would induce me to part with if I could not obtain another.

Please forward * * * * * without delay, and very much oblige Yours truly, E. LANDON.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued January 26, 1892.

467,504. Electric Switch. Henry J. Haight, New York, N. Y. Filed Dec. 24, 1890.

467,505. Electric Indicating-Instrument. Henry J. Haight, New York, N. Y. Filed Feb. 7, 1891.

A swinging armature lever having a projecting pin, a ratchet-wheel, and a pawl carried by said lever, which engages said ratchet-wheel, in combination with a limiting device for said lever, said device consisting of a link swinging on a different centre from that on which said lever swings, and said link having an aperture in which said pin enters, said aperture being larger than said pin.

467,509. Electric-Drill System. Harry N. Marvin, Syracuse, N. Y., assignor to the Marvin Electric Drill Company, same place. Filed Aug. 15, 1891.

467,510. Electric-Drill System. Harry N. Marvin, Syracuse, N. Y., assignor to the Marvin Electric Drill Company, same place. Filed Aug. 21, 1891.

The combination, with a generator of rising and falling currents and a reciprocating drill or tool provided with two magnetizing-coils, of a switch for directing the current alternately through the said coils, and a rotary synchronizing-motor driven by the current and connected with and operating the said switch.

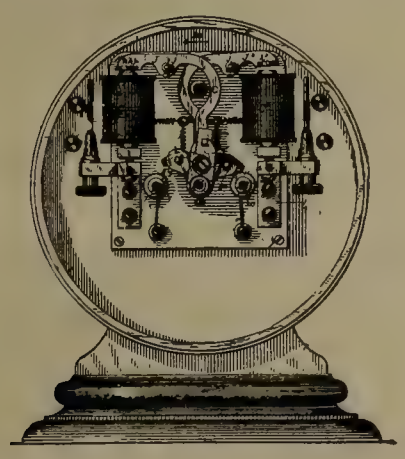
467,511. Hanger for Electric Lamps. David B. Matson, Buffalo, N. Y. Filed Nov. 24, 1890. Renewed Oct. 12, 1891.

467,520. Composition of Matter for Insulating Purposes. David H. Piffard, Piffard, N. Y. Filed May 26, 1891.

A composition of matter for insulating purposes, consisting of rubber, rosin and plaster-of-paris or its equivalent, in the proportions, by weight, of five rubber, twenty-four rosin, and twenty-six plaster-of-paris, more or less.

467,523. Incandescent Electric Lamp. Edward P. Roberts, Cleveland, Ohio, assignor to the Swan Lamp Manufacturing Company, same place. Filed July 15, 1891.

In an incandescent electric lamp, the combination, with the bulb, socket-piece, and material in the socket-piece con-



467,505.—ELECTRIC INDICATING-INSTRUMENT.

necting it with the bulb, of air-passages extending through said connecting material from the butt of the bulb to the outlet of the socket-piece.

467,530. Phonograph. John H. White, Washington, D. C. Filed June 4, 1891.

467,537. Alternating-Current Motor. Ludwig Gutmann, Pittsburg, Pa. Filed Nov. 29, 1889.

An electric motor consisting of the combination of field-magnets in circuit with an alternating-current generator, an armature whose winding is divided into circuits unequal in virtual resistance, and a secondary-current generator connected to said armature.

467,538. Electric Heater. Ludwig Gutmann, Pittsburg, Pa. Filed Nov. 12, 1890.

In a heater for alternating, pulsating, or intermittent electric currents, the combination of a conductor carrying the said current supplied from any suitable source and a metallic or magnetic hollow-core adapted to allow air circulation through its body in inductive distance to said conductor.

467,540. Electric Switch. Charles J. Klein, New York, N. Y. Filed April 6, 1891.

467,542. Carbon-Brush Holder. Cyprien O. Mailloux, New York, N. Y. Filed March 18, 1891.

467,543. Apparatus for Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Filed April 24, 1891.

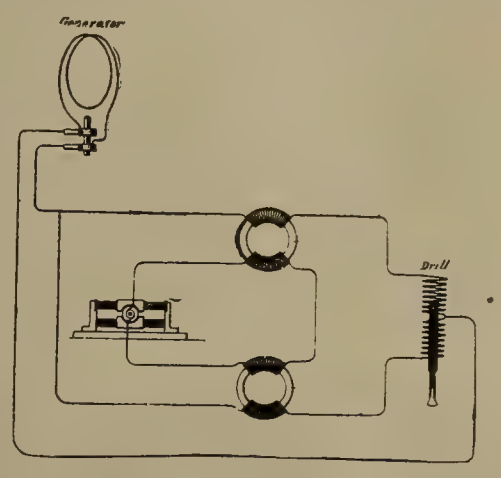
In an apparatus for charging storage-batteries, the combination of a bank or battery of dynamos having different adjusted potentials and connected to separate mains or leads, in combination with switch devices for connecting a battery to be charged to any one of said mains or leads at pleasure.

467,544. Apparatus for Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Filed April 24, 1891.

In an apparatus for charging storage-batteries, the combination of mains or leads having a definite or maintained electric potential obtained from any source, means for placing storage-batteries in branches from one to the other of said mains, and a supplemental or auxiliary electro-motive-force generator in each branch adapted to assist the applied or the counter electro-motive force and variable in effect independently of the battery and the charging source.

467,545. Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Filed April 24, 1891.

The herein-described improvement in automatically maintaining the strength of the charging-current or rate of charge in a storage-battery by running an electric motor with a constant torque by the charging-current and allowing the auto-



467,509.—ELECTRIC-DRILL SYSTEM.

matic variation of counter electro-motive force of said motor to compensate for the variations of electro-motive force of the battery as the charge progresses.

467,546. Apparatus for Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Filed April 24, 1891.

In an apparatus for charging storage-batteries, the combination of a main charging dynamo or source, a supplemental electro-motive-force generator acting either to assist the counter electro-motive force of the battery or that of a charging source, and a switch and connections whereby said supplemental generator may be thrown into or out of the charging-circuit, including the main generator and the battery, according to the state of charge and counter electro-motive force of the latter.

467,547. Apparatus for Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Filed April 24, 1891.

The combination, with the main charging-dynamo adapted to supply a substantially constant potential, of supplemental generators in series with the main generating-machine, and a number of electric switches, each having connections to intermediate points of the series circuit, whereby different numbers of the said machines in series may be connected into each battery-charging circuit as the counter electro-motive force of the battery therein rises during the charge.

467,551. Automatic Electric Controller for Air-Pumps. Adolph Bergmann, New York. N. Y.; Bertha Bergmann, administratrix of said Adolph Bergmann, deceased. Filed Sept. 18, 1890.

467,573. Secondary Battery. Justus B. Entz, New York, and William A. Phillips, Brooklyn, N. Y. Filed Jan. 7, 1891.

This is a method of treating secondary electric batteries containing a metallic solution, which consists in agitating or setting up a circulation in the solution or electrolyte while the battery is being charged or discharged.

467,576. Incandescent Electric Lamp. Harry J. Gutmann, Des Moines, Iowa. Filed April 10, 1891.

As an improved article of manufacture, an incandescent electric lamp comprising an enclosing globe, a base for the lamp, an endless circular filament disposed within said globe in one horizontal plane, together with leading-in wires extending downwardly and outwardly from the base to either side of the said filament, their lower ends being connected to said filament at diametrically-opposite points.

467,581. Electric Railway Signalling Apparatus. Frank I. Myers, New York, N. Y. Filed March 16, 1891.

467,583. Trolley-Wheel for Electric Cars. Levi A. Simons and George R. Roof, Omaha, Neb. Filed Jan. 22, 1891.

The construction of a trolley-wheel with cutting-edged corrugations on the outer surface of the wheel.

467,610. Electric-Arc Lamp. John A. Mosher, Abilene, Kans., assignor to the Mosher Arc Lamp Company, same place. Filed Jan. 24, 1891.

467,611. Rheostat. John A. Mosher, Abilene, Kans. Filed April 4, 1891.

467,613. Contact-Board for Rheostats. Sidney H. Short, Cleveland, Ohio. Filed March 18, 1891.

In a contact-board for rheostats, the combination, with a board, of a series of contacts separated from each other by air-spaces, each contact being constructed with a downwardly-projecting foot at its opposite ends, whereby the body of the contact is elevated and separated from the board and an air-space is formed between them.

467,650. Apparatus for Laying Underground Conduits for Electric Wires. Horace B. Camp, Cuyahoga Falls, Ohio. Filed Oct. 31, 1891.

467,651. Electrical Signalling Apparatus. Patrick B. Delany, South Orange, N. J. Filed Sept. 19, 1890.

The combination, with a time mechanism, its minute-arbor, an electric circuit containing a battery and electro-magnet, and contact devices by which said circuit is closed for brief periods at regular intervals during the revolution of the minute-arbor, of an armature actuated by said magnet, a time-indicating hand driven intermittently by the armature, the dial over which the hand traverses, an alarm-circuit having an alarm device therein, contacts by which the alarm-circuit is closed at one point when the armature of the magnet is attracted, one or more contact plugs or pieces adapted to be placed at any desired point on the dial to form part of the alarm-circuit, and a contact moving with the time-indicating hand to complete the alarm-circuit through said contact-pieces, whereby the alarm is caused to sound during the time the armature-magnet is attracted.

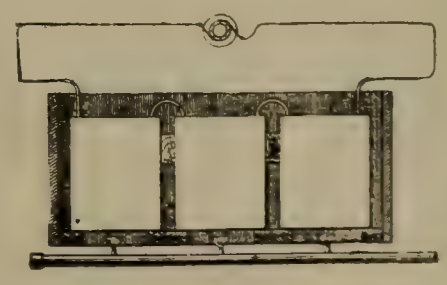
467,656. Electric-Arc Lamp. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 3, 1888.

467,669. Meter for Electric Translating Devices. Henry H. Cutler, Newton, Mass. Filed Jan. 2, 1889.

467,679. Electric-Conductor Support. Eben M. Boynton, West Newbury, Mass. Filed March 19, 1891.

A bifurcated beam having in its interior blocks of insulating material, from which blocks one or more conductors are suspended.

467,693. Motor Mechanism for Street-Cars. Richard W. Thickins, Minneapolis, Minn. Filed April 20, 1891.



467,773.—REGULATION OF ELECTRIC CIRCUITS.

467,699. Electric Railway. Warren B. Hutchinson, Passaic, N. J. Filed April 14, 1891.

In an electric railway, a hollow carrier for the main conductor, said carrier having a longitudinal slot in one side and having its rear wall inclined downward to the slot.

467,716. Incandescent-Lamp Socket. Patrick Dunn, Cleveland, Ohio. Filed March 12, 1891.

467,738. Adjustable Electrode for Dental Purposes. William P. Horton, Jr., Cleveland, Ohio, assignor of one-half to Ansel B. Jones, same place. Filed June 10, 1891.

467,741. Motor-Car. Charles Lancaster and John Sturgeon, Chester, England, assignors to John Hughes and Charles Lancaster, same place. Filed Jan. 12, 1891.

The combination, with a train of two or more cars, of a motor on each car provided with valves or devices for controlling its motion, a hydraulic ram or pump on one of said cars, and pipes connecting said hydraulic ram with the valves or motion-controlling mechanism of each motor, whereby all the motors may be simultaneously operated.

467,748. Electric Clock. Frank A. Ellis, Toronto, Canada. Filed June 13, 1891.

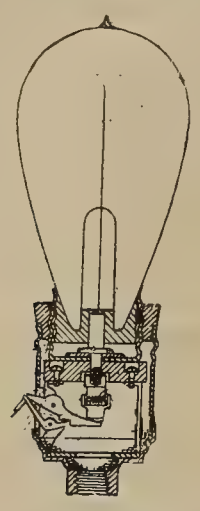
467,752. Arc Metal-Working Apparatus. Henry Howard, Halesowen, England. Filed July 6, 1891.

An apparatus for heating or welding by the electric arc, in which the work forms one electrode, comprising a pencil

forming the other electrode mounted to move longitudinally and transversely and mechanism for affecting these movements.

467,773. Regulation of Electric Circuits. Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place. Filed May 1, 1889.

The combination, with the source of electric energy of an



467,716.—INCANDESCENT-LAMP SOCKET.

electric motor the field-magnet of which is provided with a plurality of field-magnet coils, of a circuit-controlling switch consisting of a cylinder provided with a duplicate set of insulated contact-plates, a series of brushes arranged to bear on the contact-plates, connections between the contact-plates and the terminals of the field-magnet coils, connections between the armature-coil and current-reversing plates on the switch, and a rheostat and connections between the same and plates on the switch.

467,774. Electric Tell-Tale for Tanks. Charles Reuter and George Bollmann, Brooklyn, N. Y. Filed June 19, 1891.

467,817. Rail-Crossing. Smith S. Leach, Cambridge, Mass. Filed July 2, 1891.

467,833. Magnetic Separator. Francis H. Richards, Hartford, Conn., assignor of two-thirds to Roswell M. Fairfield, Holyoke, and Oscar S. Greenleaf, Springfield, Mass. Filed Sept. 29, 1891.

In a magnetic separator, the combination, with a frame work and with a magnet having alternating strong and weak fields or zones, there being a pulp passage-way between the frame work and magnet, of one or more sets of deflectors located adjacent to the magnet in said passage-way and acting to laterally deflect the current therein, whereby the fluid acted upon is directed from the weak toward the stronger field or zone.

467,875. Push-Button. Adam Lungen, New York, N. Y., assignor to himself and Robert Edwards, same place. Filed March 4, 1891.

467,884. Station-Indicator. Ruben B. Ayres, New York, N. Y., assignor to Aaron L. Ayres, same place. Filed Feb. 16, 1891.

In an electrical street or station indicator, the combination, with a metallic case or housing having openings in its front, of a pair of revolving drums, an indicating sheet or ribbon operated by said drums and formed throughout with a series of perforations or openings, a spring-supported contact adapted to project through the openings of the ribbon to form an electrical circuit with the case, clutches for engaging the drums, a shifting-lever for operating the clutches, a locking device for said lever, an electro-magnet and its armature, and a suitable battery and wire connections.

467,897. System of Electric Distribution. Nelson W. Perry, Cincinnati, Ohio. Filed April 13, 1891.

467,901. Test-Circuit for Multiple Switch-Boards. Charles E. Scribner, Chicago, Ill. Filed May 29, 1891.

The combination, in a circuit open at two points, of contacts whereby the circuit may be closed at either point or at both of two sources of intermittent currents, one source giving currents of opposite direction to and complementary to those from the other source, and a polarized device adapted to respond to composite currents from the two sources.

467,902. Test-Circuit for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Filed May 29, 1891.

H. WARD LEONARD & CO.



"Secure bid from us for electrical apparatus or construction before deciding. Railways, Lighting, Transmission of Power, Wiring, etc."

Address ELECTRICAL EXCHANGE BLDG., New York City.

VULCANIZED FIBRE COMPANY (Established 1878.

SOLE MANUFACTURERS OF

HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

FACTORY: MINGTON, DEL. The Standard Electrical Insulating Material of the World. OFFICE: 14 DEY ST., N. Y.

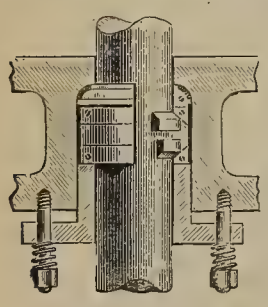
CLARK ARC LIGHTING SYSTEM

With Automatic Safety Device to Prevent Accidents from Broken High Tension Wires.

The Clark Arc Lamp for Incandescent Circuits, Single or in Series, 7½ and 15 Hours Continuous Burning.

CLARK ELECTRIC CO., 192 BROADWAY, N. Y.

FORREST'S SILVER BRONZE PACKING.



Applied to any stuffing-box, without disconnecting. Steam, air, and water tight without soft packing, under the highest steam pressure and piston velocity, non-corrosive, automatic, cannot get out of order, admits of excessive vibrations of rods, does not bind, economical, satisfactory, **guaranteed** to last 2 to 10 years with no attention. Will pack Engines by the year. Used on the best steamers in New York Harbor. References.

115 Liberty St., N. Y.

BALL AUTOMATIC CUT OFF ENGINE

MADE ONLY BY THE BALL ENGINE CO ERIE PA.

McLEOD, WARD & CO.,

Electrical and Mechanical Eng'rs,

91 LIBERTY STREET, NEW YORK.

ELECTRIC MOTORS, FAN OUTFITS,

Brushes for Sprague Motors, Hoods for Arc Lamps. Write for Prices.

PLATINUM

JAS. SCHAWELL & CO., 29 JOHN STREET, NEW YORK.

Importers and Melters, Wholesale and Retail. Scrap Purchased.

SOMETHING NEW!

IMPROVED ZINCS

FOR BATTERY PURPOSES.

Our Zincs are composed of an alloy of **Zinc and Mercury only**, and can be furnished of any size or shape desired. They are guaranteed to be as represented. Their use affords an increase of Electro-motive Force and a decrease of Internal Resistance in any cell. Hence **Increased Economy and Efficiency.**

For further particulars and samples, address THE CARR METAL CO., No. 11 GRANITE BLOCK, FALL RIVER, MASS.

PLATINUM

Refiners and Melters.

WIRE IN ANY SIZE ALWAYS IN STOCK. SCRAP BOUGHT.

Prices on Application.

ROBERTSON & LEBER,

13 & 15 Franklin St., Newark, N. J.

BATTERY ZINCS

RODS AND PLATES FOR BATTERIES.

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EDISON GENERAL AND THOMSON-HOUSTON.

The consolidation of the Edison General Electric Company and the Thomson-Houston Electric Company is announced and confirmed by Mr. Henry Villard. This important deal has been under consideration for some time, and its consummation has long been looked for by those interested.

The electrical trade will watch with eager interest for further developments in this great deal.

OPPOSITION TELEPHONE COMPANY.

A vague rumor is going the rounds on the "street" to the effect that the Standard Oil Company is making preparations to go in the telephone business on the expiration of the "Bell patents" next year.

How much truth there is in this report, it is not at the present time possible to state, but it would seem that the Standard Oil Co. will likely find a big job on its hands if it undertakes to successfully combat such an institution as the Bell Telephone Company.

The Standard Oil Company is a very wealthy corporation, and if it does go into the telephone business, for business purposes, there will likely be a battle of the giants, and it will be interesting to watch the course of events leading up to such a condition of things.

TELEPHONE FOR SHIPS.

The subject of telephonic communication between ships at sea and between a ship and the shore is one that has in late years attracted the attention of many inventors. The practical value and utility of such apparatus are obvious, and one result might be the great reduction in the number of collisions between ships.

We publish on another page a description of a sea telephone which seems to have some novel features, and probably practical ones. The object of the invention is to receive on the proper apparatus the sound-waves pulsating in a body of water, then transform, intensify, transmit and indicate the impression so produced in such a manner that it will be easy to determine the position, distance and orbit of the object from which the sound-waves proceed.

In naval circles an apparatus that will accomplish this result, and can be relied on, will, no doubt, find a very large field of usefulness.

THE BUFFALO CONVENTION.

Matters relating to the National Electric Light Association Convention, to be held in Buffalo on the 23d, 24th and 25th instants, begin to assume definite shape, and there is every promise that the meetings will be of extraordinary interest.

We publish elsewhere in this issue a list of the papers to be read at the Convention. It will strike the reader at once that the papers named comprise a series that has never before been equalled in practical value. The subjects treated in every one of them are of the most interest and importance to station managers, and, we think, those who attend the Convention will feel amply repaid for their trouble and time in the practical information they will gain.

The authors of these papers, moreover, are men of practical experience. What they will have to say will not be based on theoretical considerations; hard, practical facts will be given, and every member will have an opportunity to state what he knows that wil be of interest to the other members.

Each member should make a personal effort to make this Convention the most successful, from a practical and business point of view, that the association has ever held.

CUTTING ICE BY A HOT WIRE.

Enterprising ice-dealers should not be slow to take advantage of the facilities offered by the use of electric power in the work of cutting and gathering ice. While the ice industry is an enormous and important one, the methods of gathering the ice in vogue at the present day have undergone little or no change since the beginning of the business.

These days electricity is harnessed to all kinds of work, and ice cutting need not be an exception. We lately described and illustrated a machine designed for such work run by electric power, and in this issue Mr. J. H. Bunnell, in an article on the subject, makes a novel suggestion that certainly is worth trying.

He suggests that a wire of any desired length be stretched along the surface of the ice where it is to to be cut, and the wire kept heated to a sufficiently high degree by an electric current. By maintaining the heat the wire will cut through the ice by its own weight, and Mr. Bunnell thinks that a very few minutes, ten at the most, would be sufficient to cut 200 feet of ice in this way.

Here is an excellent chance for some ice company to show some enterprise by giving this idea a practical test. As compared with existing methods of harvesting ice we think that the economy would be greatly in favor of the hot-wire method. This, however, can only be determined by an actual test, as in the case of the practicability of the system.

PROMISE OF A LARGE EXHIBITION AT BUFFALO.

There is every indication that the exhibits of electrical apparatus and appliances at Buffalo during the Convention of the National Electric Light Association, on February 23, 24 and 25 next, will be on a much more extensive scale than was anticipated. We learn that a great many supply houses have secured quarters at the Iroquois Hotel, and intend to make as large a display of goods as they would if the Association itself had undertaken a general exhibition. The extent and number of individual exhibits will, no doubt, surprise those who attend the Convention, and it is a healthy sign to see so much persistent enterprise in the trade.

As we pointed out in our last issue, the supply men are constantly bringing out new goods, and it is natural that they should avail themselves of every opportunity to display the same at these Conventions. If Conventions were held monthly these enterprising concerns would no doubt be on hand with something new, and it is to their credit that they should go to all the expense and trouble to reach consumers. That is what they are in business for. Their goods are for sale, and buyers like to see what there is to buy. So, taking it altogether, there is an excellent promise that the exhibits, although undertaken by individual concerns, will be much more extensive than is generally supposed they will be.

In view of all the facts it would seem that no manufacturing or supply house could well afford to stay away from Buffalo. Many such concerns will be represented there, and from the looks of things now, those who are not there will be "left" in the race for business. If there is to be an exhibition, let it be a good one.

SEARCH-LIGHTS ON SHIPBOARD.

The application of electricity to the various uses on board of men-of-war is one of the most important of all. By its aid operations can be carried on at night as well as by day, and there is probably not a navy of any pretensions that does not use it in some form or another.

The electric search-light is one of the most important pieces of apparatus on shipboard these days, and to be without one is practically exposing a ship to a night attack from an enemy in the event of hostilities. Not only are search-lights useful during times of war, but in time of peace as well. They are valuable in many ways on men-of-war. On such vessels drills and manœuvres are part of the daily routine. They have to be kept up in times of peace as if war was actually at hand, and as there is no doubt that a modern naval war would to some extent be carried on at night as well as by day, it is important that the tactics should be practised at night as well. The electric search-light, with its powerful beams, makes it possible to carry on a great deal of work of this class at night.

One of the modern search-lights is a device of wonderful ingenuity and brilliancy. Night is turned into day by its use, and Jack-tar finds it much easier to do his work with its aid than formerly, when he had to work practically in the dark.

The accompanying illustration gives an idea of the uses to which this most brilliant of modern lights can be put on a ship-of-war, or any other vessel. Our view was taken on board of the U. S. S. *Newark* and shows the ease with which a steam-launch, or any other of the ship's small boats may be hauled on deck and put in their cradles at night by the aid of reflector fitted with incandescent lights.

The powerful rays of the light illuminate every nook and corner, and the sailors find it as easy to perform their work as in broad daylight.

The portability and flexibility of this class of light are its most important qualities outside of its extreme brilliancy, and it can be taken to any part of the ship.

Most all of the ships in the United States Navy are now equipped with search and other electric lights. All modern ships are, and these lights constitute one of the most important parts of the equipment of a modern vessel of this class.

POWER TO RUN A DYNAMO.

BY J. H. GLOVER.

One of the most remarkable things about the dynamo-electric machine is its power-absorbing capacity.

It is well known that in operating a mechanical device it requires less power to keep the apparatus in motion after it has been started than it does to start it. In the case of the locomotive, for instance, it requires very little steam to keep the machine in motion after it has started, but it requires great power to start it from the condition of rest. The same applies to electric cars and all other vehicles, as well as machinery. In all, the greatest power is needed to effect the start, after which little power will maintain the motion. Not so with the armature of a dynamo, however, which in its mechanical aspect is no different to any other piece of mechanism.

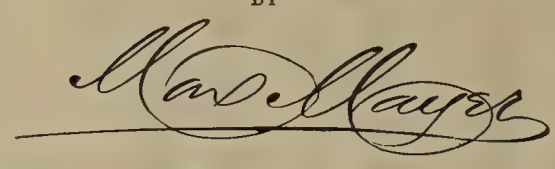
Naturally, the uninitiated would suppose the armature would run with great facility after it had got started, just as the locomotive does, but exactly the reverse is the case; and it is a remarkable fact that the faster the armature is revolved the greater is the power required to maintain the motion.

The armature of a gigantic 500 H. P. generator may be turned by the hand from a state of rest, so delicately is it balanced, but to run it at a speed of several hundred revolutions a minute requires the energy of a steam engine of great power, and within certain limits the faster we run the armature the more steam power will be required.

Now, what is the reason for this apparent anomaly in mechanics? It is this: When the armature is at rest there exists no magnetic field, the existence of which depends upon the motion of the armature, and the faster we run the armature the denser will the magnetic field become. The elements of the magnetic field consist of what are ordinarily termed "lines of force," and when we speak of a dense magnetic field, it is another way of saying that there are a great number of "lines of force." One of the peculiar properties of the magnetic "lines of force" is that they tend to arrest motion, and in the case of the dynamo the tendency always is to stop the motion of the armature in its revolutions. It is evident, therefore, that the stronger the magnetic field, and consequently the greater number of "lines of force," the greater will be the tendency to arrest motion, hence the greater will be the power necessary to overcome the retarding influence of the field.

A FEW POINTS ON DYNAMO AND MOTOR DESIGN.*

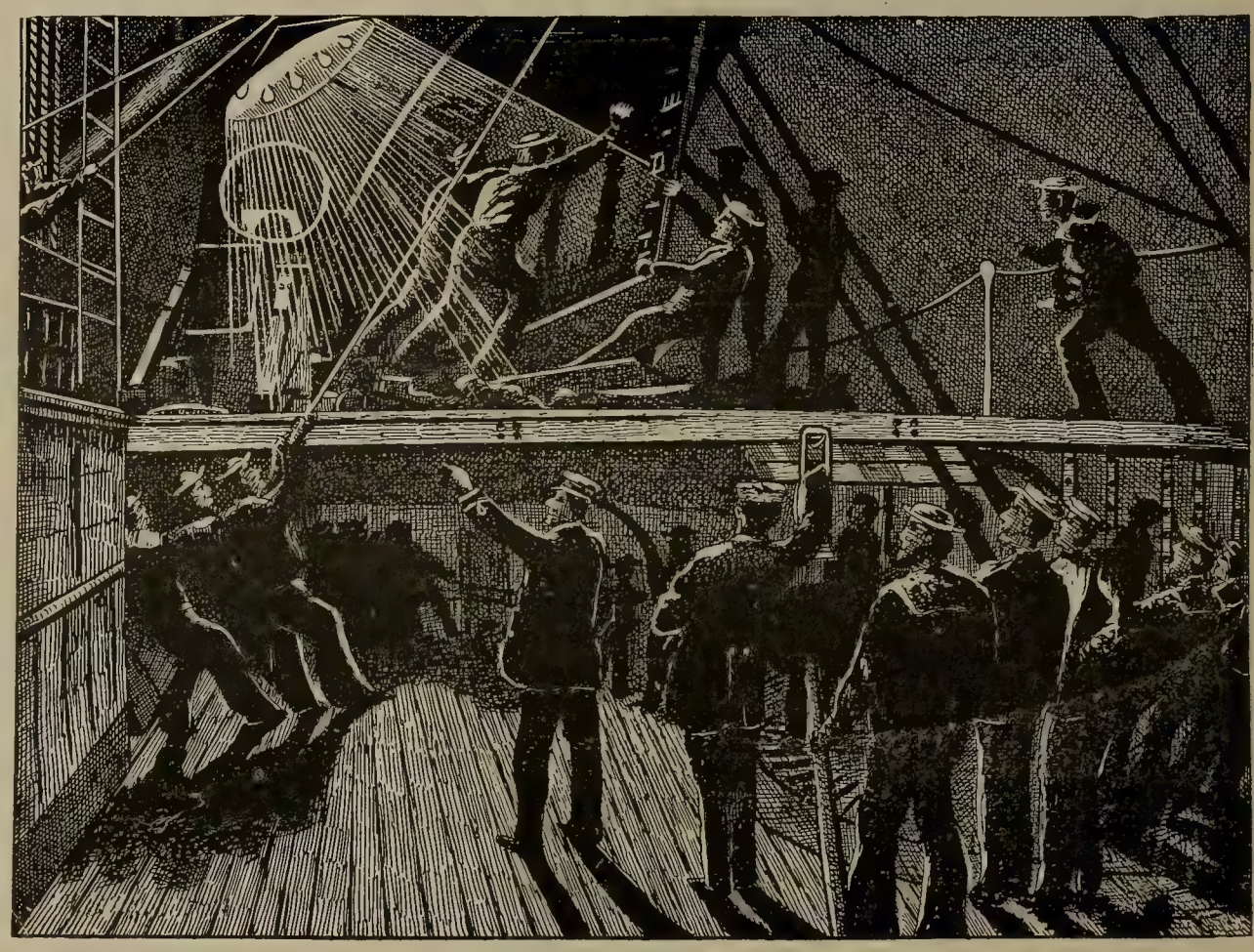
BY



In the year 1819 Hans Christian Oersted, a Danish philosopher, discovered that a current of electricity will deflect a magnetic needle, or, in other words, that an electric current and a magnet exert a mutual force upon each other. This experiment demonstrates the fundamental principle of the action of all dynamos and motors, being a direct application of the same in the motor, and the converse in the dynamo.

We know that if a current is passed through a coil of wire, free to move in a magnetic field, the coil will tend to move, and in moving is capable of exerting mechanical energy or work; and conversely, if we rotate the same coil in the magnetic field, a current will be generated or induced, as it is called. Hence we can see that by diametrically changing the conditions of a dynamo electric machine the same can be made to run either as a generator or as a motor with practically equal efficiency.

Let us consider the theory of efficiency of the electric motor. If we connect an ammeter in series with a motor, we shall find that when the same runs at its highest speed (that is, without any load) it takes comparatively a small amount of current; but



WORKING AT NIGHT ON U. S. S. NEWARK BY THE AID OF ELECTRIC LIGHT.

if we increase the load, the speed slackens somewhat, and the motor takes more current. We also know that in any conductor revolving in a magnetic field, a current, or more strictly speaking, an electro-motive force, is induced. This is what happens in the case of a motor. When the motor runs fast, the back electro-motive force is high, and as the same acts like a resistance, the current is cut down. But if we increase the load of the motor, there is less counter-electromotive force developed and consequently the motor takes more current, the resistance, so to speak, having lessened. The difference between the counter and the initial electromotive force in combination with the resistance of the motor determines the amount of current which will flow under these conditions. If E be the initial electro-motive force, e the counter-electromotive force, and R the resistance of the armature, we have for the amount of current $C = \frac{E-e}{R}$

It can be proven by a simple equation that the efficiency of a motor depends upon the ratio of the counter-electromotive force to the initial, hence we must make e— the counter-electromotive force—as large as possible. We know that $E = \frac{n C N}{10^8}$.

Where E stands for the electro-motive force in volts,
n, the speed per second,
C, the total number of external wires,
N, number of lines of force in armature,
10^8, the equivalent of volts in magnetic units, *i.e.*, 100,000,000 lines of force,

we can plainly see that in order to make e as large as possible, we must make N, the number of lines of force, as great as possible, which is most easily obtained by using a large amount of the best quality of iron in the magnetic circuit.

n, the speed, is limited mostly by mechanical considerations, although Foucault currents, friction, etc., increase with the speed.

C, the number of external wires, should be made small for the following reasons: The less the convolutions in the armature, the less the resistance, consequently the better the regulation of the machine, and the less the sparking. If the armature turns are few, the counter-magnetization of the armature is small, and there will be very little distortion and changing of neutral line, and consequent sparking, under varying changes of load. If the turns are few, the radial depth of the winding can be decreased, and consequently the magnetic resistance of the air space can also be decreased to a minimum, which means a saving of copper in the fields.

The resistance of the air space can be decreased by using teeth, forming channels on the periphery, or by winding the coils into perforations, or slots, near the periphery. Besides reducing the resistance of the air space, these methods of construction prevent the coils from flying out, due to centrifugal force, and consequently burning out of armature.

The few leading points that are here enumerated are usually followed out in ordinary dynamo or motor construction, although for some special purposes, such as an arc-light machine, where it is desired to have the magnetism of the field as steady as possible, a small amount of iron is used in the magnetic circuit. Some makers prefer to make the ampère-turns of the armature equal to those of the field, in which I can see no special benefit, as good results can be invariably obtained by using strong field and a weak armature.

In conclusion, there is one point on which I wish to lay special stress, and that is the mechanical design and construction. All the parts of the machine should be in plain sight and easily accessible. The field-coils should be removable, and all other parts interchangeable. The bearings should be self-oiling, and some method should be provided to prevent slinging of the oil. The shaft, standards, etc., should be large and very substantial. A few pounds of iron will increase the cost of a machine very little, but it may increase its life and efficiency considerably.

Electrically, the dynamo and motor have almost reached a state of perfection, but mechanically there is still great room for improvement, and I hope, and dare say, know, that some of our fellow-members will contribute to the future development and success of the dynamo and motor.

* Read before the Franklin Electrical Society, New York, Jan. 31, 1892.

A SEA TELEPHONE.

The latest thing out in inventive circles is a telephone by which sound-waves can be transmitted under the sea. It is owned by the inventors, Ernst Huber and Frederick J. Kreuper and James R. Davies, who have organized a company entitled the American Nautical Telephone Company, which is located at 13 Park row, this city, for the purpose of pushing the invention.

The invention, called the Nautical Signal or Sea Telephone, is an apparatus for the detection of sounds proceeding from any object in contact with water, which may be produced by such object or from the use of the apparatus at the place of observation or reception, and are there received when reflected from such object.

The idea of the apparatus is to receive sound-waves pulsating in a body of water, then transform, intensify, transmit and indicate the impression so produced in such a manner that it will be easy to to determine the position, distance and orbit of the object from which such sound-waves proceeded.

In the sea telephone are used certain well-known principles in the following manner: In passing through the water, the sound-waves come in contact with metal strips arranged as an "intercepter," and cause vibrations which are in turn transmitted by wires to microphones, and by them greatly magnified and intensified. The intensity of the vibrations thus produced is shown by an "indicator." Notice of disturbances in the apparatus, and indications of the direction and distance of same are obtained by the use of suitable devices.

The sound-wave intercepter consists of a block composed of some non-metallic material and preferably diamond-shaped, at each angle of which is a vertical recess rounded out at its inner end to permit the water reaching the extreme end of the recess. A metallic tube closed at the bottom and divided longitudinally by a non-conducting or absorbing diaphragm is at the end of each recess, the two chambers thus formed are each filled with sea-water, thereby producing a conductor of sound homogeneous in nature to the surrounding medium. A section of a tube composed of some non-conducting substance is placed in the rear chamber of each receiving tube, the purpose of which is to absorb all sounds coming from the opposite side of the block. This apparatus is the receiver of the telephone, and is to be attached to the keel of the vessel, deep enough to avoid the majority of sounds emanating from the surface. It may be protected from animal and vegetable matter by the use of removable wire screens.

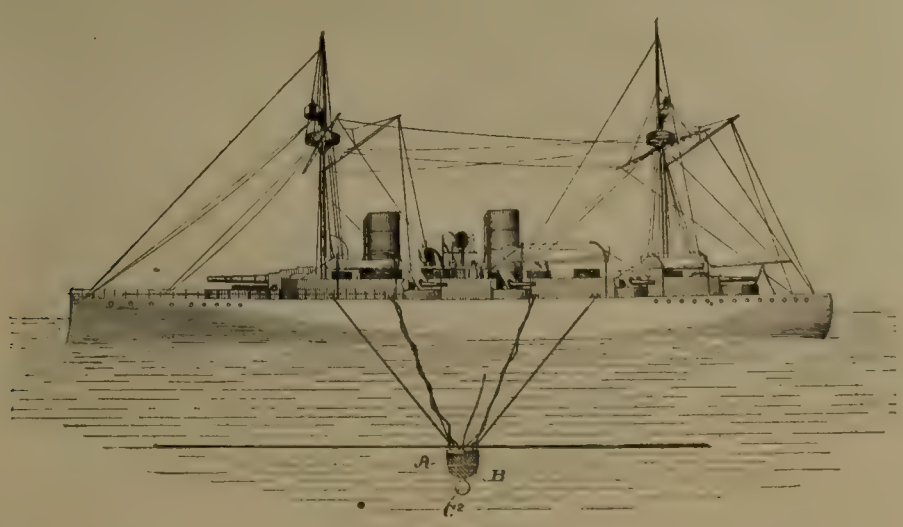
For harbor use the block may be submerged at the necessary distance from shore, and connected with the receiving apparatus on shore. A secondary block may be attached to the sound-wave intercepter, so as to intercept sounds emanating from the bottom of the sea. It is manifest that sound-vibrations passing through the water and entering the recesses in the intercepter-block will strike the exposed curved surface of the intercepter-tube, and passing through it will be communicated to the metal conducting-strips through the watery conducting medium in the tube. From the conducting-strips the sound-vibrations will be conducted through the wires to the microphones.

Each tube of the intercepter has a microphone resounder connected with it by wires. So far as decribed, the various devices constitute in effect a mechanical telephone.

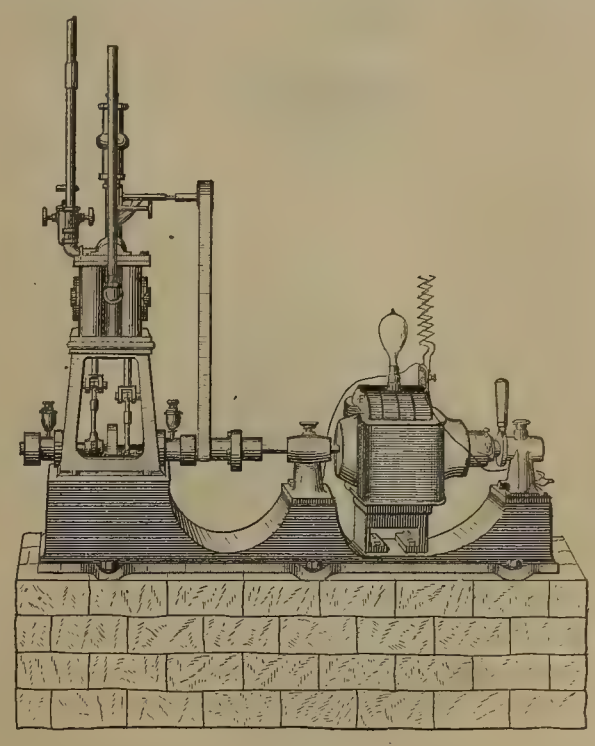
The next thing in order is a description of its operation. After having arranged and placed the intercepter in the desired position, sound-waves caused by any moving object in the water, or reflected from some object in the water, enter the recesses of the block and are received by the metallic conducting-tubes, conveyed across the watery conducting contents of said tubes to the conducting-strips of the diaphragm, then transmitted by the wires to the microphone, on the plates of which vibrations are produced. At this point of their passage the sound-vibrations are increased in volume and made stronger and transformed into electrical vibrations. From the microphones the sound-vibrations are transmitted to the director. The intensity of these vibrations is registered by an indicator, consisting of an ordinary electro-magnet and an armature supplied with a hand which moves with respect to a certain scale. If a current, resulting primarly from the sound-vibrations, passes through the electrodes, the armature will, according to the intensity of the interrupted current and the time of the influence, be attracted by the cores of the magnets, and the hand, therefore, will have a certain deflection, which will be shown by the scale over which such hand moves.

Without going into any further details, which may undoubtedly be obtained at the company's headquarters, it will be sufficient to enumerate a few of the many uses to which the Sea Telephone can be applied with the aid of suitable devices.

It will give warning not only of moving objects, but also of stationary ones, such as icebergs, submerged wrecks, rocks, etc. By its use communication may be had between two ships at a distance from each other. For this purpose the Morse alphabet is brought into play. It can be submerged in harbors of besieged ports to give warning of the approach of hostile vessels and so on *ad infinitum*. We understand that the Board of Electrical Appliances of the Navy Department has examined the apparatus and reported favorably of it. Our illustration shows the telephone in position under water.



SEA TELEPHONE.



HIGH-SPEED DUPLEX ENGINE.

HIGH-SPEED DUPLEX ENGINE.*

At the recent American Institute Fair in this city was an exhibit of a Shortt engine operating a dynamo which supplied current for several lamps. One of the main features of this exhibit was its compactness, the engine and dynamo together occupying a remarkably small amount of floor space.

This engine, owing to its compactness, is particularly adapted to small electric-light plants, and it is practicable to connect the engine directly with the armature shaft of the dynamo.

These engines possess some features which render them unique. There are no links, no eccentrics, no valve-stems and no stuffing-boxes, and the valve gear is claimed to be the most positive ever designed. The manufacturers claim that they can get greater power in a given space than can be obtained of any other engine constructed.

There are two cylinders and a double crank, with pins set at 90 degrees, thus overcoming dead centres. The cylinders are formed in one casting, and the frame is of the A pattern, which is claimed to be the strongest form possible. The pistons are double-acting—that is, steam is admitted to them at both ends of the stroke. The valves are semi-cylindrical and take their motion from the piston. The piston and valve of the right-hand cylinder controls admission and cut-off steam to the left-hand cylinder and *vice versa*, the ports being crossed.

The main bearings are conical in shape, made of anti-friction metal and milled through so that wear can be easily and quickly taken up.

It is possible to run this engine at very high speed; but for this particular dynamo it was run at a speed of 850 revolutions a minute.

The accompanying illustration is made from a photograph of the company's American Institute Fair Exhibit and represents a 2 H. P. Coupled Direct, 16 incandescent lights, 16 candle-power.

* Shortt Duplex High-Speed Engine Co., Electrical Exchange, N. Y.

NEW CLOCK BURGLAR ALARM WITH PENDULUM MOVEMENT.

This instrument has a rich ornamental case, finely finished in any desired wood. All known improvements in burglar-alarm mechanism and construction are combined in this one machine. Its clock is an accurate time-piece and has two electric attachments, one throwing the battery on and off, the other calling the servant at any desired time. The Holtzer Gravity Drop (favorably known to the trade for many years) is employed, and may absolutely be relied upon to give satisfaction in every respect. The defects so common to Gravity Drops, such as sticking, falling through a slight jar, etc, are notably absent. Each circuit is independent of the other and may be thrown off and on at will by means of the switch, the points of which are engraved to correspond with the parts of the building which they control. In addition, it has a Battery Test for ascertaining the condition of the cells which operate it, and a Silent Test which at once shows if all windows, doors, etc., are open or closed. A Continuous Ringing Switch and one which throws off all the circuits are also valuable features. The best is the cheapest in the course of time, and in burglar-alarms reliability should be the feature most sought after. Years of experience in burglar-alarm and annunciator construction have enabled this company to make thoroughly reliable articles in these two lines of work.



NEW CLOCK BURGLAR-ALARM.

* Holtzer-Cabot Electric Co., Boston.

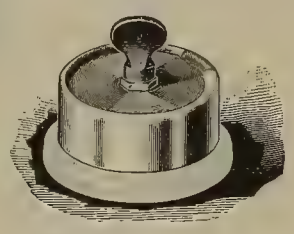
EDISON RATCHET SWITCHES.

We had occasion recently to describe the advance in the manufacture of small electrical appliances made by the Edison General Electric Co., and devoted some space to acquainting our readers with certain novelties in sockets which it had, within the last month or two, put upon the market. The development, however, in the manufacture of sockets is not the only line on which the company has been working. Small switches for use in private houses, public buildings and elsewhere, have also claimed its attention. As pioneers in the manufacture of these small switches, they have gradually improved them, both in certainty of action, in mechanical finish and in the quality of the porcelain used as an insulator in their construction, until one could hardly recognize the model of 1892 when compared with that of 1885.

The ratchet switches made by the Edison Company are known and used wherever electricity is used for light or power. Quite recently improvements have been made in those switches which render them as nearly perfect as ratchet switches can be gotten. Entirely new switches have been devised to meet the ever-growing demand for small and defective ratchet-wall switches. These are of five and ten ampères capacity single pole. The bases and ratchets are of hard vitreous porcelain, manufactured by the Edison Company at Schenectady. The ratchet is of peculiar construction, its sides being of unequal length. When the switch is "on," the shorter sides of the ratchet are presented to the contact brushes. These sides are rounded and the brushes specially curved, so that when the contact is made the brushes and contact sides of the ratchet fit with precision, thus forming a perfect contact. The ratchet itself is made of the best insulating material known. These switches are rendered instantaneous by an improvement introduced into the ratchet face.

The cover is of metal, which can be finished in any color, and is therefore peculiarly suitable for use in houses and buildings where artistic interior decorations are desired. The ratchet is removable, and can be discarded in case of accident and another substituted without destroying the entire switch.

The Edison General Electric Company has also adapted its whole line of ratchet switches to the special use of hospitals, asylums, steamships and elsewhere, where it is inadvisable to have other than responsible persons operate them. These special switches are furnished with a small collar fitting outside the cover, and firmly screwed down upon the ratchet pin, which cannot be turned except by means



EDISON SWITCH WITH PORCELAIN BASE.

of the key in the possession of a competent party. These switches will meet with great demand, and have already met with gratifying success.

The Schenectady works of the company have been compelled by the constantly-increasing demand for its ratchet switches to enlarge considerably the department in which they are manufactured, and the facilities now possessed for turning out these switches are perhaps greater than those possessed by any other manufacturers of similar appliances in the world.

ADJUSTABLE SUSPENDING SOUNDER SUPPORT AND RESONATOR.

One of the difficulties experienced by telegraph operators located in noisy situations is to hear the sounder. At a railway station, for instance, he is frequently seriously embarrassed in his efforts to receive train orders while a train is standing near by with the engine blowing off steam. The typewriter, which has in late years become so generally used in telegraph offices, also gives the operator some trouble in hearing the receiving instrument, the noise of the typewriter drowning that of the sounder: and another trying situation for operators is in exchange board rooms, where dealers in stocks, grains or whatever may be the nature of the business, are constantly yelling like madmen. Under all these circumstances the noise of the sounder is liable to be overcome by the outside noises and render the accuracy of the operator's receiving uncertain.

To overcome these difficulties J. H. Bunnell & Co., 76 Cortlandt street, New York, have devised a piece of apparatus which seems to meet every requirement. It consists of placing the sounder in a resonating-box, which is held suspended by an adjustable arm designed for the purpose. The sounder is connected with the battery and relay terminals through a flexible cord. By this arrangement the sounder may be brought to any position required, close to the receiving operator, and the entire volume of the sound is so greatly increased by the resonating-box that it can be easily and distinctly heard over all outside noises, whatever may be their nature. By adjusting the position of the resonator it also becomes possible to receive with great facility from the instrument, which may be so closely adjusted that it cannot be heard by any one except the operator who is taking it.

The sounder, which is of the well-known Bunnell Giant pattern, is clamped within the resonant-box, which is opened at both ends, and is sustained in mid-air by a swivel pendent on a swinging arm. This



EDISON RATCHET SWITCHES.

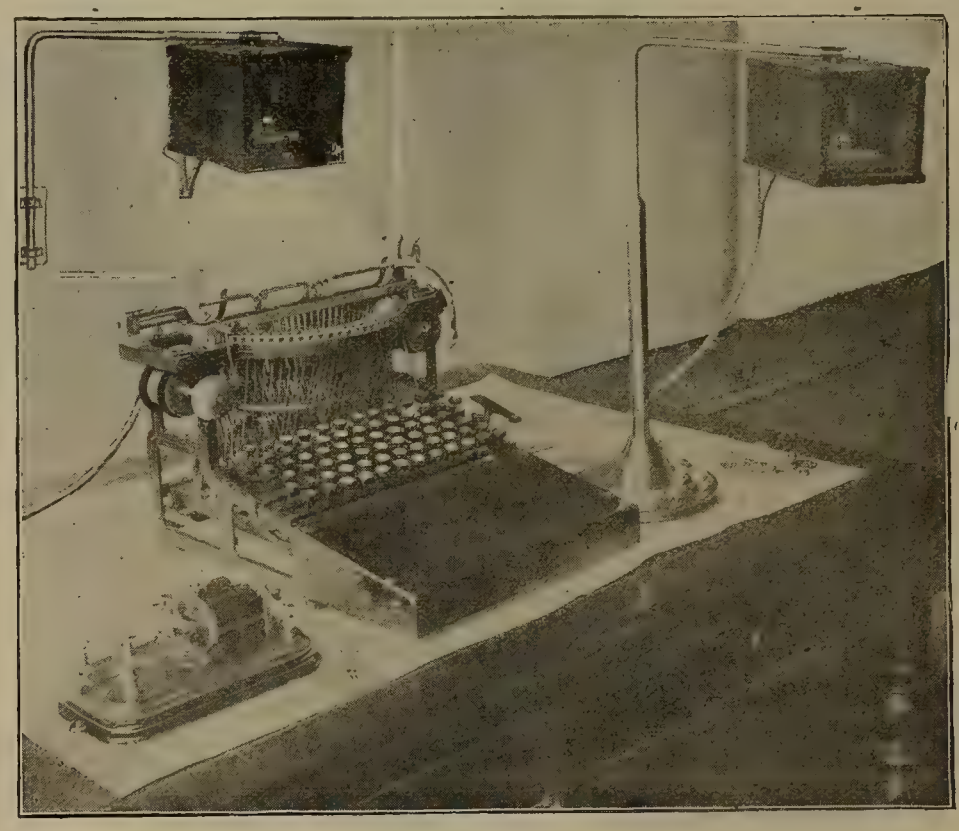
arm is also adjusted to be raised to or lowered from any height within the necessary range, and as the arm also swings laterally on its support, the operator can have the sounder wherever he desires.

The effect of clamping the sounder within this peculiar resonating-box is to increase its loudness and distinctness to a startling extent, leaving nothing more to be desired in that direction unless the operator is nearly stone deaf, for the instrument, with its enormously increased sound, can be brought so close as to almost touch the ear if desired.

Under these circumstances no typewriting machine, however noisily it may click or clatter, can interfere in the least with receiving by sound.

In railway telegraphy, at noisy stations, in stock exchange telegraph offices and in every possible situation where the telegraph must be operated in the midst of the roar and crash of such forms of modern business, as are inseparable from noise, this device will be a welcome facility and will add to the accuracy of the work done.

The accompanying illustration is made from a photograph taken by our own artist. It shows the resonating-box in position on the swinging arm, within which is seen the sounder. As the device is portable it, of course, can be placed in any position on the desk to suit the fancy of the operator.



SUSPENDED TELEGRAPH SOUNDER FOR NOISY SITUATIONS.

GENERATING STATIONS AND THEIR PHYSICAL HAZARDS.

On January 15 last Mr. George P. Low read a paper on the title-subject before the Fire Underwriters' Association of the Pacific. As it is a subject of considerable interest and importance to the managers of electric generating stations we reproduce the paper in full.

"Electric lighting people, in combating the belief that central stations are an extra hazardous risk, are enduring the penalty imposed for violating the unwritten, though well established, law condemning cheap and make-shift constructions. We all remember how, only a year or so ago, anything under the sun in the way of a shed would be pressed into service for housing electric-light machinery. Everything about the plant wore a temporary aspect; nothing appeared permanent, and the only apparent aim of the electrical concerns at that time appeared to be to furnish electric-light at the earliest possible moment. Cheap frame structures of the roughest materials were hurriedly erected, tumble-down saw and grist mills were patched up, and even abandoned barns were made to serve as electric-light stations. Then, as if pledged to the motto, 'Anything goes,' the electrical equipment was placed in reckless disregard of safety, and another electric-light station would be launched into existence to tempt fate and invite disaster. The *Chronicle* fire tables show that during the nine years previous to and including 1890, 129 electric-light stations were burned in the United States, but considering the wretched construction of so many of them, it is hard to understand why this number is so small unless it be that Providence prevails—not the public enemy. Is it a wonder, then, that the level-headed fire underwriter, who does nothing without a reason, discriminated against these risks? Their inherent hazards were certainly great, and sufficiently so in some cases to prohibit insurance, but now the lesson of experience has been learned, the necessity for central-station construction after the most approved methods is fully realized, and the electric-lighting industry in this particular, at least, is in a state of transition. New stations are being properly erected and many of the old ones are undergoing reconstruction or are being torn down and rebuilt in accordance with the modern ideas. Better days are already here, and generating stations, whether for isolated or central-station work, are no longer necessarily a risk to be avoided as one 'sure to go.'

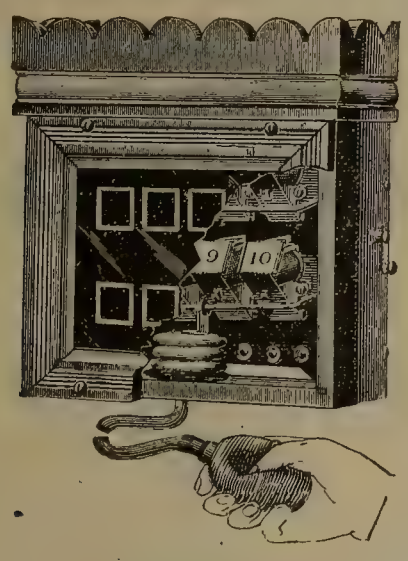
"I cannot believe that many have a conception of the wonderful influence electric lighting has exerted in developing and more nearly perfecting many mechanical appliances. A dozen years or so ago the ordinary single-expansion slide-valve engine or the Corliss compound engine represented the highest perfection attained in the art of steam-engine building. The value of these engines is not to be detracted from, yet they were all capable of running only at slow speed, and their efficiency was not near so high as the engines manufactured at the present time. Those artificial individuals known as corporations fully understand that the profits of the business they carry on depend almost as much upon

(*Continued on page* 80.)

SCHOENBERG'S PNEUMATIC ANNUNCIATOR RESET.

In annunciators, as ordinarily made, it is necessary to raise the drops after they have fallen by a little lever, which is placed on the outside of the annunciator-box. No two persons operate this lever alike, and the result is that one may turn the lever handle gently, while another will use force enough in the operation to frequently break the parts. As a rule, it is handled roughly, and the great danger in such handling is to disarrange the mechanism and get it out of order, if not break it.

The pneumatic annunciator reset, which forms the subject of this article, is designed to overcome

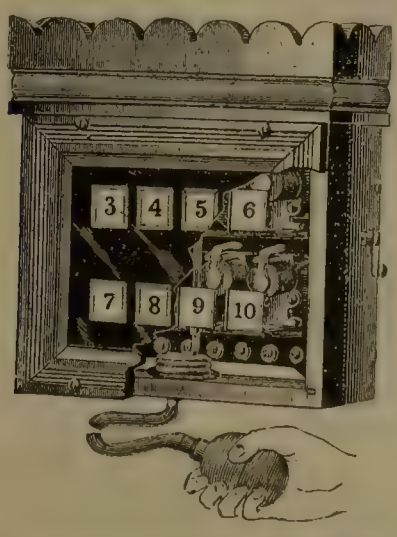


OPERATION OF ANNUNCIATOR RESET

all of the objections above referred to, and insure positive and reliable action at all times. It is the invention of Mr. Ralph A. Schoenberg, 129 East 62d st., New York City.

As will be seen by the illustrations, a flexible rubber tube is attached to a small bellows placed on the inside of the annunciator-box, and at the other end of the tube is a rubber pressure-bulb. The drops are raised or reset by inflating the bellows, which is done by means of one or more hand-pressure bulbs. The object of this device is to reset the drops gently without jar or friction.

The tube can be extended to any reasonable distance, and the bulb may lie on the desk or table, while the annunciator-box may be placed in some high but convenient position, which would ordinarily be inaccessible for the purpose of resetting annunciator drops by hand. When a drop falls a slight pressure on the bulb inflates the bellows, and this raises the annunciator drop through the operation of proper mechanism. It is a saving device, and any annunciator fitted with it need never become deranged through rough handling. It is made to



BELLOWS BEFORE INFLATION.

fit all sizes and makes of annunciators, and it is positive in its action.

If it is desired to have more than one point to reset the drop from, several bulbs may be connected with the main tube. The device can be applied to old annunciators as well as new.

This device saves great wear and tear on the annunciator, and will more than save its cost in a very short time by cutting down repair bills. It is an ingenious invention, and its simplicity at once commends it.

The E. S. Greeley & Co. has the sole agency for New York, and Partrick & Carter for Philadelphia.

SHOCKED BY INDUCTION.

A dispatch from Toronto on the 1st inst. states that Frederick W. Martin, an electrician, "while passing between two large dynamos, completed the circuit between them and was rendered unconscious, and possibly fatally injured by the shock. When he recovered consciousness it was found that he was blind."

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

THE BUFFALO CONVENTION.

Mr. C. O. Baker, Jr., General Master of Transportation of the National Electric Light Association, reports that arrangements have been perfected for a special vestibule train, composed of parlor, dining and buffet cars, which will leave the Grand Central station *via* N. Y. C. & H. R. R. R., at 11:00 A.M., on Monday, February 22 (Washington's Birthday), and will connect with the Boston party at Albany. Seat checks for this train can be procured from C. O. Baker, Jr., Master of Transportation, Room 505, 136 Liberty st., New York, at the rate of two dollars each. Railroad tickets can be procured at the various ticket offices. It will, however, be necessary for the purchaser to request the ticket agent to furnish him with a certificate, which will entitle him to rebate fare on his return passage. These certificates are made absolutely non-transferable.

The following gentlemen have charge of transportation matters for their respective localities :

H. A. Cleverly, 1018 Chestnut st., Philadelphia.
Fred W. Royce, 1408 Pennsylvania ave., Washington.
A. C. Shaw, 620 Atlantic ave., Boston.
John L. Martin, 148 Michigan ave., Chicago.
Morris W. Mead, Pittsburg, Pa.
S. D. Nesmith, T.-H. Electric Co., Cleveland, O.
C. F. Hesser, Cincinnati Elec. Light Co., Cincinnati, O.
H. D. Stanley, Bridgeport, Conn.
Prof. Henry T. Bovey, McGill University, Montreal, Can.
James I. Ayer, 322 Pine st., St. Louis, Mo.
N. J. Hart, New Orleans, La.
Frederic Nicholls, Toronto, Can.
John I. Sabin, San Francisco, Cal.
E. W. Rollins, Denver Consol. Elec. Co., Denver, Col.

The following is a list of the papers to be read at the Convention during the sessions on February 23, 24 and 25 :

How to Fire a Steam-Boiler, Richard Hammond.
The Allied Powers, Daniel Ashworth.
Switchboards : Their Safety and Operation, M. C. Sullivan.
Aërial Wires, E. F. Peck.
The Alternating Motor, Wm. Stanley, Jr.
———, L. B. Stilwell.
From the Tannery to the Dynamo, Chas. A. Schieren.
Underground Wiring, E. A. Leslie.
Underground Systems, J. B. Craven.
Municipal Franchises for Quasi-Public Works, Allen R. Foote.
Electric Lighting from a Financial Standpoint, Erastus Wiman.

In addition to the papers to be read it is interesting to note that Mr. Carl Hering will, during the Convention, give an evening lecture, illustrated by stereoscopic views, on the Transmission of High Potentials, based on the work done at Lauffen-Frankfort. Prof. Elihu Thomson, William Stanley, Jr., H. Ward Leonard and others will take part in the discussion following the lecture.

CORRESPONDENCE.

THE DEATH OF RINZABURO SHIDA.

EDITOR OF THE ELECTRICAL AGE: I have just read, with deep regret, in your issue of to-day, the notice of the death of Mr. Rinzaburo Shida, of the Imperial University of Japan.

I had the pleasure, some years ago, of meeting Mr. Shida in Yokohama, and, on one occasion, of dining with him at the Grand Hotel in that city. He was at that time, he informed me, experimenting with the Quadruplex, with a view of introducing it on the lines of the government telegraphs, which I believe he shortly afterwards succeeded in doing.

Mr. Shida was a man of quiet, unassuming and most gentleman-like manners, intensely devoted to his profession, and, in common with hundreds of the younger generation of his countrymen, thoroughly imbued with the scientific spirit of the age. His death leaves a blank, not easily filled, in the ranks of the bright young men of Japan, who, within the last decade or two, have been educated abroad.

E. T. BARBERIE.

NEW YORK, February 6, 1892.

DUPLEX STEAM-TRAP.*

In connection with the use of steam, an important point to be considered is the selection of a good steam-trap.

The steam-trap illustrated herewith is claimed to meet every requirement in an apparatus of this character, and is well recommended by users.

A well-known principle, involved in the action of metals under the influence of either heat or cold—but applied in quite a new way—is the operating principle of this trap.

The steam circulates entirely around through the frame portions 1 and 2, A being the inlet and B the outlet. The adjusting rod, 3, is provided with a right-and left-hand screw, 4 and 5, which is adapted to screw into the parts, 2, near each end of the trap.

The flow of water is reduced or increased by turning the adjusting-rod a trifle either to the right or left, as the case may be.

The theory upon which the trap operates is the expansion and contraction of metals when hot or cold. It is adjusted to be closed when filled with steam, *i.e.*, expanded. The adjusting-rod, 3, is solid, and does not connect with the trap, or, more

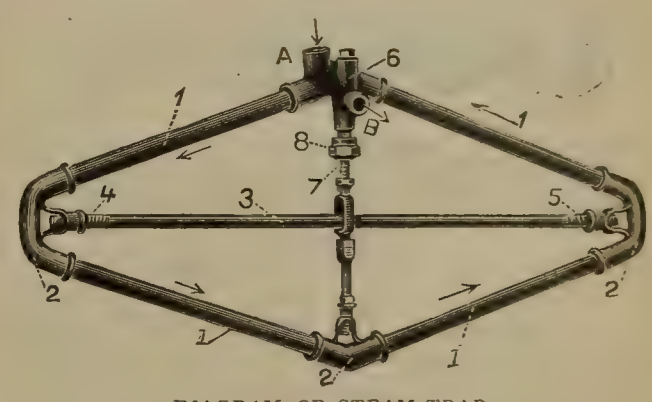
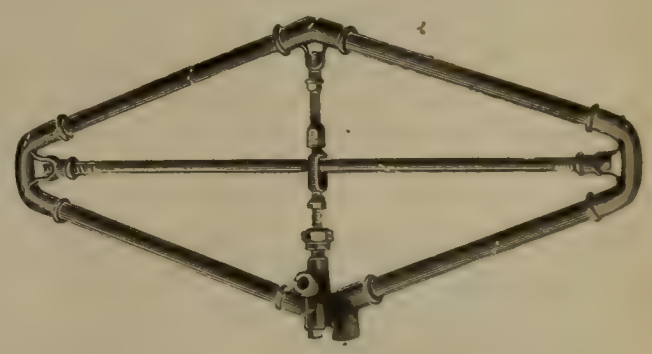


DIAGRAM OF STEAM-TRAP.

correctly speaking, does not receive the steam, consequently does not change temperature. It is always rigid and holds the two ends of the trap, 2, 2, at equidistance apart at all times. From this it is to be deducted, that when the pipe, which constitutes the trap, is heated and expands, that expansion must find vent somewhere; and as it cannot expand lengthwise, owing to the rigidity of the adjusting rod, 3, it must of necessity expand in a line across the centre, or ellipse, and as the valve and valve-stem, 7, is in this line, the expansion and contraction will move the valve-stem in and out of the valve.

This valve-stem, 7, is made in two parts to permit of the valve being readily removed at any time if necessary. The adjusting-rod, 3, passes through an opening through the valve-stem. The valve is mounted on a ground seat within case, 6, and 7 is the valve-stem, while 8 is the stuffing-box. As it is adjusted to close the valve when hot, it follows that when the water in the pipes enters the trap and cools it off, a contraction occurs, which opens the valve,



DUPLEX STEAM-TRAP.

allowing the water to flow out at the outlet B. This action renders the trap absolutely and unfailingly automatic.

This the manufacturer guarantees, and also the discharge of water at any temperature.

By the use of this trap hot steam will always be had and no water accumulated to condense it, and the full benefit of it thus assured. There is no need of commenting upon the value of this point, which must be apparent to every one.

The trap can be attached to steam-engines, pumps, boiling kettles, railroad coaches, or any heating apparatus, or wherever steam is used for heating purposes, and may be set in either horizontal or vertical position, as is most convenient.

The Meyrowitz Manufacturing Company, Ridgefield, N. J., was incorporated January 25, with a capital stock of $100,000, to manufacture electrical and other instruments. Incorporators: S. B. Meyrowitz, Ridgefield, N. J.; P. A. Meyrowitz, O. W. Meyrowitz, New York, N. Y.

* Jos. Rhem & Co., 42 Smith street, Buffalo, N. Y.

SPAN INSULATORS.*

The devices illustrated below are called "Long Strain" and "Ball Strain" insulators. They consist of interlinking hooks, separated by the insulating material and thoroughly covered with the same, and for the purpose of adjustment of wires eyes are provided. The insulators are well made, and among their features may be mentioned strength, compactness and thorough insulation.

The "Long Strain" insulators are made for special purposes, with one end threaded to receive an insulator adapted to hold an ear for straining trolley wires.

These goods are made under patents owned and controlled by the Hersey Manufacturing Company.

WILLIAMSPORT'S ELECTRIC ROAD.

Last May the work of changing the Williamsport Passenger Railway, of Williamsport, Pa., was begun, and the undertaking is now finished. The rolling stock consists of ten 16-ft. cars with McGuire trucks and Westinghouse single-reduction motors. Westinghouse generators are used in supplying the current for the operation of the road, and the overhead ronstruction was done in the best possible manner, regardless of cost, and with a view to removing any possible objection that might be made against the work by the city authorities. It is stated that the road may be extended in the spring. At the time work was begun on the change the road was 5½ miles in length, and the rails were of the centre-bearing class. Four miles of the track have been relaid, and two miles of new double-track road with 60-lb Wharton girder rails has been built, and now the road is in excellent condition. The officers of the company are: H. R. Rhoads, president; John Lawshe, treasurer; J. F. Starr, secretary; H. C. Young, superintendent.



"LONG STRAIN" INSULATOR.

far ahead of what is generally supposed, and I think you will find that some one of the three great electrical companies, the Edison, the Westinghouse and the Thomson-Houston, will make public some surprising developments at an early day."

IRON BUILDINGS FOR ELECTRIC PLANTS.*

Iron, in the construction of buildings, is becoming more and more used, particularly for manufacturing structures. The latter class includes electric light and power stations, which, from the very nature of the business, require the best protection against fire and other damage. The American electric-light and electric railway companies are fast learning that the first cost of building a new plant is not so great an element as to have a plant so planned and constructed as to reduce the cost of repairs and the cost of production to the least possible minimum. It is also a fact that it is fast becoming a matter of great difficulty to obtain suitable timber for large buildings without great expense, and even when timber of the satisfactory quality for constructing a manufacturing building is obtained, it shrinks so much on account of not being properly seasoned that it soon warps shafting, travelling cranes, etc., out of line, and in this way greatly increases the expense of maintaining and operating the plant.

It is the desire of every operator of a generating station to have a building for the same, that will be strong and able to carry all the loads of the machinery, shafting, etc., and at the same time convenient, so that it will be possible to carry on operations cheaply and economically. Iron at the present time costs little more than wood, and the advantages of its use in the construction of the building are so great that it has become an almost universal practice to build new plants of iron. Another great advantage of an iron building is the insurance, which naturally costs less than a wooden building.

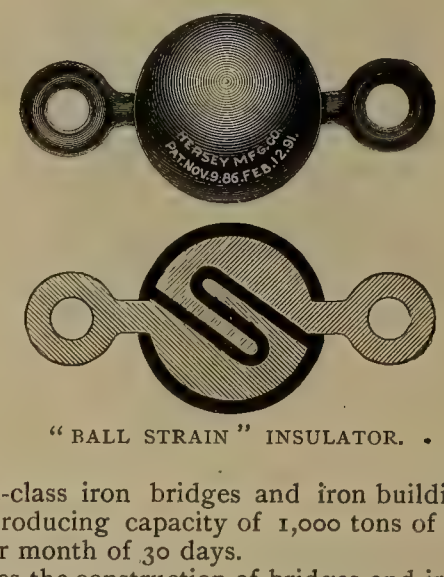
In East Berlin, Conn., there is a concern that is doing a very large business in this country in the erection of iron buildings, besides bridges and other metal structures. The growth of the company has been so rapid, and yet with so little of the boom about it, that business men have hardly realized that it is a corporation with works occupying 13 acres of land, doing a business of over $1,000,000 a year, and giving employment to 400 men; besides an equal number distributed throughout all parts of the country erecting iron bridges and iron buildings.

As showing the great increase of business it is interesting to state that when the company began operations in 1876, its business was less than $20,000 a year, now it is doing a business of over $1,000,000 annually.

Many electric-generating plants throughout the country, not to mention the structures used in other trades, are housed in buildings erected by this company.

The roofs of the buildings are constructed entirely of iron on the truss principle, which, as is well known, combines the greatest strength with lightness. One of the obvious advantages of an iron roof is the absence of danger from fire by sparks, and in view of the many fires that have been recorded of late in electric-generating plants the value of an iron structure to such concerns is apparent. An electrical plant within an iron structure is in every sense of the word fire-proof, and electric-generating companies are rapidly appreciating the great advantages of such structures.

The accompanying illustration shows the interior of the truss shop of this company. It is taken directly from a photograph and shows everything accurately. The building is 80 feet wide by 400 feet long, made entirely of iron and glass with not a particle of woodwork in its construction. The shop is fitted out with all the modern appliances for building first-class iron bridges and iron buildings, and has a producing capacity of 1,000 tons of ordinary work per month of 30 days.

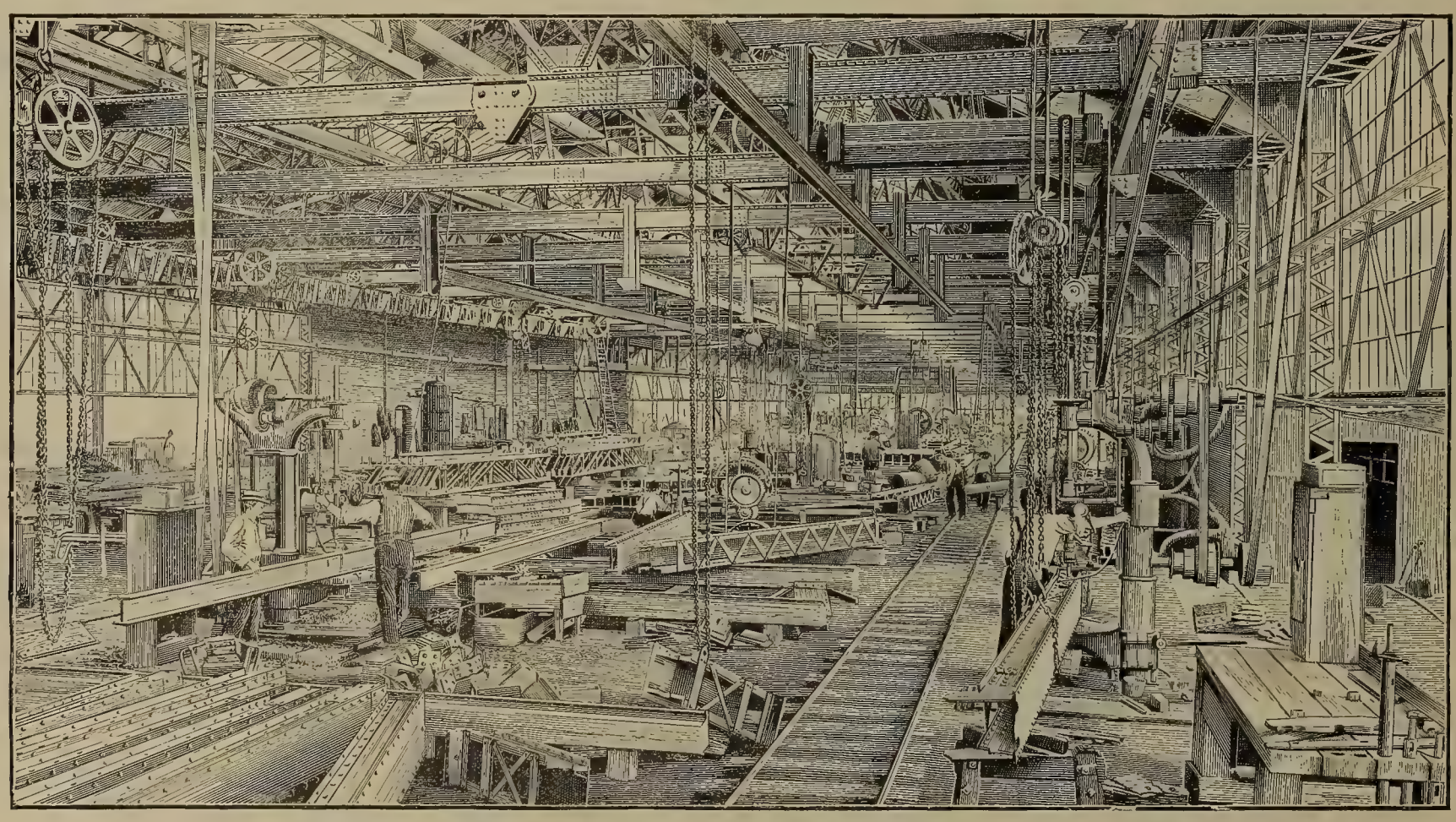


"BALL STRAIN" INSULATOR.

Besides the construction of bridges and iron buildings the company also makes travelling cranes, for which it furnishes plans and estimates. In electric-generating stations the travelling crane is a valuable adjunct for the purpose of moving machinery and dynamos about the room. These cranes are designed to run by any power. By their use any piece of machinery can be moved from one end of the room to the other. The company has supplied cranes to many electric light and power stations throughout the country, and the users of the same speak in complimentary terms of their operation.

The officers of the company are: Charles M. Jarvis, President; Burr K. Field, Vice-President; George H. Sage, Secretary, and Frank L. Wilcox, Treasurer. Mr. George H. Sage, in addition to being secretary of the company, has charge of all highway bridge business, and is assisted by Mr. D. E. Bradley.

Mr. Jarvis, the President, and Mr. Field, the Vice-President, are both graduates of Yale College, and their training, both at college and in business, has been of such a character as to render them eminently fitted to carry on the immense business of this concern. They are civil engineers by profession, and therefore understand every detail of the busi-



INTERIOR VIEW OF TRUSS SHOP OF BERLIN IRON BRIDGE CO., EAST BERLIN, CONN.

ELECTRIC RAILROAD OF THE FUTURE.

According to a dispatch from Chicago, General Manager Ainslee, of the Wisconsin Central Railroad, stated as his opinion that trains on his road would be run by electrical power before the termination of the Columbian Exposition. "The discoveries of the uses to which electricity can be put," says Mr. Ainslee, "and its adaptability to moving trains are

* Eastern Electrical Supply Company, Boston, selling agents.

* The Berlin Iron Bridge Co., East Berlin, Conn.

ness. Mr. Sage, the Secretary, and Mr. Wilcox, the Treasurer, are men of large experience, and of excellent reputation in the trade, and taking it altogether this company may be said to occupy a prominent place in first ranks in this industry in the United States.

EFFICIENCY OF ELECTRICAL TRANSMISSION.

BY R. H. GREEN.

The electrical transference of motive-power has been found to be more efficient than transmission by ropes, water or compressed air. This fact alone has sufficed to bring electric motors into use, in many cases to the displacement of every other workable system.

The whole of the power supplied electrically to the motor is not, however, converted into mechanical effect. There are various unavoidable sources of loss. There is, first, the resistance of the connecting wires. This may be regarded as the loss due to transmission. There is, in the second place, a certain loss due to resistance, which appears as heat in the motor. Thirdly, there is the loss due to friction, mechanically considered, of the motor. There is, also, the invariable magnetic friction giving rise to eddy currents in the motor, but this is frequently so small in the best types that it may be left out of account.

The electrical power put into the motor is most conveniently expressed in watts. If C be the current, expressed in ampères, which actually flows in the circuit of the motor, and E be the electromotive force, expressed in volts, at the terminals of the motor, then the electrical power (per second) in watts, P, is found by multiplying together the ampères and volts, and dividing by 746 to obtain the electrical horse-power.

$$\text{Electrical horse-power} = \frac{E\ C}{746}.$$

Since only a portion of the electrical power supplied to the motor (owing to causes already mentioned) is returned as mechanical effect at its pulley, it is convenient to express the efficiency of the motor as follows: If C is the current (in ampères) that flows through the motor, and E the electromotive force (in volts), the watts, P, of mechanical effect is

$$P = E\ C.$$

The counter-electromotive force of the armature varies in different motors. In the best types it is from five to ten per cent. less than the E. M. F. measured at the terminals of the motor.

The simplest case is that in which the dynamo at one place is connected in circuit with a dynamo (motor) at another place. The conductors between the machines must be insulated in the usual way. That is, if they are of naked copper they must be suspended above the ground and attached to insulators. If they are of the nature of heavily protected cable, they may either be laid along the ground or buried beneath it. In many cases they are laid in the water, as across streams. In the case of simply running a dynamo and a motor in that way the machines should be adapted to the work to be done. In most cases the generating dynamo is moved at a constant speed. In that case both the generator and the motor should be series-wound machines. When the generator is run at a constant speed the motor will also maintain an approximately constant speed under all conditions of load. The speed in this case depends entirely upon the E. M. F. The torque depends, on the other hand, entirely upon the current. This is known as simple-series transmission.

But in the case of motors being run off circuits used also for lighting, where, instead of constant current constant potential is required, as on an incandescent light circuit, series motors are found to be unsuitable; they will not maintain a constant speed under varying loads. But any shunt-wound or compounded motor will do this under the above conditions, because the current through the shunt does not vary, and there is less variation of the strength of the field. Shunt-wound motors, if they are to maintain a constant speed upon a constant-potential circuit must be furnished with armatures of low resistance, and the field-magnet must be relatively very powerful. If a shunt motor, on the other hand, be put upon a constant-current circuit (such as that running arc lamps) its speed will increase with its load, and will always fall off as the load is diminished.

The Massillon Light, Heat and Power Company, Massillon, Ohio, was incorporated January 27, with a capital stock of $150,000. Incorporators: J. Walter McClymonds, Joseph K. Russell, George L. Russell, Warren E. Russell, Allen A. Russell and C. M. Russell.

BIOGRAPHICAL SKETCHES.

J. BRADFORD SARGENT.

The features delineated in the accompanying illustration are those of Mr. J. Bradford Sargent, the well-known New England agent for the Stirling boiler and the Corliss engine, at 620 Atlantic avenue, Boston.

Mr. Sargent was born in 1859 in Leicester, Worcester county, Mass., where, after receiving a common-school education he entered and graduated from the Leicester Academy with high honors.

In his youth Mr. Sargent showed an inclination towards mechanics, and has ever since devoted his time



J. BRADFORD SARGENT.

to pursuits of this nature. Mr. Sargent is held in high esteem among the Eastern people, and he is exceedingly popular. This latter fact was strongly emphasized in the recent election in Worcester county. Mr. Sargent was elected by a very large majority to represent his district in the State Legislature. We extend to Mr. Sargent our congratulations on his success.

ICE-CUTTING BY ELECTRICITY.

BY J. H. BUNNELL.

I read with interest the article in your issue of January 16 on the subject of cutting ice by electric power. It has often occurred to me that it was about time for some one to improve on the antiquated methods of harvesting ice, and that electric power, which is so flexible in its application, might be made to solve the problem.

It is well known that electric power can be applied in places and situations where it would be totally impracticable to use any other form of power, and it only requires the exercise of a little ingenuity to apply it to accomplish work of any character. The application of electric power to the cutting and harvesting of ice, however, remained, as far as I know, for Mr. Kinsman to develop, and like everything else "it is simple when you know how." It is a question in my mind, however, whether any device or apparatus, whether it be ice-harvesting machinery or any other kind of machinery, is so simple as to be unsusceptible to further improvement.

I have had in my mind for some time a method of cutting ice by the aid of an electric current, which may have been thought of by others, but as far as I know it has never been referred to in public print, and I therefore unfold my plan. I have not given it a practical test, but I see no reason why it should not work. The plan is simply this: have a portable steam and dynamo plant located at some convenient point on the shore near to the operations of ice harvesting, and run from the dynamo a No. 12 steel wire of any convenient length, with a proper return. Now, by generating a sufficient current to maintain the temperature in the wire at about 200 degrees, and by stretching the wire taut along the surface of the ice, it is evident that it would cut its way through the ice. I think that it would be an easy matter to cut 200 feet of ice in a very few minutes, not more than ten. It seems to me that this would be the most economical method of all for gathering ice, and one man could accomplish as much work as half a dozen men can under the old plan.

The cleanliness of this method is an important consideration; there are no horses employed in the work, and all danger from loss of either horses or men through breaking through the ice would be removed.

A portable steam and electric plant, of course, would be indispensable to carry this method into practical operation, but these are easily obtainable nowadays, and I see no reason why the idea should not work well in practice.

As I have already said, I never heard that it has been tried, though it has probably been thought of, and if there are any of your readers who have developed plans along this line, no doubt it would be of interest to hear from them.

The ice business in this country has become an immense industry, and there is no doubt but that electricity will some day be made to play a very important part in the work of gathering ice. It is frequently necessary to make haste in the work of harvesting on account of the uncertainty of the weather conditions, and it would seem that where haste is required electricity could be made to fulfil every requirement.

ELECTRICAL SOCIETIES.

BROOKLYN INSTITUTE.

On February 19 Mr. Robert McA. Lloyd will deliver a lecture before the Department of Electricity on "Accumulators," with full illustrations. The lecture will be given in the large lecture-room, 502 Fulton street, at 8 P.M.

NEW YORK ELECTRICAL SOCIETY.

The New York Electrical Society will hold its next meeting on Wednesday, the 17th inst., at the Western Union Telegraph Building, 195 Broadway. An inspection of the new operating-rooms will be made.

NEW INCORPORATIONS.

The American Electrical Company, Chicago, Ill., was incorporated January 29, with a capital stock of $500,000. Incorporators: Eben Carpenter, Arthur B. Eads and Alonzo P. Connolly.

The Ephrata Light Company, Ephrata, Pa., was incorporated January 28, with a capital stock of $10,000. Incorporators: John F. Montzer, Andrew Baker, Charles Wise, all of Ephrata, Pa.

The Doylestown Electric Company, Doylestown, Pa., was incorporated January 26, with a capital stock of $16,000. Incorporators: Alfred Paschall, William H. Kirk, Frederick Tibbils, all of Doylestown, Pa.

The Millville Electric Light Company, Millville, N. J., was incorporated January 28, with a capital stock of $50,000. Incorporators: Francis Reeves, H. B. Kemble, Millville, N. J.; Walter Wood, Philadelphia, Pa.

The City of Pekin Electric Light and Power Company, Pekin, Ill., was incorporated February 3, with a capital stock of $15,000. Incorporators: John B. Seibert, George Herget, Jacob A. Roelfs, Thomas Cooper and L. Zinger.

The Electrical Conduit Company, Long Branch, N. J., was incorporated January 22, with a capital stock of $300,000. Incorporators: L. May, C. A. Henriques, A. Wolff, Jr., New York, N. Y.; J. Thomas, Catasauqua, Pa.; C. P. Barker, Brooklyn, N. Y.

The Washington Brick, Lime and Manufacturing Company, Spokane, Wash., was incorporated January 26, with a capital stock of $50,000. Among other things it will operate electric-light works. Incorporators: Joseph A. Spear, Henry Book, Spokane, Wash.

The Home Lighting and Fuel Company, Parkersburg, W. Va., was incorporated January 23, with a capital stock of $250,000, to manufacture and distribute gas and electricity. Incorporators: B. D. Spillman, J. A. Wetherelle, J. L. Buckley, all of Parkersburg, W. Va.

The Consolidated Brush and Novelty Company, Paterson, N. J., was incorporated January 21, with a capital stock of $50,000, to manufacture composition and other materials for electric and novelty goods. Incorporators: C. A. Bishop, A. L. Schwarz, A. W. Bishop, Paterson, N. J.

The Enterprise Mining, Milling and Smelting Company, Seattle, Wash., was incorporated January 28, with a capital stock of $1,000,000. Among other things it will operate electric-light works. Incorporators: E. J. Thorp, J. C. Allen, J. J. Snyder, C. J. Klemme and F. F. Boynton.

The Pink Granite Company, Alexander, Va., was incorporated January 21, with a capital stock of $200,000. Among other things it will operate telegraph, telephone and electric works. Incorporators: B. E. Shear, J. A. Walter, of Washington, D. C.; C. C. Clements, F. B. Arendell and A. C. Walter.

The International Chemical and Gas Company, Chicago, Ill., was incorporated January 29, with a capital stock of $2,000,000. Among other things it will manufacture and sell machinery and appliances for electrical and other purposes. Incorporators: John Schwender, Sidney C. Eastman and Max Baird.

(*Continued from page* 76.)

the legitimate reduction of operating expenses as upon actual receipts, and in response to their demands the not infrequent use of extravagant countershafting has been made no longer necessary; the automatic high-speed engine has been perfected, and finally, the triple-expansion engine wrests nearly every ounce of power from steam by bringing it down to almost a vacuum. Even the firing of boilers has become an art, so much so in fact that in some well-regulated stations engineers can tell almost the exact amount of coal burned in a given period by noting the 'load,' or the number of lamps burned during that time. Why this occurs may be easily understood; dynamos and steam-engines are both automatic in their action—that is, they develop only such power as is required to perform the work allotted to them. Each arc lamp absorbs electric energy requiring the expenditure of approximately one horse-power in its production. If, therefore, fifty arc lamps are burning from a dynamo and ten lamps are switched off, the power required to run the dynamo will instantly drop from, say, 50 horse-power to about 40 horse-power. The load of 10 horse-power being taken from the engine, its tendency is to accelerate in speed, but the moment this occurs the governor notes the change and cuts off whatever surplus steam there may be in excess of that necessary to produce the power required. Less steam is, therefore, taken from the boiler, and with proper firing less coal will be consumed. If, in your travels, you find an electric-light station where the exact lamp or ampère load is recorded continuously or at frequent intervals and where every pound of coal going under the boilers is carefully weighed and noted with the time, and results are carefully compared, then, I dare say, you may rest assured that the station managers are live, wide-awake, careful men who would permit no careless or hazardous construction to exist that would jeopardize their property. I have never yet had occasion to seriously criticise the electrical equipment of an electric-light plant in charge of a man who exercised wise station economy.

"Regarding the construction of the station proper, the building to meet the standard should be such as is recognized as the best factory construction, and as such it may be of brick or stone, preferably not over two stories high. An electric-light station is, in brief, an 'electricity factory,' and electricity, though intangible, is the product of its whirling machinery, just as fabrics come from cotton and woollen mills, or as sugar comes from a refinery. Each should be of plain mill construction, and, in the standard risk, the roof should be of slate, metal or gravel. Of course, all precautions should be taken regarding stairways and elevators. If possible, they should be placed outside, or, if inside, they should be enclosed, and provided with self-closing doors and hatches, respectively. The boiler-house should be in an adjoining building, and in any instance, it is quite essential that the boilers be separated from the engine and dynamo rooms by means of a competent fire wall, carried up through the roof, and provided with approved fire doors. It is said that linemen have more to fear from gravity than from the current in the wires they handle, and, if reliable statistics were available, it would probably be proven that more linemen are killed by falling from poles than by electricity. Possibly, too, if the truth were known, it might be proven that defective boilers and flues have caused as many, if not more, central-station fires than electricity; but, be this as it may, no one will question the propriety of separating the boiler and dynamo rooms by a fire wall. It is obviously equally important that the station should be provided with a full fire equipment, consisting of fire pumps of ample capacity, good hose on approved reels, fire buckets, tanks on roofs or standpipes and automatic sprinklers judiciously placed. When all these conditions exist, and when everything is kept neat and clean, when oil and waste are properly cared for, when steam-pipes are made tight and well felted, when bearings are perfectly aligned, and when litter and dirt are never to be found, then—aside from its electrical equipment—will the station be maintained in accordance with the sound views of the fire underwriter.

"But the consideration of the hazards attending the electrical equipment of generating stations is more properly the subject matter of the present paper, and intuitively the first appliance demanding attention is the dynamo. It is not such an easy matter for the layman to recognize the difference between high and low potential dynamos as it was even a few months ago. A new class of low-potential machines, known as multipolar dynamos, are being brought forward that appear like high-pressure alternating machines in several details, and in some cases alternators are now made to generate low-potential currents, which are afterward transformed to high pressures, but from the standpoint of safety it is well to consider all dynamos as high-pressure generators. In other words, mount all dynamos properly, keep them all perfectly clean, run all connecting wires after the most approved methods, and then safety will be assured in every instance. Wherever possible it is advisable to mount dynamos on a stone or concrete foundation for stability's sake, but never place the machine on such a foundation direct. A thoroughly dry wood case, well filled to prevent the absorption of moisture, must intervene. Concrete or stone is a conductor of electricity, and to place a dynamo on such a foundation is possibly to maintain a grounded circuit, the hazards of which have been fully described. As to dynamos themselves comparatively little can be said. They should be kept neat and clean, and they should never be located in places exposed to inflammable dust or the flyings of magnetic material. Machines should always be protected with a waterproof cover when not in use, and they should never, in any instance, be exposed to dampness of any sort. The only parts of a dynamo that are susceptible to wear are the bearings, the commutator and the brushes, and the depreciation on these is low, if the machine is properly cared for. It has been said that 'the best system is the man who runs it.' Equally true is it that the behavior of a well-made dynamo depends upon the care it receives. If the circuits it supplied with current are of faulty construction the machine receives abuse just as malignant as neglect in cleanliness. Burnouts of dynamo armatures or fields are, therefore, like fuse blowings, symptoms that disorder exist somewhere or other in the system.

The destructibility of dynamos by fire is, I judge, about equal to that of high-grade steam-engines, but contrary to the prevalent belief, dynamos are not necessarily susceptible to either serious or material injury by water. The dynamo used by the Pacific Oil and Lead Works, prior to their fire last year, remained under oil and water for fourteen days, yet it is now in daily use and giving satisfaction. Another machine fell into the Columbia river while being unloaded from a steamboat, and remained there over three weeks. Yet it was fished out and is none the less efficient for its soaking. About all that is necessary to restore wet dynamos to their original condition is to exercise great care in drying them out by sending a current through their coils. Careless or hurried drying will frequently result in a burned-out machine, which will necessitate rewinding. To do this entails a cost almost impossible to approximate to any close certainty. Some concerns are able to do their own winding, in which event the cost may be 30 or 40 per cent. of that of a new machine, but if it becomes necessary to send the machine to the factory to have it rewound, then the cost, with freights added, may approximate from 50 to 70 per cent., if not more, of that of a new machine."

(*To be continued.*)

OPPOSITION TO THE BELL TELEPHONE COMPANY.

The Metropolitan Telephone and Telegraph Company, which enjoys a monopoly of the telephone business, will have some hustling to do after 1893, as all the original Bell telephone patents will expire in that year, and a great many schemes have already been started with the intention of entering into competition with it when the time arrives.

By far the greatest of these schemes, if any truth can be placed in current rumors, will be backed up by the Standard Oil Company, or by some of its wealthy members. No surprise need be created by these rumors, as it is a well-known fact that the Standard Oil Company always has on hand an immense surplus waiting for profitable investment.

Inquiry at the offices of the company elicited the statement from one of the magnates "that the company never dabbled in anything but oil, and that if any Standard money was in the project it was put in by individuals." Nevertheless, the report that the company intends to duplicate the Telephone Company's system is believed by a great many people.

The officials of the Telephone Company say that they are not at all worried by these stories, claiming that the patents which will expire in 1893 cover the old-fashioned transmitters only, for which Berliner or "long-distance" instruments have been substituted very generally, and by which the service is made a most perfect one. The patents on these will not expire for some years yet, and until the expiration of which only local competition can be entered into.

The public at large will look forward to the time when the patents expire, with great interest, as competition will mean cheaper rates, and that is what all are after.

EXECUTED BY ELECTRICITY.

Charles McIlvaine, a murderer, was executed by the electric method at Sing Sing prison, on Monday morning, February 8, in the presence of 12 lay witnesses. Death was instantaneous, and the affair seems to have been generally successful.

DEAL BETWEEN ELECTRIC COMPANIES.

So much has been said about the projected consolidation of the Edison General Electric and the Thomson-Houston Electric companies that but little surprise was created at the issuing of the following circular by Mr. Henry Villard, of the Edison Company, from which it can be seen that consolidation between the companies is virtually assured:

"In reply to many inquiries regarding the consolidation of the Edison General Electric and the Thomson-Houston Electric companies I deem it my duty to say that negotiations to that end are progressing rapidly and there is every probability that a conclusion satisfactory to all concerned will be reached in a few days.

"Ever since I organized the Edison General Electric Company I have believed that great advantages would accrue to both the stockholders and the public if both organizations could be brought together.

"Two years ago I did my best to bring about such a result, and did reach an agreement, but certain reasons then existed which prevented the consummation of the scheme. Those interested in the present negotiations have all but agreed upon a basis that is fair to both sides, and the stockholders of both companies will be asked very soon to accept them."

Mr. Villard, it is understood, will not take any active management in the new organization, the president of which, it is said, will be E. A. Coffin, the present vice-president of the Thomson-Houston Company.

Nothing could be learned from the officials of the Thomson-Houston Company relative to the proposed deal.

The plan as outlined is to form a joint corporation to manufacture and develop electricity and electrical apparatus, to acquire patents and to transact business properly connected or incident thereto.

The capital stock of the corporation is placed at $50,000,000, divided into 500,000 shares at $100 each, of which not more than 20 per cent. may be preferred stock, entitled to receive in each year dividends amounting to 7 per cent.

Shares of the stock of the Edison Company shall be exchanged in full payment for shares of common stock in the new corporation, share for share.

Shares of preferred stock of the Thomson-Houston Company shall be exchanged in full payment for shares of preferred stock of the new corporation at the rate of four shares of the old stock (par $25 each) for one share of the new (par $100 each).

Shares of common stock of the Thomson-Houston Company shall be exchanged in full payment of common stock of the new corporation at the rate of five shares of the old stock for three of the new.

In case a majority of the stock of both the Edison General Electric and the Thomson-Houston Electric Companies is not turned in for exchange for stock of the proposed corporation by May 1, 1892, then the consolidation will be declared off.

LIGHT FOR HICKSVILLE.

A franchise has been granted to a number of business men in Hicksville, L. I., to erect poles and furnish electric light to the villages of Hicksville, Jericho, Central Park, Plain View and Farmingdale. Mr. Julius Augustin is at the head of the movement. The plant is to have a capacity of 410 incandescent lights, and the power will be supplied by the large engine in the saw-mill of H. C. Zenner. It is stated that Mr. William Simonson, formerly of the Long Island Railroad Company, will be superintendent.

NEW USE FOR ELECTRICITY.

A new application of electricity is to test whether the nails in a horse's foot are properly placed. The method is to attach one terminal of a light battery to the bit in the mouth, and the other to the shoe. Should a nail penetrate the foot a current will be established through the body of the animal, and he will give evidence in some form or another of his displeasure thereat. Who the inventor of this ingenious device is we have not learned.

NEW CATALOGUES.

The E. S. Greeley & Co., 5 and 7 Dey street, New York, have just issued their new illustrated catalogue and price-list for 1892. It contains a full description of the telegraph, telephone, electric light, power, railway and general electrical machinery and supplies which they handle.

McIntosh Seymour & Co., of Auburn, N. Y., are out with a finely illustrated catalogue of their Standard Single-Cylinder Engine, which they claim is not equalled for simplicity, durability and reliability by any other engine.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Feb. 6, 1892.

A. H. BAUER, of Chicago, electrician of the Pullman Company, was in town last week.

MR. C. G. HAGUE, Treasurer of the New Haven Insulated Wire Company, New Haven, Conn., was in town last week.

MR. D. B. DEAN, of the Electric Merchandise Company, Chicago, was in town the past week. He has secured some large orders for his company's railway supplies.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of this city, has a strike on its hands. The wiremen are on a strike, and the company means fight. It claims its business is not suffering any by the strike.

THE CROCKER-WHEELER ELECTRIC COMPANY has just placed four of its perfected fan outfits in the turrets of the new U. S. S. Miantonomoh, to blow the smoke away from the guns. This is surely a novel use of the electric fan.

C. H. W. COPELAND, agent for the Rice automatic engine, Electrical Exchange Building, 136 Liberty street, this city, is very busy, and is sending out a generous number of estimates for light and railway plants. He has already closed some excellent orders for railway and lighting plants.

THE STEELE AND JOHNSON MANUFACTURING COMPANY, 35 Howard street, this city, handles an excellent line of shadeholders, gas-fixtures, trimmings, etc. It also makes regular or special goods from brass, copper and bronze, and its work is of the highest class. The company's factory is in Waterbury, Conn.

MR. CHARLES E. CHAPIN, manufacturer's agent and jobber 135 Liberty street, this city, is doing a good business. His specialties include New York and Ohio lamps and Imperial porcelain, and he is general buying and selling agent in addition to purchasing of supplies. He also acts as resident buyer for out-of-town companies.

J. H. BUNNELL & CO., 76 Cortlandt street, New York, have just issued a circular to the trade generally, notifying all concerned that they are now prosecuting suits against infringements of patents on the Burnley dry battery. Any one making or selling dry batteries that any way infringe the Burnley patents will be held liable for damages.

MR. H. G. MADDEN, manufacturers' agent for electrical supplies of every description, 18 Cortlandt street, this city, is doing a good business in "Crown" Lamp Sockets. He claims that this socket is the most perfect ever made. The metal parts are arranged with plenty of space, so that there is no danger of short circuits. These sockets are made both key and keyless, to fit the lamps of any system.

THE METROPOLITAN ELECTRIC SERVICE COMPANY, which controls the Johnson heat-regulating apparatus, has removed its office to 126 Liberty street. The object of the Johnson heat-regulating apparatus is to automatically control artificial heat so as to give a uniform temperature. This apparatus is popularly known as the Electric Valve Service. Mr. William Frank Hall is president of this company.

THE EMPIRE CHINA WORKS, Greenpoint, Brooklyn, N. Y., of which Mr. J. L. Jensen is manager, reports increasing business. The specialties of this company are non-conductive blocks, rosettes and bases for cut-outs and switches, also insulators, cleats, lamp trimmings and other electrical supplies. The glazing and body of its ware are of the same composition, and are baked alike, which are the features of True Hard Porcelain.

DOUBLEDAY, MITCHELL & CO., on February 1, succeeded to the business of Parmly, Mitchell & Co., 18 Cortlandt street. They assumed the liabilities and assets of the latter concern, and will continue to carry on the business at the old stand. The firm consists of Charles D. Doubleday, P. W. Mitchell and another, and each of these gentlemen is well known in the trade. Doubleday, Mitchell & Co. will handle electric supplies of every description, and carry themselves in the front ranks.

F. C. TIMSON, manager of the New York office of the Electric Engineering and Supply Company, of Syracuse, is doing a nice business in branch-blocks, rosettes, lamp-sockets for all systems, switches and cut-outs for arc lamps and all specialties necessary for the incandescent and arc systems. Mr. Timson carries a full line of samples of specialties and a small stock for immediate delivery. This company is constantly developing new things.

F. W. BRADY, electrical and mechanical engineer and draughtsman, with office at 126 Liberty street, this city, represents the Keystone Electric Company, of Erie, Pa. This company makes a specialty of reversible electric motors to be operated without resistance, also a motor for running large church organs. The reversible motor without resistance, which is the company's main specialty, is also applicable to elevator work and operated with reversing switches. It is guaranteed to reverse under full load without danger.

I. P. FRINK, 551 Pearl street, this city, has now on hand a large number of orders for reflectors and reflecting chandeliers, in which electric lamps are used, covering all classes of public buildings, and well distributed over the States, among them the following from prominent churches: Protestant Dutch Church, New York City; Christ Church, Jersey City, N. J.; First Presbyterian Church, Fostoria, O.; M. E. Church, Ventura, Cal.; Catholic Church, Owatonna, Minn.; Fourth Presbyterian Church, Pittsburg, Pa.; M. E. Church, Plainfield, N. J.

THE INTERIOR CONDUIT AND INSULATION COMPANY, of this city, is making large shipments of its new Johnson switches to its agents and the principal central stations in the United States. The company is already some thirty days behind time in its orders, one illuminating company alone having ordered 1,100 of these switches in two days. The company has in preparation a handsome illustrated catalogue setting forth the good qualities of this switch. This catalogue will be issued together with a revised edition of the company's well-known No. 4 catalogue, in the course of the next ten days or two weeks.

THE following-named well-known gentlemen were in town last week: C. A. Benton, of the Detroit Electrical Works, Detroit, Mich.; J. F. Morrison, of Baltimore, Md.; D. B. Dean, of the Electric Merchandise Company, Chicago, Ill.; H. F. Cargill, of the Thomson-Houston Company, Boston; Col. Dan Coolidge, Vice-President of the Johnson Company, Johnstown, Pa.; Henry B. Oakman, of the Edison General Electric Company, Buffalo, N. Y., and W. A. Stadelman. Mr. Stadelman has sold out his interest in the Bristol, Tenn., Belt Road.

MR. ALFRED E. KORNFELD has recently perfected arrangements whereby he severs his connection with the *Electrical World* to become business manager of the Himmer & Anderson Dry Battery Company. Mr. Kornfeld is favorably known in the electrical fraternity, and is one of the rising young men in the business. We have no doubt that with his business ability he will make his new undertaking a howling success. The Himmer & Anderson dry battery has recently been perfected, and is giving universal satisfaction. Some tests recently witnessed seem to bear this out.

MR. VITALIS HIMMER, of Himmer and Anderson, 123 Chambers street, this city, manufacturers of the well-known dry battery, will shortly make a trip throughout the States, and he will likely evolve some large orders for these celebrated cells. We wish him success. These batteries give the best of satisfaction, and are highly recommended by those who know them best. The electro-motive force of each cell is 1.7 volts, and as high as 14 ampères of current has been delivered from one cell. We have seen these batteries run a small motor and fan outfit for nearly one hour, and then left to recuperate, after which they will start off on their work as strong as ever.

THE stockholders of Alexander, Barney & Chapin, 20 Cortlandt street, held a meeting on the 30th of January, at which they voted to increase the capital stock of the concern to $150,000; the new $50,000 to be preferred stock bearing interest at the rate of 8 % per annum. The increased capital will enable the A. B. C. Co. to enlarge its railway-supply department, which part of their business has been growing of late. The firm, as is probably known, is doing quite an extensive business in electric light supplies, also in bell-hangers' supplies, and has shown a wonderfully energetic and successful management.

N. L. SCHLOSS, 126 Liberty street, this city, is manager of the New York department of Thomas H. Dallett & Co., of Philadelphia, manufacturers of Bi lberg electric motors and electric-light appliances. Mr. Schloss is quite an enterprising young man, and in every way capable of filling the post assigned him here. He explained to your correspondent the advantages of the new Billberg electric motor starting-box. The box is so arranged that you have to turn on the full current in divisions, and when the current is on the switch locks itself. Releasing a spring-catch the circuit is cut out instantly. The switch is of the double-pole class, with carbon contacts, the carbons of which are held down with springs made of music wire. The box is made of cast iron and has a slate top with double-fuse connections on the upper surface. Mr. Schloss has on exhibition two sizes of Billberg dynamos and motors.

T. J. MURPHY, manufacturer of slate switchboards, Electrical Exchange Building, 136 Liberty street, has lately finished a board for the Cumberland Gap, Tenn., electric-light plant. It is 8 feet 8 inches wide and 7 feet 3 inches high, and contains no less than 350 borings. It is made in five sections of marbleized slate, with Bardilla finish. The three top pieces are 5 feet high, and underneath these are two pieces 1 foot high by 4 feet 4 inches long, and underneath these is a blank space 1 foot three inches high by 8 feet 8 inches long, provided for the purpose of setting in the rheostats, thus doing away with the necessity of cutting out the board and weakening the same. This construction renders the shipment of the boards a matter of greater facility. Mr. Murphy has also finished a slate board for Macy's dry-goods house in this city, which is 12 feet 2 inches wide and 8 feet, 1 inch high. The board has four top sections 5 feet 11 inches high, two corner pieces 3 feet square, and one bottom piece 6 feet long by 18 inches high, leaving an open space of 6 feet by 18 inches, in which the rheostats are to be set, as in the board above mentioned. He has also constructed an elegant Italian marble board 8 feet long by 8 feet high. It is made in only two pieces, each of 4 feet by 8 feet in dimensions, and all the instruments were mounted directly on the board. The rheostats are placed at the back, and all the connections carried through the slate, only the dial plate of the rheostat showing on the face of the board. This does away with the cutting of the marble and marring the appearance of the board, and permits of a finer finish. Each slab without the instrument weighed 575 lbs., and all the holes were drilled by Mr. Murphy. He desires to call particular attention to the special features of his work. Parties desiring to negotiate with him for marble boards should give the size desired, and furnish drawings showing the location of the holes where the instruments are to be attached, and he recommends that each instrument be set on one section independent of the other sections, when the board is to be of extra large size and made in sections. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	64 00
Am. Elec Exercise Mach Co., N.Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co, Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Commercial Cable Co	7,716,000	100 00	151 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	114 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 50
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*101
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	102 25
Edwards Manuf. Co., N. Y	10,000	100 00	90 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	45 75
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	14 00
Franklin Electric Co., N. Y	5,000,000	100 00	483 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*92
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	109 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., N.Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	21 00
Laclede Gas pref	2,500,000	100 00	62 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y.	3,500.000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Mount Morris 5s, N. Y	2.300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50.000	100 00	110 00
Nat'l Aut. Fire Alarm, L. I	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	20 00
New England Butt Co	100.000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	50 50
N. Y. and N. J. Tel. and Tel. 5s	1,500.000		*98
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P Co. 6s, Ohio	50.000		*95
North American Railway Co	39,767,200	100 00	16 75
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000.000	100 00	37 00
Pennock Baty. E.L.& Impt.Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000.000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500 000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	500,000	5 00	4 75
Saginaw E. L. & P. Co. 6s, Mich	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Ongley Electric Co., N. Y	250,000	100 00	90 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500,000	100 00	80
Thomson-Houston Electric Co	6,000,000	25 00	59 50
Thomson-Houston pref	4,000,000	25 00	28 50
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
United Elec. Light and Power	5,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,862	100 00	87 50
Westinghouse Electric Co	7,000,000	50 00	14 00
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate but will be found very near the mark. Corrections cordially made, correspondence solicited.

FINANCIAL.

With the breaking up of the January portion of the winter the people on the western side of the Hudson, both north and south, or perhaps more strictly speaking south and west, are waking up to the fact that the time has arrived for carrying into effect their various electrical enterprises, enlarging and improving those already in operation, and the introduction of new inventions. To do this requires money; and as New York is the centre of capital of this hemisphere, here it is that the man who has money to invest comes with or sends his wealth, and here also all who have use for money bring their collateral to offer for it. Some of the capital remains to improve the real estate and enlarge manufactories, but by far the major part of it is kept on the road tramping after employment and returning periodically enlarged with profits. At this writing there are, no doubt, more electrical securities in all stages of structural development offered in this market than at any previous time; and they are being taken up quite freely. To be sure they do not all meet with success at the first offering, but through persistent efforts on the part of the middlemen the desired result is generally brought about. It is not always the best corporation in all cases which secures capital, but more often those which, by the able presentation of persistent promoters, properly prepared, in channels frequented by investors, is what insures success, other things being equal. There is a growing desire to secure interests where consolidation or amalgamation is apparently near at hand, as with the increase of service and a certain decrease in expenses not only are larger dividends but stock dividends as well assured in the very near future; and until the various corporations are all gathered into one fold, regular and continuous commercial earnings will be either divided or used in improving the plant or enhancing its intrinsic value, but when the local consolidation is perfected is the time when great leaps in values are met with, capital is generally increased, bonds issued and the property materially improved, the centralization rendering possible that which the segregated parts could not accomplish alone. In the South it is quite customary to grant exclusive franchises to corporations for all electrical appliances, running for ten, twenty or thirty years. Labor and power is cheap there, and the standard of prices for electrical service varies but little, when taken as a special industry, over the whole country. If anything the range is in favor of the country as against the city, for we hear of many places where the street-car fare is from six to ten cents for a single journey, and 16 C. P. lamps from $17.50 to $22.00 per month on the Philadelphia, or moonlight schedule, and this in places as far removed as North Carolina, Arkansas, Colorado and Michigan. In the first State wood for fuel is only $1.50 per cord, and Colorado's metropolis, Denver, grows so fast that, like Chicago, people have stopped computing it. Twenty thousand dollars or less will purchase a plant in the first-named State, earning to-day on a 30-year exclusive franchise, with the well-known Brush electric system perfectly installed, a net income of 8 per cent., and in the second-named State the same sum will purchase stock at par earning 9 per cent., beside paying 8 per cent. on its bonds, which sold for 107, and laying by a good surplus over all. Think, you who have idle money, what the first will be thirty years hence, and what the latter will be when under one management. The day is not far off when a single corporation will own and control the public electrical light, heat and power service of even Greater New York, and this management will, under a legislative enactment fixing a maximum price per horse-power and per candle-power, supply a service at present financially impossible, and pay legal interest or more on a capital which would seem ridiculous if mentioned here to-day. The field is large and the crop sure; investors who delay lose the opportunity of cheap purchase and grand profits, beside risking the loss of their principal.

The reappearance of S. V. White in the Stock Exchange is an event which will go into financial history as the result of personal popularity and integrity as to contracts, coupled with a high social position. Had the failure to meet demands come from an error of judgment on the possible price of a railway or mining or even an electrical security, not a dissenting voice outside of the creditors, actual and expectant, would have been heard throughout the length and breadth of the land, for his reputation had been made national by the press; but for something over eighteen hundred years there has been a feeling adverse to the cornering of the food on which the world subsists, and a great many good people think it decidedly naughty to gamble in that which man must have to live. It would have been much more to the Deacon's moral and commercial credit if he had suspended on account of contracts on securities representing luxury instead of the staff of life itself, and that at its source. He has promised, and probably will meet his obligations even to paying the interest thereon, but we must not forget that the street is a noted battle-ground, and his chances of winning are handicapped by the fact that every operator on 'Change wants the profit he will be after, and not a few of them know his specialties and weaknesses. Commissions, like wages, are not apt to enable an unfortunate man to pay a million of money and current expenses with occasional losses in the few years left to perform the miracle in. I wish the Deacon luck, all the good things of this earth and heaven when he dies, and suggest that the most feasible line of recuperation for him lies in the absolutely certain profit to be realized in electric securities—an industry the introduction, installation and distribution of which has grown from hundreds of dollars to hundreds of millions before entering its teens as a commercial factor, with the surface only of the most prolific soil spaded up, offering an opportunity to educated speculative talent unequalled in the annals of American financial history outside of this prodigious overspreading development of the various electrical sciences and their component requirements. Such men as Mr. White or Mr. Field are eminently able to place electric bonds and shares in this market, paying 6 to 8 per cent,, retaining a large commission, and the very fact of personally acquainting themselves with the status and certainties of the property would enable them to join the purchasers or investors in the cream of the trade, and before the opposition or rank and file realized that the market was being loaded the head-lines of the great dailies would teem with statements of the culmination of the promise made in February, 1892.

I have been explaining consolidation and concentration of electrical interests for some time, and the following brief announcement is a long stride in that direction. The current will possibly be turned on in full before the next publication—the air is full of electricity, otherwise called rumors—and the Westinghouse be found in the circuit. These will form a huge parent corporation and include the country at large. My desire is more especially confined to single cities whose local electric corporation should be under one management and include all the industries.

"The Edison General Electric and the Thomson-Houston Electric Companies have at last agreed upon a basis of consolidation. The stock of the first named is to be exchanged for that of the consolidated company, dollar for dollar, and the Thomson-Houston stock will be turned in on the basis of 60 per cent. of its face value. The president of the consolidated company will be Mr. E. A. Coffin, now vice-president of the Thomson-Houston Company, and Mr. Villard who has acted as president of the Edison General Electric, although his resignation is said to have been in the hands of the directors for many months, will, it is understood, cease to take an active part in the enterprise."

This speaks for itself.

EASTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET, BOSTON, Feb. 6, 1892.

J. BRADFORD SARGENT, 620 Atlantic ave., Boston, Mass., New England Agent for the Stirling Boiler and Corliss Engine, has recently installed three 500 H. P. condensing Corliss Engines in the power-house, at Lowell, Mass., of the Lowell and Suburban Street Railway Co. Mr. Sargent also installed the 500 H. P. Corliss Engine in the power-house, at Leicester, Mass., of the Worcester, Leicester and Spencer Electric Street Railway Co.

AMONG the contracts recently closed by the Stirling Company for its Water-Tube Safety-Boilers are the following: Carnegie, Phipps & Co., Pittsburg, Pa., 1,200 H. P.; San Francisco and San Mateo Ry. Co., San Francisco, Cal., 1,250 H. P.; Los Angeles Con. Elec. St. Ry. Co., 1,500 H. P.; Pacific Rolling Mills Co., San Francisco, Cal., 1,500 H. P.; Braddock Wire Co., Braddock, Pa., 600 H. P.; Cincinnati Water-Works, Cincinnati, Ohio, 1,200 H. P.; Cold Storage Co., Chicago, 1,800 H. P.; Minneapolis Street Ry. Co., Minneapolis, 2,000 H. P., second order; Toledo Water-Works, Toledo, Ohio, 1,500 H. P. These orders were given after the closest investigation by the mechanical engineers of the various plants, and after they had sent experts around the country to examine the Stirling Boiler in actual operation. They were given in competition against every type of boiler manufactured in the United States. The company has sold over 100,000 H. P. in the last 3 years, all of which are giving excellent results and perfect satisfaction. Parties about to purchase steam-boilers should thoroughly investigate the Stirling and send to J. Bradford Sargent, 620 Atlantic ave., Boston, Mass., for catalogues and prices.

D. L. T.

PHILADELPHIA NOTES.

MORRIS, TASKER & CO., 222 and 224 South Third street, Philadelphia, manufacturers of boiler-tubes, wrought-iron pipes and fittings, structural work, tools, machinery, etc., make a specialty of electric-light and street-railway poles. These poles are handsome in design and and of great strength. There is nothing about the poles objectionable to the eye.

THE WASHINGTON CARBON COMPANY, Washington, Pa., carries a large stock of carbons on hand at all times. These goods are well known for their excellence. The company is represented in New York by Holmes, Booth & Hayden; in Chicago by the Central Electric Co.; in Pittsburg by the Electric Supply and Construction Company, and in Philadelphia by Frank S. Marr, Room 422, New City Hall Building.

W. T. H.

WESTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
245 STATE STREET, CHICAGO, Feb. 6, 1892.

MR. H. F. WATSON, of Erie, Pa., is manufacturer of a line of building manilla, carpet, asbestos and pulp-lined papers. The asbestos and pulp-lined papers are excellently adapted for wrapping steam-pipes, and Mr. Watson does a large trade in this line.

N. A. WATSON, corner of 16th and State streets, Erie, Pa., is the manufacturer of the well-known Excelsior boiler-feeder. This feeder is said to be the best and simplest in the market. It is independent of the engine; dispenses with heaters; there is no friction; all parts are stationary, and it is less liable to get out of order than a pump.

THE TAPER SLEEVE PULLEY WORKS, of Erie, Pa., are extensive manufacturers of friction clutch-pulleys and cut-off couplings. The friction clutch-pulleys made by this company are constructed of wood, and are therefore much lighter on the shaft and more easily handled than iron pulleys; they also have a greater hold on the belt. They have a long hub fitted with lubricators in which the shaft turns when the clutch is disengaged, leaving the pulley belt and machine at rest.

THE WALLA WALLA (WASH.) ELECTRIC LIGHT AND GAS COMPANY will expend in the neighborhood of $60,000 in making improvements in its plant. It has been decided to increase its power from 83 to 280 horse power. For this purpose water from Mill Creek, above Yellow Hawk, in 40-inch pipes will be taken, amounting to 5,000 inches, and brought down so as to provide a 75-feet fall, at which the generating machinery will be erected. The electric power will be brought to the city by wire.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, Ill., reports that it has been unable to keep up with the orders for C. E. M. goods, including sockets and cut-outs. Although January is generally a quiet month in the trade all over the country, this company did a largely-increased business during the month. It carries in stock a complete line of jack-knife switches, in single-pole, double-pole, three-pole and throw-over, and it is able to fill orders promptly. The C. E. M. goods, it reports, seem to have found general favor in the trade.

F. P. LITTLE & CO., contractors and engineers, Buffalo, N. Y., report business very good considering the time of the year. They have just completed the installation of a plant in the new Brozelle House, Buffalo, N. Y., of 800 lights. It consists of two Rice high-speed automatic engines, 50 and 30 horse-power respectively, and Thomson-Houston dynamos. They have put in a plant of 100 lights in the Wells Building, Buffalo, also 150-light plant in the Walker Building, Buffalo. The above plants have been completed since Jan. 1, 1892. The firm is engineering the work at the Capitol at Albany, and has been working at it for the past five months. They have contracted for the construction of all machinery and the installation of an 800-light plant for the Citizens' Electric Light Co., Stratford, Ont., also contracted for the installation of a 300-light plant at Welland, Ont., besides numerous other contracts.

A REPRESENTATIVE of the ELECTRICAL AGE called upon the well-known belting firm of Francis & Bickford, Buffalo, N. Y., and was cordially invited to take a look through their works by Mr. Wilson, their manager. Mr. Wilson explained in detail the process of manufacturing their belting which is especially adapted for electric-light plants. The belting is manufactured from oak tanned leather, the hides of which are the production of Southern and Texas cattle. The hides of these cattle, it is said, produce a very much superior leather than any other. Messrs. F. & B. select their own stock of leather, taking only the best, thus enabling them to guarantee every belt that they manufacture. Their belts are being extensively used in Chicago, New Orleans, St. Louis and all the principal cities in the United States. They recently sold a 72-inch belt for the Buffalo power-house, which is one of the largest belts manufactured. This firm has been established since 1867, and has kept pace with the best concerns of this country in the introduction of new features and improvements in the manufacture of a first-class belt.

N. D. W.

BUSINESS NOTES.

An introduction to the through-car service of the Wisconsin Central Lines and Northern Pacific Railroad is unnecessary. Its advantages and conveniences have been fully established. It is the only route to the Pacific Coast over which both Pullman Vestibuled first-class and Pullman Tourist Cars are operated from Chicago *via* St. Paul *without change*. Through trains leave Chicago every day at 10:45 P.M. The traveller *via* this route passes through the most picturesque, interesting and prosperous belt of country in the Western World. There is scenery with most striking contrasts that range from the rolling prairie and the pine forest level to the wildest passes of the wildest mountains in the world.

There is a series of the noblest cities, towns and villages of every variety and size, from the hamlet or the tiny farm upward; the richest mines in the world; the greenest and most lasting pasturage; the wildest scenery on the continent; cañons as weird as a nightmare; hills, snows and peaks startling in the magnificence of their beauty, and a perfection of comfort in traveling that has never been surpassed.

Fast train *via* the Wisconsin Central Lines for St. Paul, Minneapolis, Ashland and Duluth leaves Chicago at 5:00 P.M. daily with Pullman Vestibuled Sleepers and the Central's famous dining-cars attached.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued February 2, 1892.

467,917. Telephone-Holder. James A. Christy, San Francisco, Cal., assignor of part to Bernard Schrafl and F. E. Wait, same place. Filed July 12, 1890. Renewed July 9, 1891.

A telephone-support consisting of a hollow standard, a rod having a vertical adjustment therein and easy rotation or circular movement at the several points of adjustment, and two bars or sections vertically hinged to each other and to the rod.

467,919. Electric Cut-Out. Albert L. Clough, Manchester, N. H. Filed Aug. 24, 1891.

The combination, with an electro-magnet, an armature of said magnet, and movable contact-pieces severally in suitable electric connection, of a track held on and movable with said armature, a traveller to traverse said track, a movable detent to hold said contact-pieces in and to allow them to move out of contact, and a carrier for said detent.

467,924. Electric Motor. John W. Darley, Jr., Baltimore, Md. Filed May 24, 1890.

In a regulator for electric motors, the combination, with the armature-shaft, of a loose collar mounted thereon, a centrifugal governor revolving with said shaft and connected to said loose collar and moving the same along the axis of said shaft, a lever connected at one end to said loose collar and having a fixed pivot attached to one of the bearings of the armature-shaft, a horizontal rod hinged at the other end of said lever, a contact-roller beneath said horizontal rod, contact-plates beneath said horizontal roller, auxiliary resistance-coils connected to said contact-plates, and a spring connecting said horizontal rod with said lever and pressing said contact-roller on said contact-plates.

467,942. Insulator. Charles T. Lee, Boston, Mass., assignor of one-half to the Gould & Watson Company, same place. Filed Nov. 11, 1891.

An insulator comprising an outer case and a rod or stem placed within the said case and insulated therefrom by a series of sheets of mica and having that portion of the stem which projects beyond the mica in the case partially covered by a series of sheets of mica placed thereon.

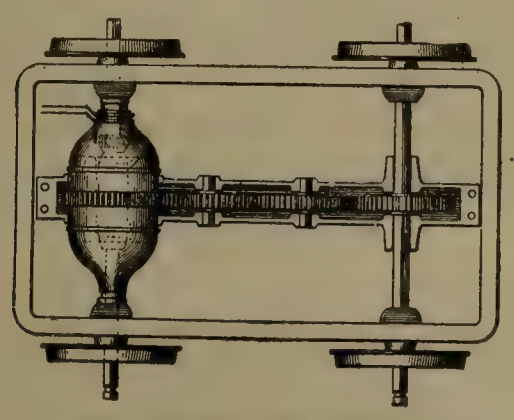
467,958. Incandescent-Lamp Socket. William L. Silvey, Lima, Ohio. Filed May 17, 1889.

467,969. Electric-Railway Motor. Henry M. Byllesby, St. Paul, Minn. Filed June 16, 1891.

The combination, with the armature mounted upon one of the car-axles, of the rotatable field-magnets concentric with said armature, the gears carried by said field-magnets, and gears connecting it with the other car-axle.

467,982. Incandescent Electric Lamp. David H. Piffard, Piffard, N. Y. Filed May 26, 1891.

The combination, with an electric lamp and supply-conductors connected to the lamp-wires of a solid homogeneous sheath or envelope of an adherent non-conducting moisture-proof cement cast around said lamp-wires and conductors and adapted to form a tight moisture-proof joint both with the glass of the lamp and the said conductors to adhere to



467,969.—ELECTRIC-RAILWAY MOTOR.

the glass and to the conductors and to remain solid under the temperatures to which it is exposed while the lamp is in use.

467,983. Incandescent-Lamp Socket. David H. Piffard, Piffard, N. Y. Filed June 25, 1891.

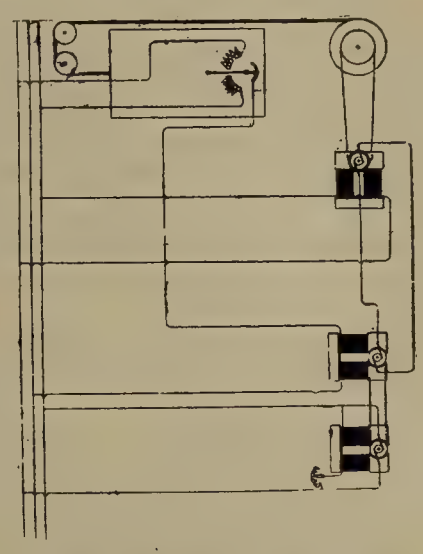
467,985. Electric Signal for Mine-Shafts. Frederick W. Bacorn, Marysville, Mont. Filed July 28, 1891.

The combination, with a mine-shaft provided with an electric conductor extending through its length, electrically open at its lower end and connected at its upper end to signalling mechanism, of a cage provided with a hoisting-rope capable of conducting an electric current, connected at its upper end to said signalling mechanism, a trolley from said cage on said electric conductor, a push-button within said cage, and connections to said trolley and hoisting-rope.

467,990. Railway Time-Signal. Eugene Fontaine, Auburndale, Ohio, assignor to the Fontaine Safety Signal Company, Detroit, Mich. Filed Nov. 28, 1890.

In a railway time-signal, the combination, with a primary actuating device operated by a passing train, of transmitting mechanism comprising a clock-work with dial indication and a positive mechanical connection between the winding-shaft of said clock mechanism and the primary actuating device and between the said winding-shaft and the indicating-hand on the dial for winding the clock mechanism and setting the indicating-hand by the direct transmission of the initial impulse from a passing train.

468,020. Electrical Measuring Instrument and Current-Direction Indicator. James J. Wood, Fort Wayne, Ind. Filed Nov. 3, 1891.



468,100.—ELECTRIC ELEVATOR.

A current-direction indicator consisting of the combination of an electro-magnet traversed by the current, a permanent magnet pivoted within the inductive influence of the electro-magnet and having a normal tendency to assume a position transverse to the lines of force of the electro-magnet, and a tell-tale connected to and operated by said permanent magnet, whereby it moves to one side when the current passes in one direction and to the opposite side when it passes in the other direction.

468,053. Insulating-Swivel. Alex. H. Englund, Chicago, Ill. Filed Oct. 12, 1891.

An insulating-swivel comprising a metallic bolt having a body provided with an enlarged head, a covering of insulating material surrounding said body and head, and a metallic shackle with a strain-collar having an aperture of less diameter than the head of the bolt.

468,099. System of Electrical Distribution. Harry W. Leonard, New York, N. Y. Filed May 12, 1891.

The combination of a three-wire distribution system extending over a large area and having continuous-current generators at a central station, means for disconnecting a section of the system from or connecting it to the rest of the system, converters adjacent to said section, means for connecting the secondaries thereof to the mains of the disconnected section of the three-wire system, a circuit through said converters to the central station, and a suitable generator connected to said circuit.

468,100. Electric Elevator. Harry W. Leonard, New York, N. Y. Filed Aug. 31, 1891.

The combination of an electro-dynamic motor and a dynamo-electric generator having their armatures electrically connected together and both having separately-excited field-magnets, means for varying the strength of the field-magnet of the generator, and means for reversing the field-magnet of the generator.

468,101. Cut-Out. John B. Murphy, Cincinnati, Ohio; Mary J. Murphy administratix of said John B. Murphy, deceased. Filed June 14, 1890.

468,107. Electric Signal System. Howard F. Eaton, Quincy, Mass. Filed March 16, 1891.

In an electric signal system, a series of signal-boxes and a signal-receiving instrument and a main electric-circuit connecting them, ground branch wires at the boxes and switches for closing them at will, a ground branch wire at the receiving-station, and two normally-open switches for said branch wire, one of which is controlled by a motor mechanism and the other by an electro-magnetic device governed by the main circuit.

468,119. Electric Switch. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 14, 1890.

The combination of the switch-contacts with a series of three or more conductors of different resistances brought into or cut out of circuit serially by the switch when opening or closing the circuit in the order of their respective conductivities.

468,120. Method of and Means for Interrupting Electric Currents. Elihu Thomson, Swampscott, Mass. Filed Sept. 1, 1890.

The method of avoiding arcs upon the interruption of electric currents of considerable potential, which consists in causing a rapid movement of the discharge-terminals relatively to one another at the interrupted point, such that the said movement does not alter the distance between the terminals.

468,121. Dynamo-Electric Machine. Elihu Thomson, Swampscott, Mass. Filed Oct. 16, 1890.

The combination, in a dynamo-electric generator or motor, of a revoluble magnetic core having a number of polar extensions of like polarity and the stationary exciting coil or coils surrounding the core, with an exterior magnet structure made in sections fitted together end to end and presenting poles of opposite polarity to the revolving magnet-poles, generator-coils surrounding said fixed poles and attached to the different sections, respectively, and means for removing and replacing the sections with their coils individually.

468,122. System of Electrical Distribution. Elihu Thomson, Swampscott, Mass. Filed March 11, 1891.

The combination, in a multiple-series distribution system, of an equalizer coupled mechanically with the main generator and means for automatically shifting the equalizer from one side of the system to another to maintain the balance.

468,123. System of Electrical Distribution. Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass. Filed March 19, 1891.

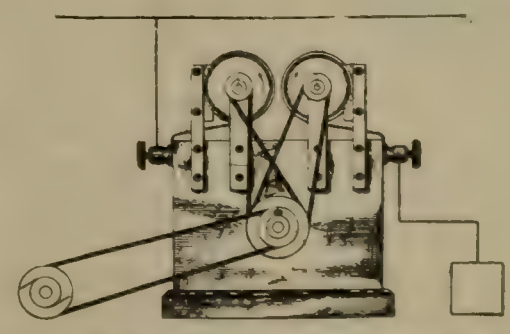
The combination, with a multiple-series distribution system, of an equalizer connected to the intermediate conductor and reconverting the excess of energy into an electromotive-force-feeding current to the outer mains.

468,125. Electric Switch. Augustus Wright, Providence, R. I. Filed July 31, 1891.

In an electric switch having binding-posts and spring contact-plates, the combination, with a lever journalled on a bracket and carrying connecting plates insulated from one another and having an extension-arm in a line with said lever, of a link pivotally secured to said extension and to a spring-operated sliding block movable in a slide.

468,128. Electric-Motor Regulation. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed June 5, 1889.

In an electric motor, the combination of a sectional field-magnet coil, a switch cutting said sections into or out of circuit, and a resistance connected in circuit between the terminals of said coil-sections and cut in upon shifting the switch.



468,120.—METHOD OF AND MEANS FOR INTERRUPTING ELECTRIC CURRENTS.

468,163. Electric Railway. Malone Wheless, Nashville, Tenn. Filed Dec. 1, 1891.

A prime conductor or power-line, a resistance-line, a working conductor, a positive wire, and a negative wire, all three in sections insulated from one another, the sections of the negative wire grounded, the sections of the positive wire connected to the resistance-line by feeders in which are electro-magnets, and the sections of the working conductor connected with the power-line by feeder-wires, parts of which are the armatures of the said electro-magnets, in combination with a car furnished with a trolley in electrical contact with the working conductor, positive and negative wires, and also provided with a motor, and a switch-line connected with such trolley.

468,164. Electric Railway. Malone Wheless, Nashville, Tenn. Filed Dec. 1, 1891.

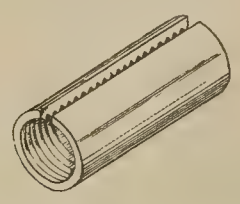
PATENTS—Continued.

468,165. Electric Railway. Malone Wheless, Nashville, Tenn. Filed Dec. 1, 1891.

468,166. Conduit Electric Trolley. Malone Wheless, Nashville, Tenn. Filed Dec. 1, 1891.

The combination of three lines of wire, each line being in sections insulated from one another, and two of such lines being parts of the same circuit, with a trolley having three pairs of wheels, one pair for each line of wire, and the two pairs which are for the lines of wire in the same circuit being insulated from each other.

468,170. Electrical Annunciator. William Ebert, Chicago, Ill. Filed May 20, 1891.



468,293.—CONNECTOR FOR ELECTRIC WIRES.

468,176. Car Construction. Henry C. Hodges, Detroit, Mich. Filed Aug. 28, 1891.

A car-frame or other similar structure composed of compound floor-sills tied together by plates passing between the members of the compound middle sills and fastened to the side sills and trussed by cross truss-plates fastened to the side sills and passing under and supporting the middle sills, said compound middle sills being composed of upper and lower members formed of angle or channel iron and made with opposing flanges.

468,186. Electric-Light Tower. Carlton A. Beardsley, Detroit, Mich. Filed Sept. 13, 1890.

The combination of a truss-tower having prismatic sides, two supporting-posts placed at opposite angles of said tower, and elastic cushions interposed between the supporting-posts and the supported corner-posts of the said truss-tower.

468,246. Telephone-Receiver. Elwood A. Grissinger, Mechanicsburg, Pa. Filed May 29, 1891.

In a receiver for electric telephones, a permanent magnet having an interior sound-conveying surface of conical form throughout.

468,253. Electric Elevator. Albert Neuburger, Kansas City, Mo. Filed July 31, 1891.

In an electric elevator, the combination, with a main line embracing the bare-metal conductors in a hoistway, a car, and suitable hoisting mechanism, of a motor-circuit, travelling contacts on the car, which normally bear on the bare-metal conductors, and a reversing-switch mechanism arranged to open and close the main line and motor-circuit and embracing a series of movable contacts arranged to successively close different branches of a divided circuit, in which are included different resistances of a rheostat.

468,260. Regulator for Electric-Current Generators. Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed June 22, 1889.

The combination, with an electric-current generator, a separate exciting-dynamo, and a resistance included in a shunt around the field-magnets of the exciter, of a regulator combined with the shaft of the generator and constructed and adapted to be actuated by the varying load on the generator and automatically vary the resistance in the shunt-circuit of the exciter.

468,281. Cut-Off for Telephones. Edwin Cann, Winnipeg, Canada. Filed Oct. 3, 1890.

468,282. Street-Railway Tunnel and Method of Constructing the Same. Theodore G. Gribble, Yonkers, N. Y. Filed Jan. 22, 1891.

Method of constructing subways or tunnels, which consists, first, in laying upon the surface of the ground under which the tunnel is to run a floor or roof having itself sufficient strength and bearing-surface upon the soil to permit side walls or supports to be built from underneath without temporary underpinning; second, building up supporting-walls from underneath such roof or sides thereof; and, third, excavating the soil under the roof and between the supports, so as to form the finished tunnel.

468,293. Connector for Electric Wires. Clyde J. Coleman, Chicago, Ill., assignor of one-half to Albert F. Wineman, same place. Filed June 15, 1891.

A coupling or connector for electric wires or conductors, comprising an open-sided sleeve having on its inner periphery a series of circularly-arranged inwardly-projecting teeth that are adapted when the sleeve is compressed to embed themselves into the surface of the wire ends and form both a strong mechanical and perfect electrical connection.

468,314. Conduit for Electric or Cable Roads. Clarence H. Bates, Minneapolis, Minn. Filed Jan. 26, 1891.

The combination, with a suitable conduit adapted to contain a cable or an electric conductor and provided with a longitudinal slot or opening adapted to permit a grip or trolley arm to enter the conduit and engage said cable or electric conductor, of a flexible closing-strip and yielding supporting devices arranged to hold said strip in said slot and permitting it to be moved downward and out of the slot and into the conduit as the grip or trolley arm passes along the slot.

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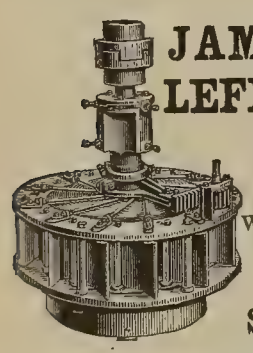
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PROBABLY A MISTAKE.

It is reported that the representatives of the German electrical firm of Siemens & Halske, who came to this country to arrange for space for the exhibit of that concern at the World's Fair, have turned their back on Chicago in disgust, and returned home. The report states that they were not satisfied with the treatment and the reception they received. We hope that there is no foundation for this report. We cannot afford to let such an impression of America and her people, particularly of the electrical fraternity, get abroad, especially at a time when we want all nations to come and see our big show.

THE NIAGARA TUNNEL.

During the Buffalo Convention of the National Electric Light Association many of the members will no doubt take the opportunity to make a trip to Niagara Falls, for the purpose of seeing what progress is being made in the work of constructing the tunnel.

This tunnel, which will, when the work is completed, supply a large water-power, is of much interest to electricians, for the reason that it is proposed to use some of this power for the purpose of operating electric-generating apparatus, the current from which is to be delivered at distant points for power purposes.

It makes the mouth of every electrical engineer water when he considers the vast amount of power that is wasted at this particular locality. In it he sees practical and unfailing constancy, and some day, when there is less sentimentality and more practical regard for the things that nature has so bountifully bestowed, we may see almost every unit of Niagara's power transformed into some sort of work. We hope, however, that the work of disfigurement, and detraction from the natural beauties of this sublime waterfall will be deferred "as long as the coal holds out."

ELECTRICAL EXECUTIONS.

The "gag" feature of the electrical execution law having been removed, the question, "Is the electrical method of executing the death sentence on criminals a success or a failure?" still remains unanswered, judging from the results in the case of McElvaine, at Sing Sing, week before last.

Governor Flower, with commendable forethought, hastened to act upon the suggestions made by the ELECTRICAL AGE, towards the close of last year, in regard to the electrical execution law, but did not go far enough. The removal of secrecy in connection with such executions was desirable, and more in accordance with our form of government, but the question above quoted has yet to be answered.

If a board of experts could be appointed for the purpose of determining this important question, its report should have the effect of settling the matter one way or the other. As matters stand now the public gets two contradictory reports of an electrical execution; one party says it is a barbarous way of depriving a human being of life, while the other insists that it is the most humane method of all. The difference of views as expressed in public may be accounted for on the supposition that influences of some nature are the cause therefor. The public cannot, and never will be able to feel settled on the question when the witnesses of such executions give out totally different reports. The only way to get as near as possible to a settlement of the question is for the legislature to grant the authority for the appointment of an examining board of unbiased and fair-minded citizens, who shall be well-known, and expert in electrical and medical science, and let them determine, as far as possible, whether the method is a failure or not. We do not claim that such a board would be omniscient, but its findings, no doubt, would have the effect of settling public opinion one way or the other, according to their report.

So long as the public must depend upon the reports of witnesses incompetent to judge whether electrical executions are a success or a failure so long will the uncertainty exist.

DIRECT-CURRENT TRANSFORMER.

The apparatus known as the "Transformer" is so closely related to alternating-current systems that the use of the word has, to a great extent, been limited in its application to such systems. In its broader sense, however, it means the transformation of an electric current from one potential to another, without reference to the character of the current, direct or alternating. But in practice the alternating-current transformer is better known, and when we speak of a direct-current transformer, the word "transformer" is naturally associated with the alternating current, and the question is often asked, "How can a direct current be transformed?"

If we run an electric motor with a 110-volt current, and it, in turn, runs a dynamo which generates a current of 50 volts, it would be quite proper to say that the original current is transformed from a higher to a lower potential, but it would hardly be correct to call the two machines a "transformer." The idea of a transformer is that it is one piece of apparatus, and not a system, and the nearest approach to this in the transformation of direct currents is the coupling of the armatures of the motor and dynamo on one shaft, the field-magnets of each machine being in close proximity.

A much simpler piece of apparatus, however, for the transformation of direct currents, is described and illustrated on the page following this.

In this machine one field-magnet is used, but the armature has two separate and distinct windings, each with its own commutator. The machine, therefore, has two commutators, and it is obvious that by running a current from any source of electricity through one set of windings in the armature the machine will run as a motor, at the same time generating a current in the other system of windings, as in a dynamo. The ratio of transformation, of course, depends upon the armature windings and other well-known conditions, and it is a matter of easy calculation to determine the proper amount of wire to be used for the transformation of a direct current at a given ratio.

This combination possesses the feature of novelty as well as great utility, and there would seem to be no end to its application. It will, no doubt, find very many uses.

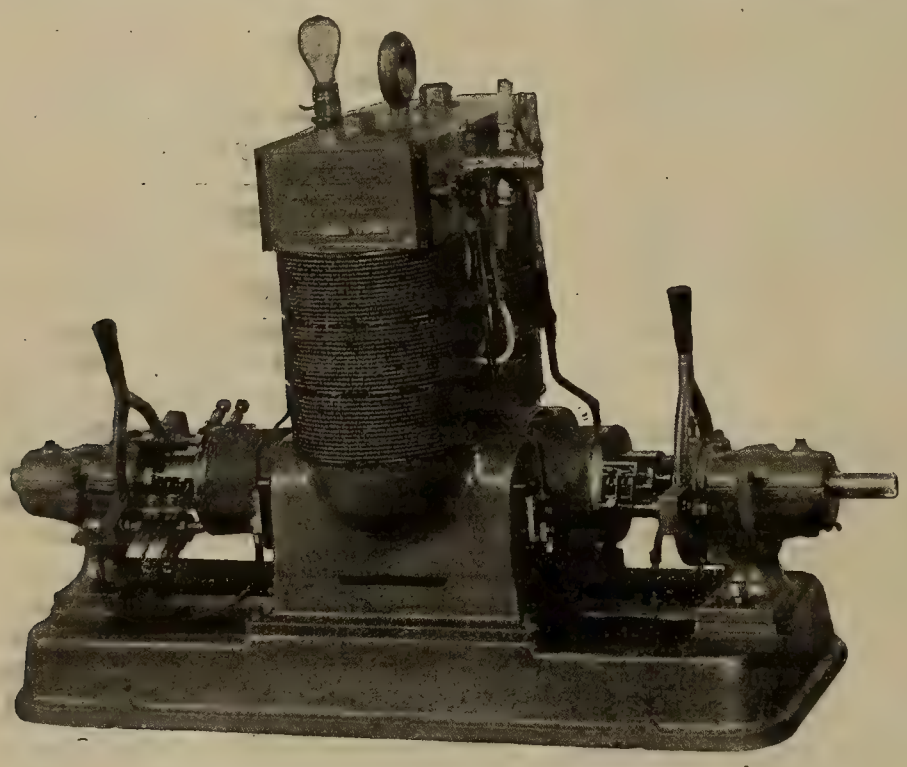
NEW EDISON TRANSFORMERS.*

In the present condition of electrical science and practical progress, each succeeding week is marked by the advent of new appliances destined to attain some advantageous end, *i.e.*, the economizing of time and expense, or the subjection of electricity to new and hitherto unconceived uses. This week we have to chronicle the genesis of a new Edison continuous-current transformer or motor-generator, of especial interest to practical electrical men, on account of the novel features which it presents. This machine has been designed for special use on street-railway circuits, and is employed to convert the current from 500 volts on the motor to 125 volts on the dynamo, thus furnishing a current of low tension for either lighting or power.

The motor-generator is, in reality, a combination of two machines in one. As its name implies, it is both a motor and a generator. The armature is so wound that it has two distinct windings, and each end is furnished with its commutator, rocker-arm and brush-holders.

The cut shows the appearance and arrangement of one of these transformers, viz.: That of 6 kilowatt capacity; the dimensions being those of the Standard Edison 12 K. W. generator, with the exception of the length of the bed-plate and pole-pieces. The head-board at the the motor end of the machine is provided with a double-pole switch, that at the generator end being furnished with a single-pole switch.

The great advantages which such a machine as this presents can hardly be estimated from a mere cursory examination. Its economical mission is that which will most strongly appeal to users of electric



EDISON DIRECT-CURRENT TRANSFORMER.

light and power. For instance, lighting is to be accomplished at a distance from the source of power, as is the case in hilly districts. Here a turbine and generator, evolving current of high potentiality, can be placed near a waterfall, to supply electricity to lamps in premises some miles away. In the place of a receiving motor for the high-potential current belted to a separate generator, one of these transformers can be employed to take the place of the two machines, and the saving effected is obvious.

Another instance may be given. A street-railway station, in which the machines are generating current at 500 volts, finds it possible to utilize a portion of this current for incandescent lighting purposes. Instead of a subsidiary motor belted to a dynamo wound for 125 volts, or a separate engine and generator, wires are led from the 500-volt machine to the motor-generator, and current of the necessary tension for incandescent lamps is produced.

The uses of these machines, however, are not confined to the conversion of high-potential current to low-tension current alone, the obverse also holds good—low-tension current can be supplied to it, and high-tension current developed, proportions always holding.

They are manufactured in various sizes and for various voltages—the highest being as high as 1,200 volts in primary circuit.

The Hancock Light and Power Company, Findlay, Ohio, was incorporated January 26, with a capital stock of $25,000. Incorporators: Charles F. Smith, James A. Bope, William C. Neibling, Vincent H. Coons and Linden R. Clark.

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* Edison General Electric Company.

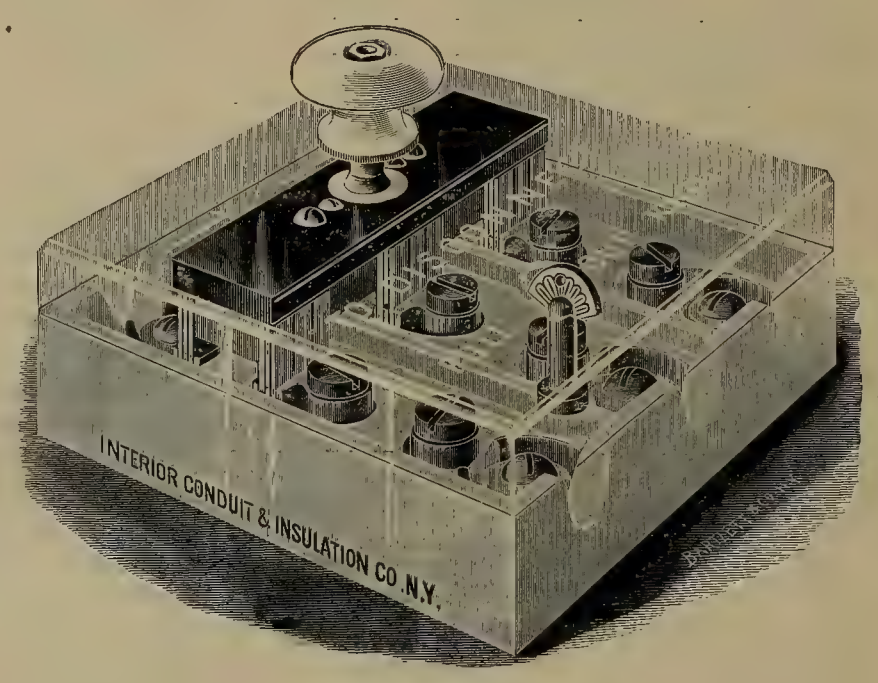
COMBINED PLUG SWITCH AND MAIN LINE CUT-OUT.

Electrical switches for breaking currents of both large and small volumes may be divided into two classes. 1st. Those that are required for constant use. 2d. Those that are but seldom called upon to perform the service for which they are designed. The key socket is a familiar illustration of the former, and the huge feeder switch of the latter class. To the first class many new designs are contributed from time to time, but to the latter, the use being to a certain degree limited, but few are well enough known to demand recognition. The device illustrated herewith, is a switch of the second class, and is known as the V. V. Service Cut-out, the invention of Mr. J. H. Van Vleck, the electrician and chief engineer of the Edison Electric Illuminating Co., of New York, for whose special requirements the switch was originally designed.

The fire underwriters in the principal cities require the placing of a switch and cut-out in the main line of every circuit entering a building, which can be readily disconnected by the firemen in case of necessity, and when so disconnected, insures the certainty that the current is absolutely shut off.

This switch, combining in a compact form within itself a switch and cut-out, has filled this requirement to the entire satisfaction of the New York Edison and other well-known illuminating companies.

In this device the extra cost of the switch arrangement is but a small additional expense over the necessary safety cut-out, so that the combination fills a gap between the conditions where the expense of a regular snap switch and cut-out would be unwarranted, and where a cut-out without a switch would be insufficient.



PLUG AND MAIN LINE CUT-OUT.

The switch is constructed wholly of fire-proof material, its base and cover being of the best quality of porcelain. It is made for the two and three wire systems of the plan illustrated, from which it will be seen that one-half of the device embodies the ordinary safety cut-out principle for holding the safety fuses, while in the other half there is a novel form of quick acting snap switch.

The connections are of bronze of ample capacity, with strong screws for the binding posts. The contacts made by means of the plug are admirably fitted, and when the plug is withdrawn to open the circuit, the movement is accelerated by means of a strong spring which is contained in the plug itself, insuring a rapid and complete break with a sharp snap action. The only exposed portion of the plug is finished hard rubber, the whole presenting a neat and attractive appearance.

The use of this appliance is however by no means limited to the above particular purpose, but is offered by the Interior Conduit and Insulation Company, of New York, for general use as the best and cheapest three-wire main line cut-out and switch in the market for general wiring.

FIRE IN WIRE MILLS.

John A. Roebling's Sons' braiding shop at Trenton, N. J., was consumed by fire on the night of February 4. Loss $300,000, covered by $140,000 insurance. The fire was caused by an explosion of chemicals which were stored in a vault, and is the second disaster of this description from which the firm has suffered during the past year.

EXPERT VIEWS ON ELECTRIC RAILROADS.

Mr. O. T. Crosby, General Manager of the Railway Department of the Thomson-Houston Electric Company, was interviewed a few days ago by a representative of a daily paper, on electric railways in general. Touching the Brooklyn trolley matter, Mr. Crosby said:

"On the whole, I am heartily gratified at the outcome, for after protracted discussion the decision is emphatically in favor of the trolley. Its introduction was bitterly opposed, as has been the case in other cities, not by the great mass of the people, to whom a half hour saved by rapid transit means more home life, more happiness and health, but by those who do not habitually use street cars. The attack on the electric railway is undemocratic to the core. The trolley system is not the only method of electric traction, but it is the only one which operates successfully and in which level-headed business men have found cause for enough confidence to back it with their dollars. The storage battery has friends among electrical enthusiasts, but three years of trial right here in New York have ended in the withdrawal of every car, and that in spite of the fact that they were continually under expert care and supervision. The storage battery of to-day is unable to endure the severe conditions imposed by every-day street-railway service, and nearly two tons of batteries must be continually dragged around on each car."

Regarding the storage-battery system, Mr. Crosby expressed himself as follows:

"A great many thousand dollars were spent in Boston in trying to operate a conduit road, and the result was total failure. It was costly to install and well-nigh impossible to operate. The main difficulty is that in our Northern climate it seems to be impracticable to keep a slotted conduit free from water, mud and slush. These reach the bare conductors that furnish the current, 'short circuit' them, and your line is crippled. Only in better climatic conditions or by the help of considerable improvements can success be secured."

On being asked if the use of the trolley involved serious risk to human life, Mr. Crosby replied emphatically, "No."

"When electricians," he continued, "put the electric pressure on street-railway circuits at 500 volts, they knew just what they were about and had the safety of the public in view. The history of the service has proved the wisdom of their action. The trolley has never caused the death or serious injury of a single human being, in spite of all the hue and cry against it. Every statement to the contrary has upon careful investigation been found to be untrue. I have investigated numerous reports of accidents, and they have, without exception, proved to be either gross exaggerations or baseless rumors. Hundreds of electric railroad employés have received shocks from the full pressure of the trolley wire in working about the power-stations and car-houses without result more dangerous than a scare and trifling burns. The pressure on the trolley wire is automatically kept constant. I have personally received shocks from the full pressure of a trolley wire, and know from experience that the effects are not serious. The only legitimate objections to the trolley system are æsthetic ones, and with our new noiseless motors and the improved and less obtrusive methods of overhead construction even these are of little moment."

WHAT IS THE BACK STROKE?

BY THOMAS R. TALTAVALL.

A young telegraph operator once dropped in at the telegraph office of a railroad station to see a brother operator, when his attention was attracted by the clicking of a certain instrument in the office. To him it sounded like a foreign language, the sounds were so mixed and unintelligible. He asked the railroad operator if it was a different alphabet to the Morse that was used on that wire. He explained to the railroad man, as best he could, how the instrument sounded to his ear. The railroad operator at once said, "I guess you get the back stroke."

What is the "back stroke?"

Telegraph sounders are so constructed that the end of the armature lever opposite that at which it is pivoted, plays between two limiting points, or screws. These screws are used for the purpose of varying the play of the lever to suit individual tastes. Two movements of the lever are necessary to form a dot or a dash —one down and the other up. When the lever is drawn down by the attractive force of the magnet, and is allowed to immediately return to its original position by the pulling force of the retractable spring the dot is formed. The motion of the lever corresponds exactly with that of the transmitting key, and in the act of making a dot on the key, the key must be closed and opened immediately. The mere downward pressure of the key does not constitute a dot, as many suppose; it is necessary to allow the key lever to return to its original position again before the dot is completed.

The same applies to the dash, except that it is necessary to maintain a longer contact at the key points—the distinction between the dot and the dash being merely one of duration. In the formation of the dot therefore the sounder lever starts from its position of rest, which is against the upper limiting screw, and strikes the lower point first, then it flies back to the starting point, and the dot is completed.

In the practical sounder, the noise produced by the lever striking against the lower point is *less* than that produced by striking against the upper point—in other words the upper stroke is louder than the lower one. In learning to read by sound the operator naturally and unconsciously learns to distinguish this difference of sound and becomes accustomed to it. Many operators, however, in practical work, alter the adjustment of the sounder to suit their own peculiar fancy, and this sometimes results in rendering the up and down strokes nearly alike, as far as their relative noises are concerned. Indeed, some operators go to extremes, and prefer to have a lighter up than down stroke. The result of this disturbance of the proper relations of the sounds of the two strokes is, that when another operator suddenly comes within hearing distance of the sounder so altered, while it is in operation, his trained ear naturally selects the lighter stroke as being the first component part of each dot and dash. In the case, however, of the sounder altered in the manner just referred to, the lighter stroke coming at the wrong end of the character has practically the effect of reversing the signals, and they become unintelligible to him because his ear commenced to read at the wrong end of the character. This is what is known as the "back stroke"; it is simply the reversing of the relative intensity of the two sounds produced by one complete movement of the sounder lever.

The "back stroke" is very annoying to operators, and acts upon the ear much the same as a musical discord does to the ear of the trained musician. It might also be likened to a photograph negative. In the negative the lights and shades are reversed, that is, the shades are light and the lights are dark. The "back stroke" represents the same idea as affecting the ear.

The accompanying illustration gives a graphic representation of the relations between the two sounds. The upper line represents the regular Morse characters for the letters A, B, C, D, E, and F, and the lower line represents the effect of the "back stroke" of the same letters. It will be noticed that the spaces dividing the regular characters, become characters themselves in the "back stroke," and the result is inharmony and an unintelligible combination of sounds.

The remedy for "back stroke" is a simple one; all that is necessary is to stop the operation of the sounder and let it start again. As soon as the ear catches the two sounds in their proper order the trouble at once disappears.



DIAGRAM SHOWING MORSE CHARACTERS AND THE COMBINATIONS RESULTING FROM THE BACK STROKE OF THE SAME.

IMPROVED SWITCHES.

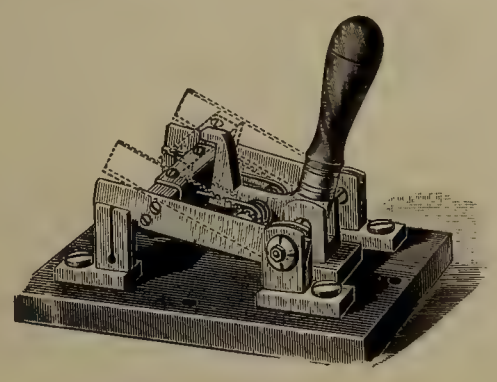
There are a number of good, quick, break switches, but a real good, quick, break switch should be cheap, reliable, positive and indestructible. None of the switches at present on the market can claim all these features. The single, double and three-pole quick break switches brought out by The Baehr Electric Manufacturing Company, of 110 Livingston street, Brooklyn, N. Y., are said to possess all these desirable features.

These switches have been adopted by the Edison Electric Illuminating Co., of Brooklyn.; The Elektron Manufacturing Company, of Springfield, Mass. and several other large concerns; and large orders have been placed for the same.

In these switches a greater throw of the blades upon leaving the spring clips is obtained; not only one flat steel spring but two spiral springs are used, as will be seen from the cut. The straight ends of these springs pass through a brass plate into the fibre yoke, which connects the two blades. These springs act upon this brass plate, which is bent at right angles and covers the top and one side of that yoke, thus taking all strain off the fibre; in fact, the manufacturers do not in any way depend on the strength of the fibre. It only serves to insulate the metal lifting arm from the brass plate. This lifting arm is so wide underneath that it lifts almost directly under each blade and not only in the middle of the connecting yoke, thus preventing wabbling, should one blade stick a little more than the other.

The blades are screwed on the fibre yoke in such a way that it is impossible for them to work loose.

The working parts of these switches carry no current. The switches are built to break any number of volts and ampères. All the metal parts are polished and lacquered and mounted on a slate base,



IMPROVED SWITCH.

which is soaked in linseed oil, to make it impervious to moisture. Unusually good workmanship distinguishes these switches throughout.

The accompanying cut represents a 100 ampére switch.

The makers of this switch also build ⅛ and ¼ H. P. motors and motor dynamos, which are remarkable in their performance and cheapness. Their dead beat ampère meter is especially adapted for isolated plants, etc.

ANNUAL DINNER OF WESTERN UNION OFFICIALS.

The officials of the Western Union Telegraph Company held their annual dinner at the Holland House, New York, on the evening of February 6. Dr. Norvin Green presided. At his right sat Vice-President and General Manager Thomas T. Eckert, and on the left Mr. Erastus Wiman. The executive, scientific and mechanical departments of the company were represented by their respective heads. After-dinner speeches were made by Dr. Green, Charles A. Tinker, W. C. Humstone, Thomas F. Clark, R. H. Rochester, Col. R. C. Clowry, W. J. Dealy, Erastus Wiman, Col. Anderson, Mr. Bailey, Mr. Wise, Gen. Wager Swayne, W. B. Gill and Rush Taggart.

The speech which was of greatest general interest was that delivered by Col. R. C. Clowry, Vice President and General Superintendent of the company, who has his headquarters at Chicago, and who is one of the directors of the World's Fair. He gave many facts concerning the great Exposition, some of which we reproduce herewith.

"The World's Columbian Exposition" he said, "is located in what is known as Jackson Park, seven miles south of the centre of the city of Chicago, and covers 664 acres, having a water frontage of 1½ miles on Lake Michigan, and connecting with the city and the other large parks by a system of boulevards. The Exposition will be reached by steam, elevated and cable railroads, as well as by lake transportation. The grounds have been laid out under the general supervision of the well-known landscape architect, Mr. Frederick Law Olmsted, of Boston. There will be numerous small lakes or lagoons in the grounds, which are to be connected with Lake Michigan and navigated by boats propelled by steam and electricity, as well as gondolas, manned by experienced boatmen. It is estimated that the Exposition will be five times larger than the Paris Exposition of 1889."

Col. Clowry then referred to the various buildings, giving the area of each and the designers of the same. The Electricity Building, covering 5½ acres, was designed by Van Brunt & Howe, of Kansas City.

In referring to different architects, Col. Clowry said that the best architectural talent in the United States had been brought into requisition to furnish designs and plans for these buildings, so that the work could in no sense be considered local in character.

"The material used in the construction of the buildings," said Col. Clowry, "is iron, wood, and what is called "staff." This staff is composed mostly of plaster of Paris, acme cement and jute fibre, made into a paste with water, and thoroughly mixed up by hand. The fibre is very strong and holds the cement together, and when the mixture is completed it is moulded into square blocks, or ornamental pieces, as may be required. Most of this ornamental work has been completed for some time past, it having been decided best to finish it before the cold weather began, so that it would fully stand the test of the two winters before the Exposition opens. When placed in buildings this staff may be treated on the outside so as to represent any kind of stone, and it presents a beautiful appearance, as may be seen in some of the buildings which are now well under way.

"The estimated cost of the electric plant is $1,500,000. And this is the largest appropriation made for any department of the Exposition. The Electricity Building will be 345 feet wide by 700 feet long. It has been arranged to place the names of forty-one deceased electricians on the exterior frieze of this building. Directly in front of the main entrance will be a colossal statue of Franklin in the act of drawing the lightning from the clouds by means of a kite string. The different countries will be represented by the names of electricians on the frieze of the building as follows: America, 7; England, 15; Germany, 7; France, 6; Italy, 2; Spain, 1; Russia, 1; Denmark, 1; Greece, 1. After a very full consideration of the subject by the Electrical Committee, it was thought best not to place the names of living electricians on the frieze.

"The power plant of the Exposition will be located in a building adjoining Machinery Hall, and all generators operated by steam will be placed in this space. The distance from the power plant to the centre of the Electricity Building is 1,400 feet. Leading from this power plant to the Electricity and other large buildings will be an underground electric subway 1¼ miles long. The dimensions of this subway vary from 6 feet 6 inches square in the clear to 6 feet 9 inches wide by 4 feet 6 inches high. The electric conductors and cables will be placed on insulators attached to racks in the subway, a space being left in the centre wide enough for inspectors to pass through. The capacity of these subways is such as to amply provide for all the conductors for electric lighting, electric power service, telegraphic and telephonic service. There is to be an elevated electric railway almost encircling the Exposition, and just inside of the fence which surrounds the grounds. This railroad will be used for the transportation of passengers, and it is intended to attach to the structure several cables to be used as electric conductors in addition to those placed in the subway.

"In addition to the electric power to be used in the Electricity Building (which will probably be operated from a number of small generators installed as exhibits), about 2,500 horse-power will be distributed to other large buildings, all of which, with the exception of the Machinery Hall, will receive all of their power by electricity. The highest voltage to be used in connection with the service, unless by special arrangements to be made hereafter, has been placed at 3,000 volts for arc lighting. The transmission of power will be done generally at a pressure of 500 volts. The distribution within the building will be of low potential, not exceeding 250 volts. Nothing has been determined upon in reference to alternating currents for incandescent lighting, but in no case will such voltage be over 1,000.

"It is expected that the lakes and lagoons will be navigated by about fifty boats, propelled by steam and electricity. These boats will not be over thirty-five feet long and seven feet wide, and will carry from twenty-five to thirty passengers each.

"An elevated movable sidewalk is now being exhibited at the grounds, operated by electricity. Nothing has as yet been determined as to using these sidewalks for transportation after the Exposition is opened. The sidewalk platform is provided with seats, and moves at the rate of six miles an hour.

"It is intended to have a large electric fountain in front of the Administration Building. This fountain will be similar to the one shown in the Paris Exposition, and to the fountain permanently established in Lincoln Park, Chicago, but will probably be much larger than either. The water will be thrown up in numerous sprays of different heights, showing ever-changing colors produced by the effects of the electric light.

"The grounds and buildings will be lighted by 6,766 arc lamps of 2,000 candle-power each and 131,452 incandescent lamps of 16 candle-power each. It is estimated that the electric plant at the World's Columbian Exposition will be ten times larger than that employed at the Paris Exposition. The Art Building will be lighted exclusively by incandescent lamps, and the subject of outlining at night with incandescent lamps some of the architectural features of the prominent buildings is being considered. It is estimated that the light and motive plant at the Exposition will require 26,000 horse-power, of which 22,000 will be required for the electric plant.

"The Act of Congress requires that the Exposition buildings shall be dedicated with appropriate ceremonies on Oct. 12, 1892, being the 400th anniversary of the discovery of America by Columbus. It is expected that all the buildings will be fully completed on that date, and the finishing touches will be applied between that time and May 1, 1893, when the gates of the Exposition will be thrown open to the public."

PROJECTION BY MEANS OF THE ARC FOCUSING LAMP.

BY



In this Pictorial Age, when the busy people of our era must read as they run, graphic illustrations are being more and more used to tell to the hurrying passer-by the fact which either teacher, merchant or advertiser wishes to impress on the all-seeing and alert optics of the scurrying throng of soldiers in Life's battle.

The oil lamp was long since superseded by the oxy-hydrogen, calcium or Drummond light. The bulk of the required tanks to hold the gases, the occasional danger from explosion when manipulated by inexperienced hands, and the cost of maintaining, have all deterred the many from this use of the calcium light.

Many attempts have been made to devise some simpler and less expensive light for the purpose of projection; magnesium, zirconium and various like substances have been tried, and found wanting. These chemicals produce very brilliant but short-lived flashes of light, but they have all been discarded for purposes of projection, and are only used in this day of the kodak and gelatine plates for picture-making, when an illumination of only a few seconds is required.

Carburetted hydrogen, or illuminating gas, with improved Argand burners, has been used; indeed it was the only satisfactory method of getting a powerfully focused light for purposes of projection until the advent of the electric arc lamp.

The electric light possesses features which commend it above every other illuminant for this purpose.

1st. It is easier of manipulation.

2d. Gives a better definition of the slide, showing up beauties of detail entirely unperceived when any other illumination is employed.

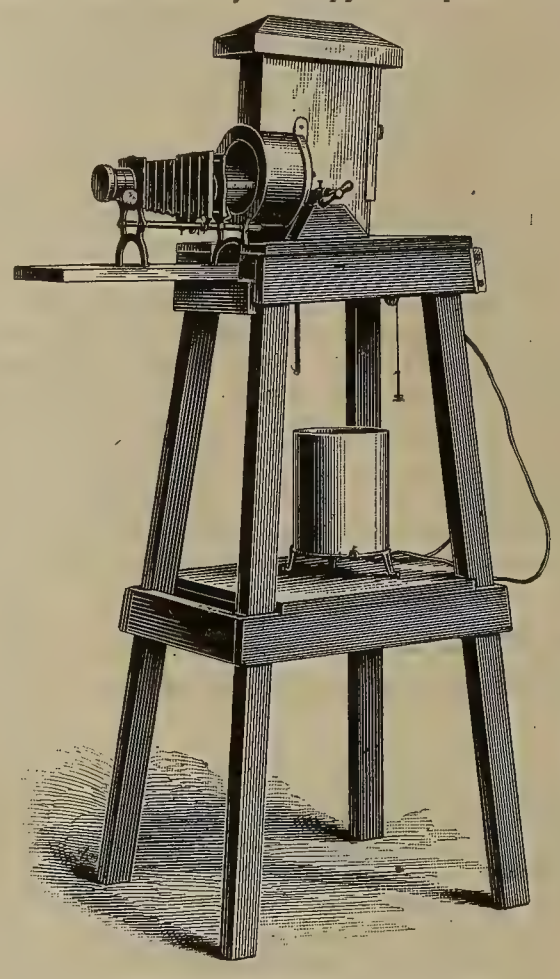
3d. An accuracy of focus is possible with the arc of an electric light which is absolutely impossible with oxy-hydrogen, zirconium, magnesium, gas or oil.

4th. The cost of electric light is, say, for 15 ampères or nominal 3,000 candle-power, only 30 cents per hour, or 90 cents for a 3-hour entertainment, as against $3.00 for a calcium or oxy-hydrogen light for the same period.

5th. The candle-power of a 15-ampère electric lamp is about 3,000 as against 900 candle-power for the calcium, and 1,000 to 1,200 for the best Argand gas-burner constructed for this purpose.

Prof. Landy, of the Columbia School of Mines was among the first to employ the electric arc lamp for the purposes of projection in the stereopticon.

But while the result was all that could be desired, he labored under the disadvantage of not having an automatic arc focusing lamp. In the lamps employed by him for this use only the upper or positive carbon was movable. The lower or negative being fixed, as in the ordinary commercial arc lamp. In order, therefore, to maintain a focus it was necessary to hand-feed the carbons when they were consumed below the axial line of the condensers.

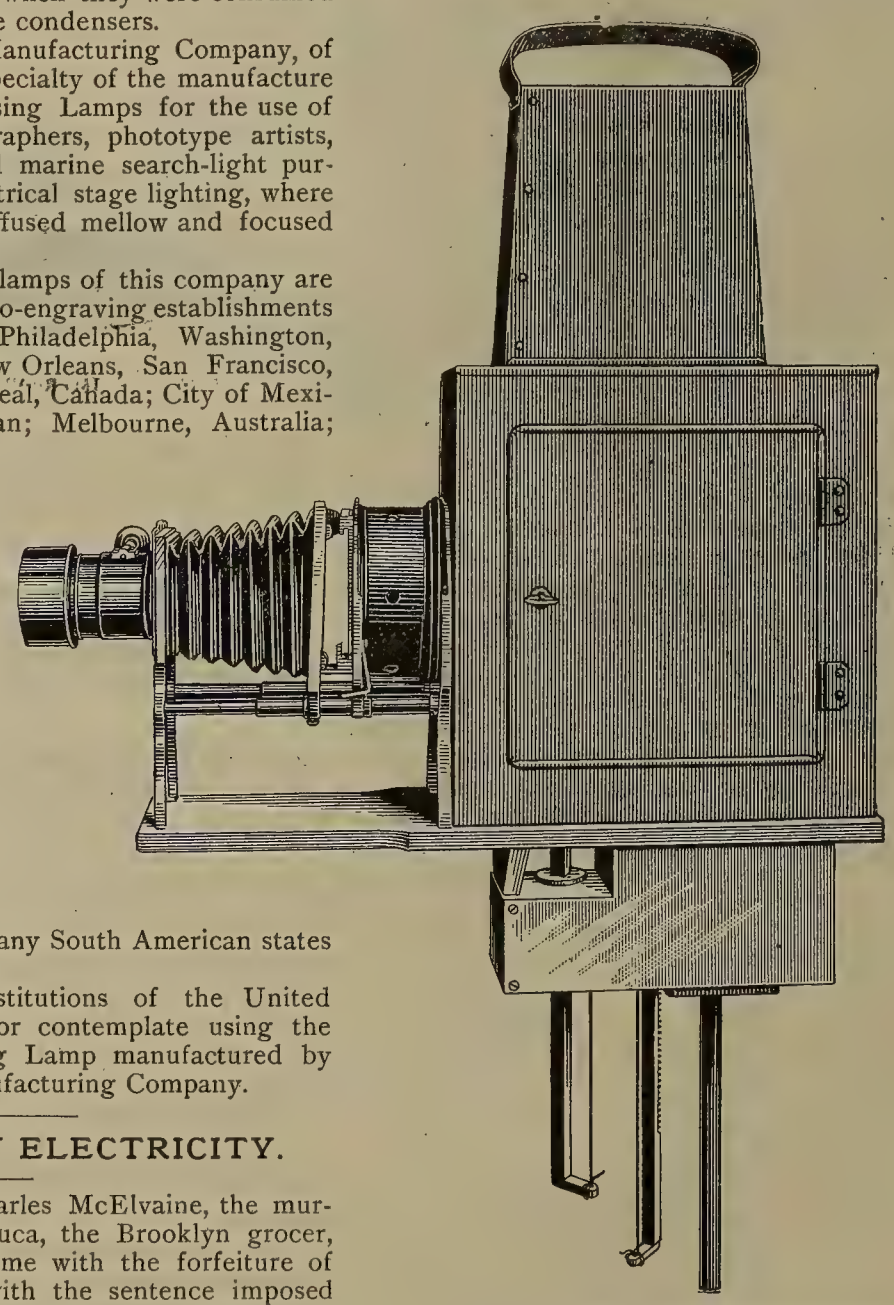


AUTOMATIC FOCUSING ARC LAMP.

The Scott Electrical Manufacturing Company, of New York, has made a specialty of the manufacture of Automatic Arc Focusing Lamps for the use of photo-engravers, photographers, phototype artists, and for stereopticon and marine search-light purposes, as well as for theatrical stage lighting, where a powerful and evenly diffused mellow and focused light is necessary.

Many of the focusing lamps of this company are used in the principal photo-engraving establishments of New York, Boston, Philadelphia, Washington, Chicago, St. Louis, New Orleans, San Francisco, Portland, Oregon; Montreal, Canada; City of Mexico, Mexico; Jeddo, Japan; Melbourne, Australia; London, England, and many South American states and other countries.

Many educational institutions of the United States are either using or contemplate using the Automatic Arc Focusing Lamp manufactured by the Scott Electrical Manufacturing Company.



AUTOMATIC FOCUSING ARC LAMP.

EXECUTED BY ELECTRICITY.

After many delays Charles McElvaine, the murderer of Christian W. Luca, the Brooklyn grocer, paid the penalty of his crime with the forfeiture of his life in accordance with the sentence imposed upon him at the time of his trial, on the morning of February 8, when he was executed by an electrical current at Sing Sing prison. This is the first execution under the new law about which the public have been allowed to obtain definite information. There seems to be a diversity of opinion among the witnesses as to the success of the execution. The eight reporters present were evenly divided for and against it. To quote Assemblyman Meyer J. Stein, "I do not know whether death was instantaneous or not. I only know it was horrible, and shall do all in my power to have the law repealed. The sight was cruel and unnatural, and it made me sick." The physicians in attendance also appear to be divided on the subject.

After the witnesses had been invited into the execution-room, Warden Brown made a short address, informing them that they had nothing whatever officially to do with the execution, and that any one who offered suggestions would be immediately ejected from the place. Dr. McDonald then said:

"In the killing of McElvaine a new method of applying the electricity will be tried. Contact will be made through the hands, which will be immersed in cells containing a solution of salt and water. This was suggested after the first execution in Auburn, but, for reasons, was not tried. Eminent electricians —Mr. Edison in particular—have publicly expressed their opinion that contact should be made through the hands, and the experiment will be made. We know how well the application of the currents to the other parts of the body and to the forehead, the seat of consciousness, works, and arrangements have been made by switches which will enable us, in case either application should fail, to use the other. Now I want to say to the physicians that it is desirable to have each physician present make a separate examination of the body, and when the current is all off each will step up in turn and express his opinion, if he has one to express, before the official announcement of death is made."

McElvaine was then brought into the room, his legs were pinioned to the chair, which was a new one and had been made smaller so as to prevent moving about as much as possible. One electrode was fastened tightly to the bared leg near the knee, and the leather harness containing the head electrode was fixed to the head. After all the details had been attended to, Dr. McDonald gave the signal, whereupon a current of 1,600 volts was sent through the condemned man's body. There was an almost imperceptible quiver, then the body shot up an inch, the lips parted, water oozing from the mouth. The current was then turned off and the body sank back, the lips slowly closing.

The general belief was that the man was dead, but unexpectedly peculiar sounds emanated from his throat, and a second shock was sent through the body by Dr. Ward, who, seizing a rubber tube hanging from a bag of water, pressed a stop which caused a stream of water to flow down into the head and leg electrodes, it having been arranged previously that it was to be done in this manner instead of through the hands should a second shock be necessary.

The current was again turned off, and after an examination the man pronounced dead.

GENERATING STATIONS AND THEIR PHYSICAL HAZARDS.

(*Continued from page* 80.)

In one or two instances adjusters have been imposed upon and underwriters have been grossly swindled by misrepresentations regarding the fire or water damage sustained by dynamos, and before settling a loss on a dynamo which is not irreparably injured, it is frequently better to secure the report of a disinterested expert upon its condition. If a dynamo is burned, and yet retains its original shape—that is, if the field-magnets or frame have not become cracked or warped or tempered by heat or sudden cooling—then it is safe to say that the only portion which may have sustained serious injury by fire will be the winding, possibly only the few outside layers. Armatures are more susceptible to injury by fire, but they can frequently be rewound and made thoroughly serviceable at a cost varying from 25 to 40 per cent. of the original value of the machine. It should be borne in mind, however, that these figures are by no means absolute, as it is quite impossible to establish a universal rule regarding the destructibility of dynamos. Dynamos, or armatures, "burn out" from short circuits, defective construction or careless or ignorant handling, and these accidents are attributable to conditions which should not exist, and under which the machine is not supposed to run. The rule exempting fire underwriters from losses on dynamos occasioned by fire within themselves is, I think, well taken.

From the dynamo, leads or wires are taken to the switchboard, a very essential contrivance designed to facilitate the throwing of different outside circuits upon different machines, and to group different machines or circuits together in every advantageous manner. The switchboard also contains all such cut-outs and switches as are necessary for safety, or to control all circuits and apparatus, and also many of the station instruments, such as the lightning-arrester, for protecting the apparatus from lightning; the ground-detector, for notifying the attendant whenever a ground comes on the circuit; also ammeters for measuring the current strength or ampèrage of each machine or circuit, and voltmeters for indicating their potentials. Then resistance-boxes or rheostats—one for each dynamo—are generally placed on the switchboard. These generally consist of coils of iron or German-silver wire so connected to the dynamo that the current used for exciting the field-magnets flows through them. By moving the lever of the rheostat, resistance consisting of a wire or wires of low conductivity may be thrown in or cut out of the field windings, entailing a less or greater current flow through the coils and consequently a decreased or increased electromotive force from the dynamo, as has been previously explained. Rheostats are essential to the satisfactory working of most forms of dynamos, and in policies the specific amount named on dynamos should include the value of the rheostats, which must be considered not as an accessory device, but as a part of the original machine. The other instruments that appear on the switchboard and have been referred to are not absolutely essential to the working of the dynamo. They are necessaries which enable attendants to keep the plant, both inside and outside the station, in such a condition that both safety and satisfactory service will be assured, and as such their independence from the dynamo will be recognized. A dynamo may burn, yet the switchboard or station instruments may receive no exposure therefrom, neither will a burning switchboard necessarily jeopardize the dynamos connected to it, and for this reason, if for none other, specific amounts should be written on station instruments as well as on dynamos. To "blanket" them is to "blanket" two distinct risks. As to the destructibility of station instruments, those appearing in the switchboard generally consist of five pieces of mechanism comparable to fine clock-work, though not as intricate or as complicated. The instruments found in a well-equipped testing-room of an electric-light station are, however, among the most delicate, exact and expensive used in any branch of science. Their value is frequently great, and being very delicate they are readily susceptible to injury by either fire or water.

Generally, the hazard attending the use of switchboards is considerably greater than that of dynamos—or, more properly speaking, perhaps fires originate on or around switchboards more frequently than about dynamos; but in every instance, except, possibly, lightning, electric fires originating in generating stations must be looked upon and deplored as preventable fires. From their nature, switchboards are the points from whence every portion of the system supplied by the station receives its current, and hence the maximum potential and the maximum ampèrage always exist at that place. It is most essential, then, that the workmanship and materials in and around the switchboard be of the best and most recent character. Unless it is quite impossible to do so, station switchboards should be placed far enough away from walls or partitions to permit easy access on all sides. Do not close in the switchboard in any manner. If it is wainscoted in and provided with a door, some evil genius may file away his cast-off shoes, coat, oily jumpers and waste, broken bottles, and sardine and oyster cans—as I once found—behind there. These are the jackasstical deeds and things that frequently lead to the troubles which occur in generating stations. Permit no part of the switchboard to remain out of sight, and then there is much less liability of litter accumulating. Again, switchboards should be entirely of non-combustible material, such as marble or slate, but wood may be used without material hazard. Of course, all switches cut-outs, rheostats and other instruments exposed to heating or arcing should be mounted on non-combustible bases. In some low-potential systems, and even in electric-railway work, bare conductors consisting of heavy copper wires or bars are frequently placed on the front of the switchboard. They are rigidly secured and well separated, and I fail to see that any hazard accompanies their use. Only the best solid-rubber insulators should be used behind switchboards, however, and all wiring should be run on porcelain knobs or glass insulators in such a manner as to maintain as great an air space as is possible between the conductors. The use of wood cleats on high-potential switchboards is seldom, if ever, advisable, and it would be far better if none but porcelain or glass insulators were used for all work within stations. The wires leading from dynamos to the switchboard should rarely be led down and run under the floor unless the space below be an occupied, finished room, and invariably wires in passing through walls, floors or woodwork should be encased in the heavy glass tubes known as floor insulators. Unless special and unusual precautions are taken it is never advisable to conceal wires in generating stations. They should always be run in plain sight on porcelain or glass insulators, and it is of the greatest importance that they be well separated and rigidly run. To bunch station conductors is to indulge in a foolhardy experiment, always to be advised against.

Wire towers are in themselves a necessary evil so far as the underwriters' idea of station construction is concerned, but in many cases their use may be obviated without inconvenience. It has been suggested that a far less hazardous arrangement than a wire-tower, with its shaft or flue-like opening extending from the dynamo-room up through the roof is afforded by imbedding a massive wooden girder in a convenient outer wall of the station, then leading all outside wires out through holes bored through the girder. Of course these holes must slant upward as they pass inward, in order to prevent the ingress of water during rain-storms, and they must be well bushed, preferably with glass floor insulators sufficiently long to pass clear through the timber. When these suggestions have been carried out and the lines have been provided with competent water drips or loops and glass insulators to relieve the wires from strain at the girder, then the hazard attending the use of a wire shaft and tower will have been eliminated. Electrically speaking, no unusual hazard exists in wire shafts and towers, provided the construction is proper, but the objection raised against them is that entertained against all kinds of similar openings, such as light wells or elevator shafts. Should the wiring in them be indifferent or improperly done, however, then a formidable electrical hazard would exist. It will be remembered that nearly all competent insulations are highly inflammable, and in the shaft leading to a wire-tower the wires run vertically, or are hung upon reels. Should a short circuit occur, the arcing would ignite the insulation, which would carry fire along up the line like a taper. Being fanned by the strong draught, which always rises in such openings, the fire would certainly spread, and blazing drops of melting insulation would create unlimited trouble, which would not be averted by throwing the current off the wire or shutting down the plant. In such an instance automatic sprinklers would render a service of inestimable value, but to sprinkle burning wires carrying current would, I think, be making a bad matter decidedly worse.

It is meet that in discussing central-station construction mention should be made of outside lines and line building. In low-potential systems bare copper is oftentimes used on all outside pole lines, and the practice, though not the best, is generally recognized as reasonably safe, provided the circuits are substantially supported and carried above all other wires. Bare wires in overhead electric-railway circuits are, however, not to be tolerated except, of course, for the trolley wire, which must be exposed to contact with the trolley. This is necessary principally for the the reason that electric-railway feeders run under all other lines and are almost sure to cross with fallen wires or with circuits under construction or repair. As a preventive the placing of guard wires seems to be the only competent suggestion. Some electric-railway companies have placed their supply circuits underground, carrying up feeders to the trolley wires at necessary intervals. Such a practice is to be commended, as in this case at least a wire underground cannot engage in mischief-making for the simple reason that it is not accessible to anything susceptible to injury. Though this condition may apparently prevail in all underground electric constructions, still it does not actually exist, for the undergrounding of electric-light circuits have developed new and unlooked-for hazards, principal among which is the liberation and ignition of explosive gases. The undergrounding of telephone, telegraph or other similar signal wires is not, however, subject to the difficulties attending the burying of electric-light circuits, and if all such signal wires were placed in subways the frequent fires that occur from cross-circuits would be obviated.

Regarding the pole lines and outside construction, I have often thought that a first-class system of housetop construction would be far safer and far more satisfactory than distributing circuits by pole lines. If all electric-light wires were placed on substantial frames, firmly secured to fire-walls, and so constructed as to maintain all wires at least ten feet above flat roofs, and if all telegraph and telephone wires were placed on similar structures, entirely separate and apart from the electric-light racks, then cross-circuits would occur with less frequency, the streets would be free from poles, and firemen would not be hampered by wires every time they endeavored to raise a ladder to a burning building. Be this as it may, however, I cannot but feel that proper housetop construction has a legitimate sphere of usefulness. Line wires carrying high-potential currents are generally protected with some weather-proof insulation—that is, an insulation designed to withstand the variations and exposures of the weather. It is also essential that this insulation be very tough and non-abrasive. Some companies run their high-potential circuits with a solid-rubber insulation, and I believe this to be an excellent practice, despite the yet-to-be-proven claim that the modern rubber insulations fail to survive atmospheric changes.

What has been said will, I hope, convey an idea of the inherent hazards of generating stations, and, in conclusion, I can only emphasize the conviction that, with the competent safeguards and methods of construction now used and practised, the occurrence of an electrical fire in a generating station is the occurrence of a preventible fire.

THE EDISON GENERAL ELECTRIC COMPANY.

The following is the report of Mr. Samuel Insull, Second Vice-President of the Edison General Electric Company, to President Villard on the Company's prospective business for the current year. The report is dated January 30, 1892:

EDISON ELECTRIC LIGHT COMPANY'S CENTRAL-STATION LICENSEES.

The Edison Light and Power Company, of San Francisco, is about to install a central-station plant with a capacity of 20,000 incandescent lamps at an estimated cost of $500,000, exclusive of real estate.

Under the contract recently entered into with the Edison Electric Light Company and the Edison General Electric Company, the Chicago Edison Company has obligated itself to invest about $2,000,000 within five years. Of this amount a large sum will be expended during the current year.

The Edison Electric Illuminating Companies, of New York and of Boston, respectively, are both building new central stations and propose making large additions to their underground systems during the coming season.

Negotiations are in active progress for the installation of new central-station plants in a number of large cities.

A great deal of work yet remains to be done in connection with the installation of the large central stations at Milwaukee and Cincinnati.

With this extraordinary amount of work in view and the natural additions to plant made from year to year by the other Licensee Illuminating Companies, it is expected that the increase in central-station capacity will amount to upwards of 150,000 lights, assuming large orders for all of our various products and for further considerable payments of royalty stocks to the Edison Electric Light Company.

CASH STATIONS AND ISOLATED PLANTS.

In addition to the sales to the Edison Electric Light Company's Licensees, this company and its predecessors sold prior to October 31, 1890, incandescent lighting apparatus, having a capacity expressed in sixteen-candle-power lamps of 931,255 lights. During the fiscal year just closed, the apparatus sold in this department had a capacity of 472,475 lights, being upwards of fifty per cent. of the total business done during nine previous years. This branch of our work has shown a further increase during the present fiscal year, and we have reason to expect this year's sales in this department to be equal to upwards of 500,000 lights.

ARC LIGHTING.

Prior to October 31, 1890, we had installed only 470 arc lights. During last year we installed plants (central station and isolated) having a capacity of 5,202 2,000-candle-power lamps. At this moment we have orders on our books for arc dynamos and lamps of a capacity of 2,000 lights, and a corresponding increase for the remainder of the year is confidently expected.

MINING PLANTS AND TRANSMISSION OF POWER.

During the past year we have installed a number of mining plants operating electric motors for hoisting, pumping, ventilating, drilling and traction purposes. In several cases the initial power (usually water-power) has been transmitted electrically from a considerable distance. The many advantages of electrical over any other form of power for mining purposes, especially where water-power can be availed of as initial power to drive our generators, and the success we have already achieved, leads us to look for the very rapid development of this entirely new branch of electrical work.

ELECTRIC STREET-CAR MOTORS.

During last summer we were compelled to put on the market a single-reduction motor to meet the demands of the street-railway companies for a motor, the wearing parts of which would not suffer such rapid deterioration. While a great deal of experimental work had to be done to bring this new motor up to the high standard attained by our double-reduction (Sprague) apparatus, we happily passed that period some months ago, and our single-reduction motor is, we have reason to believe, from tests made by our customers, of very substantial construction and more economical of operation than any similar apparatus now offering. There is every indication that there will be a large increase of business in this department also.

SIEMENS CABLES.

Our cable plant at Schenectady is now completed, and we are already beginning to get orders for electric light, telegraph and telephone cables. The high reputation attained by the Siemens cables in Europe is proving of assistance to us here, and we may reasonably expect to secure considerable business during the year.

INCANDESCENT LAMPS.

The sale of lamps keeps pace with the demand created by the installation of new apparatus in central station and isolated plants. It requires but little effort to retain the renewal lamp trade created by the installation of our own apparatus, and we are constantly gaining customers amongst those who have installed plants of other manufacturers. This trade has been influenced by Judge Wallace's decision in the filament case, and should the decision on appeal be in our favor our lamp business would increase enormously. We are happily in good position to take care of it, as we have large surplus capacity at our lamp works, and can add to our output with great rapidity and with a comparatively small investment in additional plant.

STATIONARY MOTORS.

This branch of our work has shown a phenomenal growth, partly on account of the extension of our central-station systems, and partly on account of our greater ability to take the business offering owing to our improved organization. Formerly, customers of illuminating companies alone bought stationary motors, but now a large manufacturer seldom buys an isolated plant for lighting purposes without purchasing motors for running machinery or for crane or elevator work.

SUPPLY STORES.

The establishment of supply stores, wherever we have district or sub-offices (in all twenty-two in the United States and Canada), has greatly benefited the business of our wire and decorative fixture departments, and has largely increased the sale of all kinds of small electrical fittings, of which we are today the largest manufacturer in the country. Our stores place us in direct contact with consumers, there being no intermediary between the manufacturer and the user. This must give us a great advantage in competing for trade.

FOREIGN BUSINESS.

We are giving considerable attention to foreign business, having within the last six months organized a Mexican and South American Department in New York, and removed the Antwerp agency to London, for the greater convenience of our European and other foreign business naturally centering there.

The Board of Trustees of the Edison General Electric Company held its annual meeting in the office of Drexel, Morgan & Co., this city, on February 12, for the election of officers. All of the present officers of the company were re-elected for the ensuing year without opposition, as follows: President, Henry Villard; Vice-President, J. H. Herrick; Second Vice-President, Samuel Insull; Secretary, A. Marcus; Treasurer and Assistant Secretary, F. S. Hastings; Assistant Treasurer, A. S. Beves; Comptroller, Joseph P. Ord.

A letter, of which the following is a copy, was read at the meeting by Mr. Villard.

To the Board of Trustess of the Edison General Electric Company:

"When I went to Europe in June, 1890, intending to be absent a whole year, my resignation from the presidency of the company was left in your hands. It was not accepted, and, against my wish, I continued to hold the position. The rapid growth of the company's business has made it clear to me, however, for a long time past, that some one should fill the difficult place who could devote all his time to its duties, which my other occupations have not permitted me to do. You have just chosen me for a third time as the chief executive of the company. While I am sincerely grateful for your confidence, I can only accept with the distinct understanding that I shall be at liberty to retire whenever a suitable successor acceptable to you can be found, but in any event not later than April 1 next. Yours truly, H. Villard.

"Feb. 12."

At the annual meeting of the shareholders of the company, which was held on February 10, the following Board of Trustees was elected: C. H. Coster, Thomas A. Edison, J. H. Herrick, Samuel Insull, Edward H. Johnson, A. Marcus, Carl Schurz, Francis S. Smithers, Henry Villard, Samuel Spencer and J. Hood Wright.

At this meeting Mr. Villard said that the committees representing the stockholders of the Edison General and Thomson-Houston Companies had practically agreed upon the terms of the consolidation.

It was reported after the meeting that Mr. H. McK. Twombly would be elected president, and Charles A. Coffin, of the Thomson-Houston Company, would be elected general manager of the consolidated companies, the name of which, it is reported, will be the American Consolidated Electric Company. It was also stated that the separate controlling boards of the two companies will be retained. The new company will have a capital stock of $50,000,000 in 500,000 shares of $100 each, of which the Thomson-Houston puts in $18,400,000 worth of stock. The Edison General Company's capitalization is $15,000,000, and there will be left in the treasury of the new company $6,000,000 of preferred and $10,600,000 of common stock.

In regard to Mr. Villard's desire to retire, that gentleman said:

"Since June, 1890, I have been anxious to retire from the presidency of the Edison General Company. Even within the past three months I would have given a premium to any man who would have accepted the responsibilities of the office. I have so many enterprises on hand now that I cannot afford to give the time to the Edison Company that the detailed business of the concern requires."

It is reported in some quarters that there is a possibility of the Westinghouse interests being included in the general deal, while on the other hand it is stated that the Westinghouse Company is now in a position to maintain a separate and independent existence and contest with the new combination, and that it can keep the field against the Edison and Thomson-Houston Companies combined. Nothing definite in regard to the relations of the Westinghouse Company with these companies can yet be ascertained, however. The financial report of the Edison General Electric Company will be found in our financial columns of this issue.

"MY REMINISCENCES OF LINCOLN."

A large crowd assembled at the Electric Club rooms on Friday night, February 12, to listen to the address of Mr. A. B. Chandler, President of the Postal Telegraph-Cable Company. The title of the address was "My Reminiscences of Lincoln."

Mr. Chandler was a United States military telegrapher at Washington during the Civil War, and was for years in the closest confidential asssociation with the great President.

The lecture was divided into two parts. During the intermission the Brunswick Quartette rendered some war songs and choruses and other melodies, which were thoroughly appreciated.

Mr. Chandler's remarks were wholly in the nature of anecdotes of the famous President, and were greatly enjoyed. We suppose that nothing has ever been said or written about President Lincoln that was not accompanied by some reference to the stories and quaint humor of that great man, and Mr. Chandler's "Reminiscences" were not an exception; indeed they sparkled with the wit and humor of the War President.

Among other things, Mr. Chandler said:

"I first saw Lincoln at Allegheny, Pennsylvania, when he was on his way to Washington to assume the task of reconciling a great nation to itself; for it was even then clear that his administration was to be fraught with difficulties such as had not fallen



A. B. CHANDLER.

upon any previous President of the United States, although I believe that neither he nor any other citizen of the republic had then any expectation that so terrible and destructive a war was impending. He was received there with great enthusiasm by the multitude that had gathered to see him, and acknowledged their demonstrations with the homely dignity that was peculiar to him, and without making any speech. I was among the few who were there privileged to enter the private car in which he and his family were making their journey, and I shall never forget the deep impression which his towering form and his already sad, and always kindly face, made on me as I took his hand. I had then no expectation of seeing him again during his presidency.

"The next time I remember of his speaking to me, was very early one morning, perhaps six o'clock, soon after I went to Washington. I had been on duty all night. He left the office as late as ten or eleven o'clock the night before, but so anxious was he for news from the armies that he often came over from the White House soon after daylight to see the despatches which had come in during the night. He happened to find me on this morning in just the same position (writing at the desk that we then called Col. Stager's) in which he had seen me the night before, and, as he came in, he said 'Have you been sitting right there all night?' Then he read over the the new messages, carbon copies of which we made on letter size tissue-paper, and put, without folding, in a little drawer in what we called the cipher desk. The contents of this drawer were for his special information. The messages were placed in it in the order of their reception, and he was quite careful to keep them so. It was his habit to read from the top down, and when he came to those which he had already read, with a smile he said, 'Well, I guess I have got down to the raisins.' As I seemed in doubt as to what that might mean, he explained that a little girl, having eaten improperly, both in quantity and quality, beginning with a lot of raisins, was made quite ill, and could only find relief in the process a sick stomach is apt to compel. After an exhausting siege of throwing up, she gave

an exclamation of satisfaction that the end of her trouble was near, for she had 'got down to the raisins.' I suppose that I have heard Mr. Lincoln use the expression twenty times at least, when he had finished reading the new messages in his drawer, and had reached those which he had read before.

* * * * *

"Of one thing I wish to make special and grateful mention, namely, the deep and genuine sympathy which Mr. Lincoln manifested for the soldiers in the field. He did not fail to realize the necessity for the exercise of strict discipline, and yet no soldier boy was ever executed for sleeping on his post, or other like offence, when Lincoln could prevent it. I think I have known him to come over to our office, himself, alone, at least half a dozen times, in the night, with a message of reprieve for some poor fellow who was under sentence of death which nothing but the President's power could stay, and his solicitude would not allow him to intrust his message to an 'orderly' or other messenger, when a human life depended upon his direct action, and an execution might take place unless the official stay was hurried to its destination."

Among the audience were a number of old-time telegraphers, many of whom saw service during the war.

THE BUFFALO CONVENTION.

A special vestibuled train, composed of parlor, buffet and dining cars will leave the Grand Central Station, 42d street, New York, at 11 A.M., Monday, February 22, and will make the following stops to take on delegates of the Convention of the National Electric Light Association: Albany, 2:45 P.M. (Boston delegation joins); Utica, 5:25 P.M.; Syracuse, 7:00 P.M.; Rochester, 9:24 P.M.; Buffalo, 10:45 P.M. Seat checks for this train can be procured from C. O. Baker, Jr., General Master of Transportation, 136 Liberty street, New York, at $2.00 each. Railroad tickets on the certificate plan can be obtained from any of the New York Central Railroad offices. Tickets will also be on sale at the Electric Club, Saturday afternoon and evening, February 20, and, for greater convenience, orders acceptable for tickets and certificates on the train can be obtained at Mr. Baker's office upon payment of outbound fare, $9.25 each. Checks should be made payable to C. O. Baker, Jr.

PROGRAMME OF THE CONVENTION.

The following is the programme of the meetings of the National Electric Light Association, to be held in Buffalo Feb. 23, 24 and 25:

TUESDAY, FEB. 23.

Meeting of the Executive Committee at 9 A.M., parlor, Iroquois Hotel.

Morning meeting, 10:30 o'clock, at Library Building.

Address of Welcome, by Hon. Charles F. Bishop, Mayor of Buffalo.

Address of President Huntley.

Report of Committee on Underground Conduits and Conductors, M. J. Francisco, Chairman.

Afternoon Session at 2 o'clock, Report of Committee Safe Wiring, M. D. Law, Chairman.

Report of Committee World's Columbian Fair, B. F. Sunny, Chairman.

Paper by Richard Hammond, "How to Fire a Steam-Boiler."

Evening Session at 8 o'clock, Paper by Carl Hering, "Transmission of Power."

Discussion by William Stanley, Jr., H. Ward Leonard, L. B. Stilwell, Elihu Thomson and others.

WEDNESDAY, FEB. 24.

Morning Session at 10 o'clock.

Paper by D. Ashworth, "The Allied Powers."

Paper by William Stanley Jr., "The Alternating-Current Motor."

Paper by Erastus Wiman, "Electric Lighting from a Financial Standpoint."

Afternoon Session at 2:30 o'clock.

Paper by M. C. Sullivan, "Switch-boards: Their Safety and Operation."

Paper by Charles A. Schieren, "From the Tannery to the Dynamo."

Paper by Allen R. Foote, "Municipal Franchises for Quasi-Public Corporations."

THURSDAY, FEB. 25.

Morning Session at 10 o'clock.

Paper by E. F. Peck, "Overhead Construction."

Paper by E. A. Leslie, "Operation of High-Tension Currents Underground."

Paper by J. B. Craven, "Underground Construction of Buffalo Railway Company."

Afternoon session at 2:30 o'clock.

Paper by L. B. Stilwell.

Report of Secretary and Treasurer.

Report from Executive Committee.

Election of Officers.

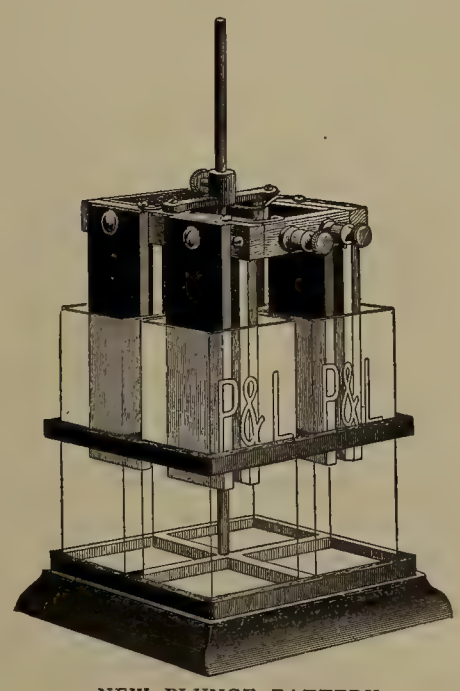
THE P. AND L. PLUNGE BATTERY.

The student who wishes to obtain a distinct idea of the facts about electricity must necessarily do some experimenting, without which it is impossible to acquire a clear conception of that mysterious force.

One of the first and most important pieces of apparatus necessary is, of course, a battery, and one that is easy of manipulation, giving a powerful current, and low in first cost and maintenance. The type of battery best suited for such work, also for running small motors, charging induction coils, lighting small incandescent lamps, etc., is, without doubt, some modification of the "Plunge" class, as it permits the operator to arrest all unnecessary waste of material by simply raising the plates from the exciting fluid as soon as the experiment is at an end, and also making it possible to obtain a powerful current at any time, by simply lowering these plates.

A simple, compact and well-made form of such battery, designed and manufactured by Pfund & Lawton, 153 Broadway, Brooklyn, N. Y., is shown in the accompanying illustration.

It is simple, compact and correct of design, commends itself to the use of all desiring a battery capable of producing a large amount of current at a low cost. All waste, when not in use, is prevented by raising the elements from the solution, which is accomplished by means of a frame, to which the zincs and carbons are attached, sliding on an upright rod fast-



NEW PLUNGE BATTERY.

ened in the centre of the base and secured at any height on this rod by turning a thumb-screw.

The elements used are the same as in other batteries of this type, viz.: zinc and carbon excited by a solution of bichromate of potash, bichromate of soda or chromic acid. These solutions, sustaining all their properties when left exposed for a long time, can remain in the jars, thus rendering the current available at a moment's notice.

The E. M. F. of each cell is 1.9 volts, while the internal resistance is but a small fraction of an ohm.

As will be seen by the illustration, the battery is very compact, and consists of four cells set on one base. The jars are of glass, and each is 2½ inches square and 6 inches high. No offensive odors or fumes are given off, and the zincs are well amalgamated and will last a long time.

One excellent advantage of this battery is that the jars can be taken out, emptied, cleaned and refilled without taking the plates apart. One charge of fluid is good for a four-hour continuous run, and costs only two cents per cell.

OBITUARY.

HENRY CHURCH.

Mr. Henry Church, manager of the Phœnix Iron Works, of Meadville, Pa., died in that city January 31 last.

In the death of Mr. Church Meadville has lost one of its most prominent business men and citizens. Although it was known by his friends that he was ill, his death was unexpected, and caused widespread sorrow throughout the city.

Mr. Church was a son of Hon. Gaylord Church. He was born in Meadville November 13, 1842, and was consequently in his 50th year at the time of his death.

While a young man he was engaged in railroading, and served at different periods as brakeman, conductor and baggage-master, and afterwards became interested in civil engineering. In 1871 he became associated with the firm now known as Dick & Church, proprietors of the Phœnix Iron Works.

Mr. Church was a thorough business man, and was reliable, honest and upright in every walk of life. At one time he was a candidate for mayor of his native town. He was a member of Crawford Lodge, 408 F. & A. M. He leaves a wife.

At the funeral, the pall-bearers represented each department of the works, and among the honorary pall-bearers were John Dick, Sturges T. Dick and Col. S. B. Dick, all of whom were associated with Mr. Church in the Phœnix Iron Works.

The sorrow-stricken family has since received another blow in the death of Mr. Church's mother, by a paralytic stroke.

THE DEATH OF MR. GEORGE WORTHINGTON.

At a meeting of the members of the Electric Club held at the club-house Friday evening, February 12, the following minute was ordered to be spread upon the records of the club: "The Electric Club, of New York, hereby expresses the profound sorrow



GEORGE WORTHINGTON.

felt by its members upon learning of the death of Mr. George Worthington. His genial companionship, his hearty good-will, never failing towards any, his disinterested friendship, his utter unselfishness, endeared him to all who came within the circle of his acquaintance. The memory of these traits of his, as well of his manly independence and courage, leaves in our minds and hearts the gracious sense of past comradeship to temper the sad knowledge of our friend's departure. He was one of the founders of this club, and the leading spirit in the work of building it up to usefulness and for the benefit and pleasure of its members. The secretary is requested to communicate this minute to the family of Mr. Worthington."

NEW BOOKS.

THE ELECTRIC RAILWAY IN THEORY AND PRACTICE. By Oscar T. Crosby and Louis Bell. 394 pages, with 179 illustrations. The W. J. Johnston Co., New York.

This work presents both the elementary theory of electrical traction and the general features of the best practice, describing in detail particular methods and forms of car machinery, only so far as they are of importance in illustrating the broader principles on which they depend. The contents of the book by chapters are: 1. General Electrical Theory. 2. Prime Movers. 3. Motors and Car Equipment. 4. The Line. 5. Track, Car-Houses, Snow Machines. 6. The Station. 7. The Efficiency of Electric Traction. 8. Storage-Battery Traction. 9. Miscellaneous Methods of Electric Traction. 10. High-Speed Service. 11. Commercial Considerations. 12. Historical Notes.

There are besides five appendices giving decisions in electric railway *vs.* telephone cases, instructions to linemen, engineer's log-book, classification and expenditures of electric railways, and concerning lightning protection, the latter by Prof. Elihu Thomson.

It will be seen by the subjects of the chapters that the book covers every feature of electric railway practice and brings the subjects up to date.

No doubt this book will be of great value to every one interested in electric railways. The electric railroad is at the present time attracting more attention than any other branch of electrical industry, and this book appears at a time just when all the information possible on the subject is being sought after.

NEW ELECTRIC RAILROAD SYSTEM.

A test was made on Saturday, February 13, of a new system of electric propulsion for street railways, which is said to do away with the overhead trolley wire. The test was made on a piece of track at Coney Island, full of sharp curves and damp places, all possible conditions of actual railway practice being present. The test of the system, which is that of the American Engineering Company, of New York, is said to have been very successful, and made a very favorable impression upon the street-railway men and electricians who were present. This particular system is known as the "Multiple Distributing Station System." Twelve feet apart, between the rails, and flush with the road-bed, are metal plates 6 x 8 inches in size. Through the operation of the proper mechanism, these plates become connected with the feed wire as the car passes over them, thus supplying the motor with current.

TELEPHONE EXCHANGE DAMAGED BY FIRE.

Fire on the morning of February 14th caused some damage to the 18th street Telephone Exchange, New York. The building in which the exchange is located is at the corner of Broadway and 18th street. The switch-board was damaged, principally by water, and all the circuits were interrupted. There are about 1,300 subscribers depending upon this exchange, but on Monday morning a good many of the circuits were restored.

EASTERN NOTES.

OFFICE OF THE ELECTRICAL AGE,
65 OLIVER STREET,
BOSTON, Feb. 13, 1892.

THE DOW ADJUSTABLE SHADE CO., 309 Washington street, Boston, is meeting with well-deserved and flattering success. "The Dow" is the only 16-cord shade upon the market.

J. EDWARD WALLACE, of the Eastern Electrical Supply Company, Boston, has just returned after a most successful trip through New York, Pennsylvania and Ohio. Mr. Wallace s headquarters are at Scranton, Pa.

C. B. ELLIOTT, Manager of the Hard Rubber Department of the Revere Rubber Company, Boston, is making rapid strides toward the front, with the "Elliott" Hanger and Pull-off. "Flexite," manufactured by this company, is still growing in favor.

THE CROWN ELECTRIC MANUFACTURING CO., Bridgeport, Conn., of which Mr. E. L. Smith is vice-president and general manager, although but recently established, is "booming" with orders for its "Crown" Socket and "Crown" Turn Handle Switch, the latter either single or double pole. It manufactures these goods in all sizes, from 5 to 100 ampères.

J. BRADFORD SARGENT, 620 Atlantic avenue, Boston, New England agent for the Corliss Engine of C. and G. Cooper and Co., Mount Vernon, Ohio, has, the past week, contracted to install a 500 H. P. C. and G. Cooper & Co.'s Corliss Compound Condensing Engine, similar to the one installed last summer in the power-house at Leicester, of the Worcester, Leicester and Spencer Electric Railroad. Mr. Sargent will be represented at the Buffalo Convention by his brother, H. E. Sargent.

THE EASTERN ELECTRICAL SUPPLY COMPANY, 65 Oliver street, Boston, Mass., of which Maybin W. Brown is General Manager, has just closed a contract for the entire equipment, with the exception of motors, for the Worcester and Shrewsbury Railroad, of Worcester, Mass. The road is four miles long, and the Eastern Electrical Supply Company will supply the rails and twelve cars, in fact everything with the exception of the motors. This company is the largest house of its kind in New England.

MR. ELMER P. MORRIS, manager of the street-railway department of the Thomson-Houston Company, Boston, last week closed a contract for the equipment of the Coney Island and Brooklyn Electric Road, seven and one-half miles in length, also for the equipment of the Saratoga (N. Y.) Electric Street Railway. Among the recent contracts received by the street railway department of the T.-H. Company, can be mentioned the equipment, including poles, etc., of the Jersey City and Bergen Electric Railroad, Wilmington, N. C., Electric Railroad Co., also in St. Louis, Mo., and San Francisco, Cal. Mr. Morris informs me that their new combination switch and cut-out, for car lighting, will be ready by March 1. Mr. Morris left Friday for a Western trip, to include New York, Pittsburg, Columbus, Cleveland and Cincinatti, and will be at the Convention at Buffalo next week. D. L. T.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Feb. 13, 1892.

MR. W. H. MCKINLOCK, of Chicago, was in town last week.

MAJOR EVARTS, of the Simplex Insulated Wire Manufacturing Company, Boston, and Mr. Cook, of the McGuire Manufacturing Company, Chicago, were both in town last week.

MR. F. DAY VOORHEES, manager of the Norwich Insulated Wire Company; manufacturer of paper insulated wires and cables, has closed a contract with the United States Electric Lighting Company, Washington, D. C., for cables of 500,000 C. M. and 165,000 C. M.

JOHN M. TUFTS, the well-known manufacturer of bank and office furniture, and the celebrated Tuft's roll-top desks (formerly sold as the Derby), will remove February 20, from his present quarters, 131 Fulton street, to 83 Nassau street, this city. Mr. Tufts is also the Eastern agent of the Indianapolis Cabinet Co.

THE CROCKER-WHEELER ELECTRIC COMPANY will have a full line of motors set up and running at the office of its Buffalo agents, Messrs. F. P. Little & Company, adjoining the Broezel House, during the Convention of the National Electric Light Association. Messrs. Otis Bros. will also have one of their celebrated pumps operated by a ½ H. P. Crocker-Wheeler perfected motor, with the latest C.-W. automatic switch.

THE ENGINEERING EQUIPMENT COMPANY, 143 Liberty street, has completed arrangements with the Syracuse Tube Company, of Syracuse, N.Y., to handle the latter's electric light and railway poles for the Eastern, Middle and Southern States. It also keeps on hand a large line of cotton leather belts for immediate use. A special feature is made of hard fibre pipe, and the company intends bringing out a new multiple duct pipe for telephone, signal, feeders and other wires where metallic circuits are required. It is likewise fully prepared to equip a complete conduit system.

AT the annual meeting of the stockholders of the North American Phonograph Company, recently held in this city, the following-named gentlemen were elected as directors for the ensuing year: Thomas A. Edison, Samuel Insull, J. Adriance Bush, A. O. Tate, M. A. Nolan, Scott Tremaine and Thomas R. Lombard. The directors subsequently held a meeting, and elected the following officers: Samuel Insull, president; Thomas R. Lombard, vice-president; Cleveland Walcut, secretary, and Thomas Butler, treasurer. The New York office of this company is located in the Edison Building, 44 Broad street.

WORD has been received here from J. A. MacLure, who was formerly secretary of the Thomas Murray Company, of this city, and who went down to Colima, Mexico, last fall to do some railroad work, that he has completed two miles of it, and also the necessary car-houses, and it is expected that he will be back in New York again within the next six weeks or so. His many friends will be rejoiced to hear that his health has improved to a great extent since his sojourn in the land of the cactus and mesquite, and that, when he returns, it will be with renewed health and vigor to resume his former active labors in the street-railway field.

MESSRS. PIERCE & THOMAS, of 42 Cortlandt street, this city, engineers and contractors for the installation of complete electric light, electric railway and power plants, are general agents for McIntosh & Seymour, automatic single and compound condensing and non-condensing steam-engines. This firm has lately closed contracts with the following electric railway and electric light companies for complete steam-plant installations or enlarging present ones: The Globe Street Railway Company, Fall River, Mass., changing to electric power, using the Thomson-Houston system, complete steam plant, consisting of 1 600 H. P. tandem compound engine, and 1 350 H.P. tandem compound engine, water-tube boilers, condensers, etc.; Merrimac Valley Street Railway, of Lawrence, Mass., increasing plant, using the T.-H. System, 1 250 H. P. tandem compound engine, complete steam plant, including boilers, condensers, etc.; Excelsior Electric Light Company, Tarrytown, N. Y. (enlarging plant), 1 150 H. P. compound tandem engine, with boilers, etc. Their latest contract was for the Rock Creek Railway Company, of Washington, D. C., where they are installing a complete steam plant, including 2 250 H. P. compound tandem engines, boilers, condensers, etc. These contracts include all machinery, piping and masonry work, necessary for complete installations. The plants are to be turned over in running order after being operated by the contractors thirty days. This firm, during the present year up to date, has secured contracts for complete steam plants aggregating $150,000. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,825,000	100 00	64 50
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 50
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	†20 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	107 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light.	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Commercial Cable Co	7,716,000	100 00	151 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	113 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*101
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	81 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	102 50
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	44 00
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	13 75
Franklin Electric Co., N. Y	5,000,000	100 00	†83 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guarantee Identification Co., N.Y.	50,000	50 00	51 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*92
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	109 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., N.Y., 6s.	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50.00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	21 00
Laclede Gas pref	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa.	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver.	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s.	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	20 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s.	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P Co. 6s, Ohio.	50,000		*95
North American Railway Co	39,767,200	100 00	16 75
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E.L.& Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	55 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250.000	100 00	85 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500 000	100 00	80
Thomson-Houston Electric Co	6,000,000	25 00	60 50
Thomson-Houston pref	4,000,000	25 00	28 50
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100.000	100 00	
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	86 50
Westinghouse Electric Co	7,000,000	50 00	15 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		18 25

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The following is the third annual report of the Board of Trustees to the Stockholders of the Edison General Electric Company. The report was delayed in consequence of the new general corporation law

of the State of New York, which went into effect May 1, 1891, pursuant to the provisions of which the annual meeting is held on the 10th day of February, 1892, instead of on the 18th day of January, 1892.

In the last annual report the statement was made that, owing to the large and rapid increase of the company's business, it had become necessary to provide for the enlargement of its manufacturing plants and for additional working capital, and that for these purposes your Board had disposed of most of the unissued capital stock of the Company held in the treasury, and had borrowed $2,000,000 through the Sprague Electric Railway and Motor Company, in repayment of which loan the lenders agreed to take a like amount of the stock of this Company. To make corresponding provision, a special meeting of the stockholders was called and held immediately after the annual meeting, at which, in accordance with the recommendation of the Board, the increase of the capital stock from twelve millions to fifteen millions was authorized by a unanimous vote.

Two millions of the increase were used in liquidation of the loan to the Sprague Company, and the remaining one million was left unissued in the treasury to meet future requirements.

The net earnings in the fiscal year 1889–90 having exceeded eight per cent. on the total stock of the Company, the trust existing under three certain agreements with the Farmers' Loan & Trust Company (whereby dividends had been temporarily deferred on some $2,482,700 of the Company's stock), reached its termination. The stockholders at the last annual meeting were therefore asked to authorize the payment of the regular dividends on the deferred stock (so called), and such other action as was required for the exchange of the trust certificates for the regular dividend-paying stock. The recommendations of the Board in these respects were also unanimously approved.

In consequence of the steadily growing financial requirements for current business, as more fully explained in another place, the Board deemed it prudent to dispose of the remaining $1,000,000 of stock in the treasury, so that of the $15,000,000 authorized $14,964,900 is now outstanding, the difference being reserved for the retirement of the outstanding Edison Electric Light Company's stock, unless the Board should decide to dispose of the same in some other manner.

Reference was made in the last annual report to the new working organization, which went into effect on August 1, 1890. Under it, the United States and Canada were divided into eight geographical districts, each in charge of a head official, entitled District Manager, instructed by, and reporting and directly responsible to, the executive officers of the Company. The organization has now been tested by an experience of fifteen months, and the Board feel warranted in saying that the practical results from it have been fully up to expectations. The change has contributed not only to the greater efficiency of the service in every way, but directly and indirectly to the growth and stability of our business, and to the prompt execution of orders. The new system has entirely superseded the old one of securing business mainly by the payment of commissions, and all officers and employés of the Company are now under salaries. The Company was fortunate in securing able, faithful and experienced men for the management of all the districts. The first of a series of conferences, intended to be held annually, of all the district managers with the chief executive officers of the Company, was recently held in New York.

In order to enable the stockholders readily to compare the general balance-sheet for the past year with that of the previous one, the figures for both have been printed in parallel columns, together with the differences they show.

The footings of the general balance show $21,507,284.42 in 1890–91, against $17,958,852.81 in 1889–90, being an increase of $3,548,431.61. The increase of assets includes additions to "Manufacturing Plants" of $1,262,410.91, to "Patents" $26,604.14, to "Real Estate" (completion of main office building in New York) $ 36,624.81, to "Capital Stock of Edison Electric Light Company" $12,693.32, to "Stocks and Bonds" $502,846.65, to "Cash" $348,274.53, to "Bills and Accounts Receivable" $261,663.36, to "Work in Progress" and "Materials and Supplies" $771,963.75. The balance also comprises two new items, "Laboratory Account," $66,815.72, being the share borne by the company towards inventive work completed or in progress in Mr. Edison's Laboratory under the new contract with him, referred to in the last annual report, and "General Liquidation Account," $158,534.42, representing unliquidated items, making part of cost of acquisition of various sub-companies and stock of Sprague Company.

Included in the liabilities is an allowance for "Depreciation of Manufacturing Plants." This account shows that $271,592.29 had been taken out before the year's profits were figured. The total amount now carried in this account is slightly over ten per cent. of the entire cost to this company of the manufacturing plants, notwithstanding the fact that the amount of cash expended to enlarge those plants during the past two fiscal years is $2,211,685.61, and on this new investment the actual depreciation so far is little or nothing. "Mortgages on Real Estate" ($200,000 of which is on the main office building in New York) shows an increase of $65,000, "Capital Stock" $1,115,500, "Bills Payable" $1,709,238.75, "Accounts Payable" $44,350.59. The surplus of "Profit and Loss" carried forward, viz., $1,260,067.11 (after payment of eight per cent. dividends on capital stock), is larger by $64,513.98 than that brought over from the preceding year.

The increase of $1,262,410.91 in "Manufacturing Plants" represents investments in lands, buildings, machinery, tools and miscellaneous equipment, which were rendered necessary by the growth of business, and this expenditure has secured to the several works an enlarged capacity and technical efficiency. Your Board are happy to say that with the large expenditures during the past year no considerable outlay in the same direction is likely to be required for some time, unless there should be an exceptional growth in electrical business throughout the country.

The "Bills and Accounts Payable" represent a total of $4,201,417.75, against $2,447,828.41 in 1889–90, making an increase (as already stated) of $1,753,589.34, or (deducting the $348,274.53 excess in "Cash in Hand" at the close of the past year) of $1,405,314.81. The reasons for this large increase in the company's liabilities are readily seen. In the first place, the peculiar character of the manufacturing and contracting business calls for the employment of more cash or working capital in proportion to production than in perhaps any other existing industry. The continuous purchases of expensive raw material consumed in large quantities, such as copper, require the constant use of a great deal of ready money. The rapid progress of the technical art, too, involves the necessity of devising and manufacturing new articles, the marketing of which is sometimes slow at first. In the second place, the system of District Agencies amounts to nothing less than the opening of as many wholesale stores, fully supplied with stocks of the company's manufactures, from large motors and dynamos down to the smallest incandescent lamp fittings, in order to save time and expense in filling local orders. To this cause the increase of $849,585.63 in "Materials and Supplies" on hand over 1889–90 is directly and specifically due. Lastly, as has been shown, the addition to the items "Manufacturing Plants," "Real Estate," "Stocks and Bonds" and "Laboratory Account," amounting together to $1,968,698.09, represent a corresponding absorption of working capital, thereby necessitating the raising of additional capital by increasing the stock or the use of the company's credit as a substitute In order to keep its use within prudent limits the $1,000,000 of treasury stock was disposed of as stated, and it is the opinion of your Board that an issue of another $1,000,000 of stock should be made at an early date.

The properties of the company in fixed form, *i.e.*, in manufacturing plants and real estate, having been increased by $1,399,035.72 during the year, now represent a cost on the Company's books of $5,748,548.70, less $537,663.56 standing to the credit of "Depreciation Account." Besides this, at the close of the year the company owned (in addition to patents) the stocks of controlled companies and other stocks and bonds (including the stock of the Edison Electric Light Company) appearing in the balance at an aggregate nominal value of $5,936,668.60, and had in cash on hand, bills and accounts receivable, work in progress (booked at cost), and materials and supplies (also at cost), no less than $9,273,868.86, and all this against bills and accounts payable of $4,201,417.75. These figures show the intrinsic strength of the company.

Summarily stated, the gross business of the General Company amounted to $10,942,640.34, on which the profits, including the $271,592.29 written off against the cost of the manufacturing plants, were, according to the books of the Company, $1,666,535.72. To this amount must be added the General Receipts at the main office, $83,013.99, making a total of net earnings of $1,749,549.71.

Deducting from the above net receipts of the Edison General Electric Company (exclusive of those of the Edison Electric Light Company) the sum of $271,592.29 charged off on manufacturing plants, and $286,477.59 charged off against "Liquidation," "Materials in Stock" and "Experimental Account," we have $1,191,479.83 as the net result of the year from the business of the Edison General Electric Company alone. Adding $1,100,432.48 surplus profits carried over from the preceding year, we have a total of $2,291,912.31 profits available for distribution. After paying $1,031,845.20 in dividends, $1,260,067.11 is carried forward into the new year.

As set forth elsewhere, the Edison Electric Light Company has received during the year $631,672 in bonds and stocks, as license fees, from licensee companies, worth, at a moderate valuation, say $500,000, of which the Edison General Electric Company (through its holdings of Light Co. stock) is entitled to over ninety-nine per cent., or say $495,000, which is equal to 3.16⅔ per cent. additional on the capital stock.

The year's profits were not so large as those for 1889–90. This is largely due to the considerable decline in the prices obtained for the product of the manufacturing establishments owing to increased competition and other causes. Another general cause of the diminished profits was the depression prevailing in all classes of business during the greater part of the year, and the unwillingness of capital to engage either in old or in new enterprises. This was especially noticeable in the business of large central stations, of which fewer were organized than usual, while those previously organized proceeded more cautiously than usual in enlarging their plants. The general condition of the country imposed great caution upon the management. The General Company could have done a much larger business if it had been willing to accept securities in payment for orders; but in view of the commercial and industrial situation at large, a strict rule was adopted of declining all such, and doing business exclusively on a cash or short-credit basis. In order to effect settlements of a number of contracts taken prior to the present organization, securities were, however, accepted. This accounts for almost the whole of the increase of $502,846.65 in "Sundry Stocks and Bonds." The result of the general policy pursued proved at once the wisdom of the course adopted, and the remarkably safe and solid character of the Company's business. For, although the gross sales reached nearly $11,000,000, the bills and accounts receivable increased only $261,663.36 during the year, showing the promptness with which collections were made.

The changes in the condition of this Company are fully set forth in the accompanying comparative balance-sheet. As will be seen, its relations to the local companies licensed by it have again yielded very gratifying returns. Much progress has been made by this Company during the year toward sustaining the position to which the ownership of the Edison patents entitles it, namely, the exclusive ownership of the fundamental patents relating to the business of incandescent electric lighting.

On July 14 last, Judge Wallace, in the United States Circuit Court, at New York City, filed a decision in the test suit on the principal lamp patent, sustaining that patent as covering broadly all existing incandescent lamps. The case had been most stubbornly contested for several years by the infringers, and, as was to be expected, an appeal was taken, which will come up for early hearing. A favorable decision by the Appellate Court, which is confidently expected by our counsel, will give the Company the control of the manufacture and sale of the incandescent electric lamp.

Satisfactory advance has also been made in the suits prosecuted to establish the right of this Company to the only system of electrical distribution and regulation suitable for incandescent lighting upon an extensive scale. Among them are the test suit upon the feeder patent and that upon the three-wire patent, in which a great mass of testimony has been taken during the past year. These cases will be ready for argument during the coming year.

A patent has lately been granted to Mr. Edison on the principle underlying the high-tension transformer system, and suit is about to be brought upon that patent to establish this Company's right to the transformer system, as well as to the direct-current system.

This Company's patents upon electric railways (including the Sprague patents), which are universally infringed, have also been, during the past year, made the basis of suits against competitors, with a view of establishing its rights in the electric railway business.

From the date of its organization in 1878 up to the present time, the Edison Electric Light Company has accumulated all its profits in its treasury. These profits are mainly in valuable stock of local illuminating companies. Recognizing the justice of a distribution of some part of them, the directors of the Light Company have, since the close of the fiscal year, declared a dividend of about $1,500,000, par value of these securities.

Over 99 per cent. of them come to this Company as the owner of nearly all the stock of the Light Company.

The following tables show the assets and liabilities of the Edison General Electric Company, October 31, 1891, with the increases as compared with the statement of October 31, 1890:

PROFIT AND LOSS ACCOUNT, OCTOBER 31, 1891.

ASSETS.	October 31, 1891.		INCREASES.
Manufacturing Plants		$5,347,571.61	$1,262,410.91
Patents (on manufacturing processes and articles manufactured)		322,848.12	26,604.14
Real Estate (on Broad st., N. Y. City)		400,977.09	136,624.81
Capital Stock of Edison Electric Light Co.		4,355,743.45	12,693.32
Entire Capital Stock of Sprague Electric Railway and Motor Co. (representing Sprague Patents)		680,000.00	
Sundry Stocks and Bonds (of various local Electric Illuminating and Electric Street Railway Companies received in part payment for work done)		900,925.15	502,846.65
Cash	$782,857.28		
Bills Receivable	1,092,508.00		
Accounts Receivable	2,353,636.20	4,229,001.48	609,937.89
Work in Progress (cost to date of all labor, material, etc., on uncompleted Installations)	1,188,551.97		
Materials and Supplies (on hand and in process of manufacture)	3,856,315.41	5,044,867.38	771,963.75
Laboratory Account		66,815.72	66,815.72
General Liquidation Account (representing unliquidated items, making part of cost of acquisition of Sub-Companies and stock of Sprague Co.)		158,534.42	158,534.42
		$21,507,284.42	$3,548,431.61

LIABILITIES.	October 31, 1891.		INCREASES.
Allowance for Depreciation		$537,663.56	$271,592.29
Mortgages on Real Estate		265,000.00	65,000.00
Capital Stock	$13,964,900.00		
Notes Payable in Stock at Par	1,000,000.00	14,964,900.00	1,115,500.00
Bills Payable	3,485,991.23		
Accounts Payable	715,426.52	4,201,417.75	1,753,589.34
Dividends Declared and Unpaid		278,236.00	278,236.00
Profit and Loss, Surplus carried forward (in excess of dividends declared and paid)		1,260,067.11	64,513.98
		$21,507,284.42	$3,548,431.61

EXPENSES.			EARNINGS.		
General Expenses		$794,738.63	Profit and Loss—Surplus brought over, October 31, 1890	$1,195,553.13	
Items now written off:			Less amount chargeable to 1889–90 against liquidated items taken over from various Sub-Companies	95,120.65	$1,100,432.48
Net amount charged off during the current fiscal year against liquidated items, taken over from various Sub-Companies	$148,083.99		Profits from November 1, 1890, to October 31, 1891 (not including those of the Edison Electric Light Company)		2,272,696.05
Amount charged off against Materials in Stock upon taking Inventories	128,293.60				
Experimental Account	10,000.00	286,477.59			
Dividends declared or paid, including Interest on Notes payable in Stock.		1,031,845.20			
Balance—Surplus carried forward, October 31, 1891		1,260,067.11			
		$3,373,128.53			$3,373,128.53

Who among my 50,000 readers has not been frequently advised that it required no special effort to get money ?—the science being altogether in saving it and employing it in such a manner that it may earn a fair interest. The safe-keeping of money and its representative collaterals are only one of the thousand duties in which electricity is now used. The doors of many depositories are so arranged that at the moment of robbery from within, or attack from without, they can be closed by simply touching a button ; the vaults of others are connected not only with electric burglar or fire-alarm stations, but also with the sleeping apartments of the highest officials. Some of the largest vaults are so nicely equipped that the unauthorized abstraction of a single coin will cause the safe to sink into a pool of water. Thermostats automatically perform a similar duty in case of fire. The stocks of several corporations using these special applications of electrical energy will be found in the foregoing list at prices enticing to investors. The last which has come to my knowledge is the Ongley Electric Co., of New York, whose specialty among a number of kindred inventions is the Watchman's Register. He must be at his station guarding your treasure or the alarm will call assistance and record all his actions. The same equipment gives the engineer or employer full control over the engines from any part of a block of buildings or ship. Only a few of the treasury shares remain unsold. These disposed of, one must wait financial disaster to the owners, or pay a round premium to obtain them. The smallest and most valuable investment quoted is the Identification Company. The specialty of the corporation is to identify by means of a certificate, in a neat leather case the size of any ordinary check, any man or woman in any part of the world, at a cost for life of only five dollars. The person who has stood at a bank counter, check or draft in hand, which was refused until some one could be found to identify him, will know just what a boon this is ; also the man without a bank account, who has to pay heavy discounts for cashing good paper. I shall be happy to explain the matter and procure cards for any of our readers. But there is still another benefit in having one of these cards—it carries a $500 accident life policy for a year, and this part is renewable for $1.50 per year ever after. Electric people actively engaged are considered too risky for any life insurance company. This identification card, however, regardless of your occupation, enables you to save money and identify yourself anywhere while living, and if you are killed by accident saves $500 to your family. Lineman Baldwin, of Grand Rapids, must have had one of these policies last month. The day was cold, and he took a little whiskey beside a warm stove, then, stepping to the corner, started up a pole. As soon as the cold air struck him he became drunk, and had a rough-and-tumble fight with his pals who came up to his assistance before they could get a bow-line over him to lower him down to the snow-line. One of these cards pasted into your bank or pass book defies all mistakes of drawing by the wrong party. Time is money ; and as a time and money saver this patented contrivance is without an equal.

CATALOGUE.

Messrs. Chas. A. Schieren & Co., 45–51 Ferry street, New York City, the well-known manufacturers of leather belting, have just issued their new catalogue and price-list for 1892. It contains full and complete details of the various kinds and grades of belting, Electric, Planer, Link, Royal Extra, Bulls Head, etc., made by them, and the cost of same. Throughout the catalogue are illustrations of the various departments through which the belting passes during the process of manufacture. The last pages of the book are devoted to interesting data respecting various modes of transmitting power by belting. A very useful Telegraph Cipher-code to be used in connection with their business is also included in the catalogue.

The Mosher Arc Lamp and Manufacturing Company, Chicago, Ill., was incorporated January 27, with a capital stock of $25,000. Incorporators: J. M. Fisher, J. A. Mosher and G. W. Carpenter.

PHILADELPHIA NOTES.

MR. LA ROCHE, of the La Roche Electrical Works, Philadelphia, Pa., is now on the way to Cuba to close some orders for his systems. The La Roche Works does a large export business, and its electric-light systems are giving great satisfaction.

THE CUTTER ELECTRICAL AND MANUFACTURING COMPANY, 27 South 11th street, is doing an excellent business in C–S reflector shades. This shade is claimed to be the best in existence for study or desk uses; it can be placed in any position desired, and it diffuses the light. It is made of aluminum, and is exceedingly light in weight. The shade-holder is automatic, and is adaptable to any system. It is neat in appearance and one of the most effective devices of its kind yet brought out. W. T. H.

CLEVELAND NOTES.

CONSEQUENT to the rapid growth of business, which necessitates more room, the firm of A. B. Lyman & Co., 36 S. Water street, Cleveland, O., will remove their business in a few days to the ground floor of the building in which they are at present located, where they will have better facilities to display their goods and serve their numerous customers. This firm keeps constantly on hand a large stock of electrical supplies of all kinds. Mr. Moses, who is at the head of this concern, reports business exceedingly good, and every one connected therewith is kept busy.

THE Hill Clutch Works of Cleveland, O., furnished the Buffalo power-house the original line of shafting, which is about 105 feet long, and on which there are Hill's friction pulleys 72 inches in diameter, and 32 inch face. There are about 11 Hill patent self-oiling bearings. The shaft of the large engine is 128 feet long, part of which is 9 inches in diameter. This shaft is supported by 18 of Hill's patent ball and socket self-oiling bearings and adjustable floor stands. There are 10 friction clutch pulleys of 72 inch diameter and 32 inch face. When the new plant is completed the company will be able to run the entire line of shafting from either one of the two engines.

The receiving pulley of the large engine is 96 inches in diameter and 74 inch face. This pulley is on a hollow sleeve; which rests in its own bearings. The power is transmitted to its line shaft by means of a Hill friction clutch, and a similar arrangement is used for the smaller engine. The belts from both engines are controlled by one of Hill's patent adjustable tighteners, as well as the belt connecting the main line of shaft to a counter-shaft. The clutch mechanism of each pulley is worked by means of a geared operator, by which means the dynamos are started or stopped very easily. The original line shaft has been running for a number of years, and has given most excellent satisfaction.

A DESTRUCTIVE fire, which broke out on the morning of January 13, totally destroyed the works of Thomas H. Lovell & Co., Cleveland, O., manufacturers of electric street railway supplies. The loss to them on machinery and stock amounted fo upward of $40,000, which was partially covered by insurance. This firm, now in the third year of its existence, shows by its rapid growth that it has kept pace in the constant improvement in this branch of industry, numbering among its customers most of the leading roads in the country, including the following: The Brooklyn Street Railway, East and Broadway line, Cleveland, O.; Akron, Canton, Steubenville, Zanesville, Toledo, Youngstown and Alliance, O.; Erie and Scranton, Pa.; Buffalo, Albany and Rochester, N. Y.; Louisville, Ky.; Nashville, Tenn.; Seattle, Washington and St. Louis, Mo. They make a specialty of gearing for all systems, which they turn out in first-class style, both as to material and workmanship. They are at the same time open to receive contracts for all kinds of repair work connected with street railroads, and they also handle several specialties. The firm has resumed operations in new and commodious quarters, No. 5 Water street, and are prepared to fill all orders promptly. N. D. W.

AN OPEN LETTER.

The following letter received from Mr. S. G. Poole, Secretary and Treasurer of the Forrest Silver Bronze Packing Co., 115 Liberty street, New York City, speaks for itself :

TO THE EDITOR ELECTRICAL AGE: We learn that some makers of Metallic Stuffing for Stuffing-boxes have gone about reporting that "Forrest's Silver Bronze Packing" has been taken out of some engines and their Stuffing put in in its place. We desire to state in the most public manner, *i.e.*, through the ELECTRICAL AGE, that such is not the case, and "Forrest's Silver Bronze Packing" has never failed in a single instance to do its work satisfactorily whenever it has been tried, and there is no place in existence where it has been used and rejected. Perhaps Stuffers had better depend on the merits of their goods instead of holding their trade by decrying an article which will best them in a severe test. "Forrest's Silver Bronze Packing" is not a Stuffing, and does not Stuff the Stuffing-box. It Packs the rod. It does not touch the walls of the Stuffing-box ; it stops the steam right at the cylinder, not by excessive friction and pressure on the rod and against the Stuffing-box but by a simple contact with the rod. It simply touches all around the rod, and has a ground joint between the two lower rings excluding the steam from the box—the springs used being on the studs outside and always to be depended on and never lose their temper by the high temperature in the Stuffing-box, but at all times keep the packing in contact with the rod and seated at the ground joint.

If any one really wishes to know whose Stuffing we are replacing with our "Silver Bronze Packing," we have a long list of names, kinds and places to show, but we forbear. We do not consider any of the Stuffing or any devices which press on the walls of the Stuffing-box to get a pressure on the rod as our competitors in any sense.

Is this news to your readers? It is certainly not a very good treatment to us, and we wish to meet them before the public. Yours very truly,

FORREST SILVER BRONZE PACKING CO.,
S. G. POOLE, *Sec.* and *Treas.*

BUSINESS NOTES.

The following letter from Mr. J. S. Rogers, Secretary of the Moorestown Electric Light Co., Moorestown, N. J., explains itself:

Z. Latshaw, Esq., Gen'l Manager National Electric Mfg. and Construction Co., New York.

DEAR SIR: I am somewhat at a loss how to answer your inquiries of the 28th inst., from the fact that we have not yet been running quite a month on meters exclusively. On Jan. 1, 1891, we put all commercial consumers on street lights, and gave the privilege of use of meters to such domestic consumers as desired. As a result nearly all our consumers came into the meter arrangement, except 16 of our heaviest users—those who did not know what a switch or key socket was made for. On Jan. 1, 1892, a resolution was finally passed placing *all* our consumers on meters except the street lights, and meters were put on all consumers by the 15th of January.

We have over 1,900 lights wired on two T.-H. machines of 500 lights capacity each; the minimum number of lights burning in December was 380, the maximum 920, and the average 575. We have three series of street lights of 40 lights each, 25 C. P., 3½ ampères each, which burned 254 hours in December. We manufactured during the month a total of 14,030 ampères, delivered from the machines in 488 hours, from which a revenue of $545.78 was derived, or nearly 4 cents per station ampère. We charge ¾ cents per transformer ampère, so that on the basis of 20 16 C. P. lamps per each station ampère we received actually about ⅙ cent per transformer ampère. The reason for this, as you will note, is obvious, but no accurate figures can be given until after the February run, when we can tell what the new meter consumers are using, and what revenue we derive from them. Some of them will have their bills trebled and even quadrupled on meters. Our street-lighting contract is also too low. We receive $17 per annum per light on moonlight schedule. In the 254 hours burning in December, the three series consumed 2,667 station ampères, equivalent, as above, to 53,340 ampères if transformed, for which we received $170, being about ⅛ of a cent per transformer ampère. In addition to this our plant is not wired to its full capacity, and we can readily carry at least 1,000 miscellaneous lights more, as this would not increase our maximum load beyond what our machines are guaranteed to stand—an overload of 25 %. Based on the earnings of the past 6 months our earnings per annum with the present load will average about $6 per light; wired to our full capacity, without increasing the plant, it should be at least 40 per cent. more than this, or about $8 per light capacity, which would pay us, at present cost of labor and coal, about 10 per cent. on a capitalization of $30,000, with coal at $2.15.

We are now burning 9 lbs. of coal (buckwheat) per station ampère manufactured per hour. Our coal cost us per ampère in December .0091 cents, and our labor 015 cents.

We are yet weak, and are operating in a country town, where it is uphill work.

I have perhaps told you far more than you care to know, and yet not what you asked for, as this is a matter in which I take a deep interest, not only as a manager of the company, but as an investor, and it has been a long fight to get meters introduced here at all. In December, 1890, we were running with a full load on both machines, and were considering what to do to increase our plant. In January we put ⅘ of our lights on meters, and one year later, December, 1891, after adding over 1,000 lights to our consumers' list, our average load had only increased 25 lights. On the first evening when the balance of our consumers were put on meters, in January of this year, our load dropped 60 lights, and maintained that drop throughout the balance of January. Our coal consumption has made a corresponding drop, so that on March 1 we are in hopes a material increase in net earnings will be shown. We are thoroughly convinced that until sugar, coal oil and other commodities are sold by monthly contract there is no profit in selling electric light on monthly contract.

Yours truly, J. S. ROGERS, *Sec.*

P. S.—I might add that the rating of 20 lights per station ampère is too high; 17 lights would be nearer the mark, as a certain percentage is consumed in charging the lines and transformers; there is also a certain drop on long lines, and necessarily, some leakage from grounds, especially in damp weather. I would also add that of the current manufactured a considerable quantity is consumed in lighting the station; we have also placd our station on a meter, as we believe that economy should begin at the foundation. Taking the present ratio of burning in the station since we put on a meter we are burning nearly 8,000 transformer ampères per month, or, at commercial rates, about $60 worth, which represents a reduction equal to the cost of about 2 tons of coal.

The coal consumed also includes the amount used in banking fires during the day. J. S. R.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued February 9, 1892.

468,336. Trolley-Wire Support. Jonathan P. B. Fiske, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 30, 1891.

A trolley-wire support comprising a hanger extending along the top of the wire and a sheet-metal clip extending below the wire and clamped to the hanger at its ends.

468,388. Elevated Electric Conduit. Charles O. Newton, Homer, N. Y. Filed Dec. 18, 1889. Renewed July 25, 1891.

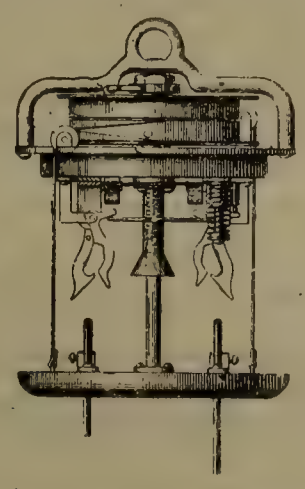
An elevated support for electric wires, having a platform, a central inclosure on platform and footways at the sides of inclosure, and a passage within the inclosure separate from the wireways also within the inclosure.

468,411. Carbon-Holder for Arc Lamps. Samuel P. Parmly, Chicago, Ill. Filed Sept. 30, 1890.

The combination of a carbon-rod with a carbon-holder, the two connected by a swivel-joint, carbon-holder provided with two channels and a thin separating-rib, so as to receive two carbons side by side and a clamp to simultaneously grasp and hold the two carbons in position.

468,412. Arc-Light Globe-Holder. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, of Illinois. Filed April 6, 1891.

The combination of a movable globe-holder with two rods downwardly depending from the lower-carbon support and passing through the holder and securing devices whereby such holder is adjustably secured to the rods and a re-



468,413.—ARC LIGHT HANGER.

movable rest at the lower ends of such rods to receive the globe-holder.

468,413. Arc-Light Hanger for Inside Use. Charles A. Pfluger, Chicago, Ill., assignor, by direct and mesne assignments, to the Standard Electric Company, of Illinois. Filed May 15, 1891.

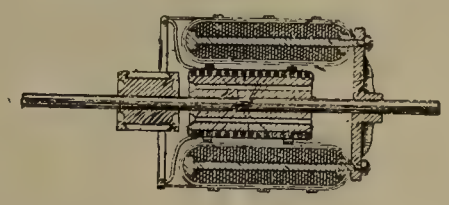
In an arc-light hanger for interior use, the combination of a supporting part with dependent circuit-closing hook attachments, an arc lamp provided with terminals adapted to engage such hooks, a horizontal drum with an interior motor or spring to wind the same in one direction, and suspending tapes or bands passing around the drum in the same direction and over the pulleys to the lamp proper.

468,414. Electric Alarm-Clock. William S. Burroughs, St. Louis, Mo. Filed March 25, 1890.

The combination, with a time-piece, an alarm, and conductors, of an arm moved by the time-piece and a series of contacts arranged at regular intervals along the path of travel of arm, and means for moving the contacts into path, contacts being held normally out of path by springs.

468,416. Dynamo-Electric Machine. George E. Dorman, Chicago, Ill., assignor to the Standard Electric Company, of Illinois. Filed Dec. 17, 1890.

In a multipolar dynamo-machine, a cross-connecting device consisting of a drum within the armature, drum having thereon a series of insulated rings, each ring provided with a series of bars connected to its outer edge and running parallel with its axis, securing-bands which pass longitudinally about the rim of such drum and securing the rings, and surrounding rings which pass about and secure the bars.



468,416.—DYNAMO ELECTRIC MACHINE.

468,426. Electrically-Heated Smoothing-Cylinder. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed May 26, 1891.

In an electrically-heated smoothing device, a cylindrical heating-body of magnetic metal provided with studs or cores, in combination with an electrical conductor forming part of an electric circuit and wound in helices about the cores for heating by resistance and magnetization.

468,451. Magneto-Electric Machine. John Hunt, New York, assignor to James Macbeth, Brooklyn, N. Y. Filed April 24, 1891.

An electric generator comprising a portable box constructed with opposite foot-rests upon which the operator may stand, a magneto-electric machine inclosed in box, a pull up operating handle above the latter, a vertically-movable connection passing from handle through the top of the box, and mechanism connected thereto for imparting rotation to the armature of the magneto-electric machine upon pulling connection upwardly, whereby the weight of the operator standing on foot-rests and the reaction of his upward pull are utilized for holding the box down in place during the operating-stroke.

468,487. Electric-Lighting System. Sylvanus L. Trippe, New York, N. Y. Filed Feb. 25, 1891.

The combination, with an electric generator and a series of two or more circuits, of a switch and transformer and an electro-magnet both interposed between the generator and the circuits.

468,491. Frame for Car-Trucks. David L. Barnes, Chicago, Ill. Filed June 6, 1891.

468,492. Electric-Motor Truck. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed Sept. 16, 1889. Divided and this application filed May 1, 1891.

The combination, with the axles of a truck, of an electric-motor journalled upon one axle by bearings at its yoke end, a journal-box on the opposite axle, and a supporting bar or frame extending from the upper pole-piece and having a spring attachment to the journal-box.

468,497. Lightning-Arrester. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 5, 1890.

A lightning-arrester consisting of a series of conducting particles supported in a form of plastic insulating material and arranged so as to form a succession of small disruptive spaces in the discharge-path.

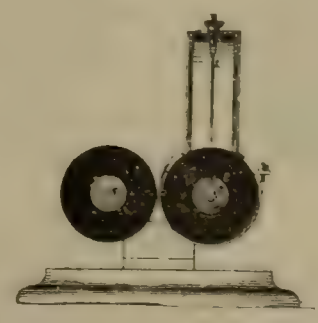
468,500. System for Operating Glow-Lamps by Means of Multiphase Currents. Johannes F. H. Görges, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Sept. 3, 1891.

A system for operating glow-lamps by means of multiphase currents, which consists in a number of rotation-current conductors corresponding to the number of phases of the current, any desired number of glow-lamps, a number of current-introducers to each lamp equal to the number of conductors and connected to the conductors, and glow-bodies at the interior of the lamp electrically connected to each other and to pairs of the current-introducers.

468,526. Motor-Gearing for Electric Cars. Elbert B. Phillips, Cleveland, Ohio. Filed Jan. 6, 1891.

The combination, with a car, of a propelling-motor, two sets of gearing for coupling the motor and axle to drive the latter at different speeds and means whereby the power of the motor may be applied direct.

468,575. Electric-Railway System. William J. Ogden, Baltimore, Md. Filed Nov. 20, 1891.



468,597.—ELECTRICAL INDICATOR.

In a double-track system for street-railways, the combination of a single conductor centrally located between the tracks and having two contact edges and a width to permit two trolley-rollers in contact with opposite edges of conductor to freely pass each other without contact between them and without leaving the conductor, and arms hinged to the cars, respectively, and each carrying a trolley-roller which rests removably in contact with conductor.

468,597. Electrical Indicator. Marion A. Deuel, Rochester, N. Y. Filed July 3, 1890.

An indicator for indicating the condition of a telegraphic or analogous signalling line, consisting of a delicate magnetic needle suspended at one end in a non-magnetic frame or case secured to one of the coils of a main-line signalling-instrument, frame or case being provided with one or more transparent sides through which the needle may be observed.

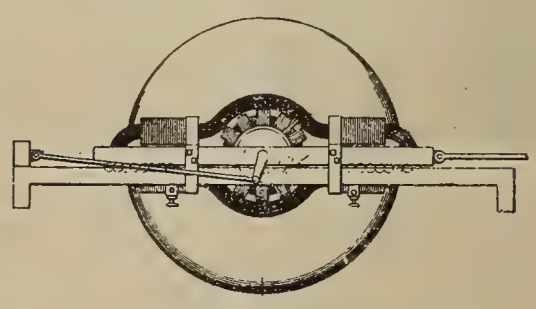
PATENTS—Continued.

468,599. Magnetic Separator. Erminio Ferraris, Turin, Italy. Filed March 13, 1891.

468,654. Electric Connector. George Gibbs, Milwaukee, Wis. Filed Nov. 23, 1891.

In a multiple electric connector, a member provided with conducting-fingers, in combination with a second member provided with corresponding conducting-fingers and with a clamping mechanism to bind the fingers of the two members forcibly together.

468,686. Electric Governor. John T. O'Brian, Kearney, Nebr. Filed Feb. 9, 1891.



468,716.—ELECTRIC MOTOR.

468,711. Electric-Arc Lamp. Addison G. Waterhouse, Hartford, Conn. Filed Aug. 21, 1891.

An electric-arc-lamp frame consisting of a cup-shaped top, having side sockets for receiving lamp-terminals, lamp-top and sockets formed so as to completely cover and surround the regulating mechanism belonging to the lamp and the lamp-terminals, and an anchor-plate electrically connected to one of terminals, anchor-plate and terminals being embedded and rigidly secured in their places by means of cement, which conforms and adheres to the inner surface of lamp-top and sockets.

468,716. Electric Motor. James T. Wilson, Tyrone, Pa. Filed Aug. 6, 1891.

The combination, with the fixed frame and the reciprocating frame mounted thereon, of an electric motor having its armature-shaft journalled transversely in bearings on the reciprocating frame, and a crank and pitman connection between the armature-shaft and the fixed frame.

468,752. Rheostat. Alton J. Shaw, Muskegon, Mich. Filed Oct. 15, 1891.

In a rheostat, an integral bar or body constituting the resistance and a series of plates embedded in bar at points between its ends and projecting therefrom at one side to form contact-surfaces, the plates being of lower specific resistance than the body of the bar.

468,755. Telegraphy. William F. Wentz, Newark, N. J., assignor of one-half to Otto G. Hoerster, same place. Filed Feb. 14, 1891.

In a telegraphic system, the combination, with a main line, including both terminal and intermediate stations and main batteries or generators, of means for reducing the current which is free to flow over the main line, and an electro-responsive apparatus controlling means to make it operate when the main circuit is open.

BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48-inch double belts and six 25-inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., Street Railway Company, two 24-inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway, of Wheeling, W. Va.

EMPIRE STATE EXPRESS.

The Christmas number of *Harper's Weekly* contains a full-page cut of the "Empire State Express" of the New York Central & Hudson River Railroad. This is the fastest train in the world. The cut was made from a photograph taken by A. P. Yates, of Syracuse, while the train was running sixty miles an hour. It shows distinctly the locomotive, No. 862, and four coaches. It is a perfect picture of the train. Some idea of how rapidly a photographer's camera works may be gained from the fact that a train running at the rate of sixty miles an hour moves eighty feet in a second, and the shutter of the camera has to be opened and closed in the eightieth part of a second, in order that the picture be not blurred on the plate. That is quick work; but photography has reached that degree of perfection that it can be done. "The Empire State Express" leaves New York daily at 9 A.M., and makes the run from New York to Buffalo, 440 miles, in 504 minutes, the actual running time being 52½ miles an hour. It is a pleasure to ride in such a train.

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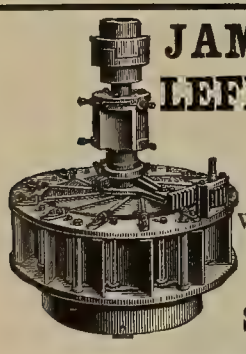
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THE ELECTRICAL AGE.

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OUR HEADQUARTERS AT THE CONVENTION.

The headquarters of the ELECTRICAL AGE at Buffalo during the Convention of the National Electric Light Association will be in Parlor K, Iroquois Hotel. We extend a cordial invitation to all members and their friends to "drop in" and see us.

THE CONVENTION.

Buffalo will be electrified this week, and the presence of so many gentlemen of the electrical persuasion should give the city a shock that will stimulate her electrical enterprise for many years to come.

We trust every member of the National Electric Light Association will feel repaid for his trip to Buffalo. The Convention promises to be an excellent one from a practical standpoint, and those who desire a little relaxation will find plenty of places in and about the city to interest them. One of the grandest waterfalls on the face of the earth is only a few miles from the city, and is easily accessible. A trip to Niagara Falls will no doubt constitute part of the personal programme of many of the members.

The ELECTRICAL AGE will have its headquarters at the Iroquois, and we extend an invitation to all to give us a call.

THE BUFFALO ELECTRIC RAILROAD.

The electric railroad in Buffalo will, no doubt, be inspected by many of the members in attendance at the Electric Light Convention this week, and in view of this fact the description and illustrations we give on other pages of this issue will be of particular interest at this time.

The system of the Buffalo Street Railway Company, when completed, will be one of the most extensive in the country, and in its construction many novel features have been introduced. Buffalo's streets are wide and straight, and this affords an excellent opportunity to attain the highest development in electric railway construction and operation.

While electric railroading is not directly in the line which most concerns those in attendance at the Convention, it has an interest for all electrical engineers, whether they are connected with electric lighting or any other department of electrical industry. The electric road and the electric light are both dependent upon the same force for their operation.

SEARCH-LIGHTS IN THE ARMY.

A novel application of the electric light is in its use for military purposes. Experiments were recently made in England with a view of adopting it for use in the English army, and, according to our information, the results were entirely satisfactory.

The light resembles the search-lights used in the navy, and through its agency the movements of the enemy are made plainly visible. This gives the attacking force all the advantage, as it can plainly see and fire at the enemy with effect, while the lattter, blinded by the powerful light, or prevented by the natural darkness, cannot see the aggressors to return the fire.

From a scientific point of view a war, either on land or at sea, between large powers, would be an affair of great interest. The great improvements made in the science of warfare through the agency of electricity have not as yet been put to a practical test. This is a case, however, where the world will be happier by not knowing how efficient a servant electricity is in warfare. The policy of the foremost nations is to prepare for war in time of peace, but under the present state of the relations between the governments of Europe there is no telling at what moment all of these scientific appliances may be called into practical use.

PROGRAMME OF THE CONVENTION.

The following is the programme of the meetings of the National Electric Light Association, to be held in Buffalo Feb. 23, 24 and 25:

TUESDAY, FEB. 23.

Meeting of the Executive Committee at 9 A.M., parlor, Iroquois Hotel.

Morning meeting, 10:30 o'clock, at Library Building.

Address of Welcome, by Hon. Charles F. Bishop, Mayor of Buffalo.

Address of President Huntley.

Report of Committee on Underground Conduits and Conductors, M. J. Francisco, Chairman.

Afternoon Session at 2 o'clock, Report of Committee Safe Wiring, M. D. Law, Chairman.

Report of Committee World's Columbian Fair, B. F. Sunny, Chairman.

Paper by Richard Hammond, "How to Fire a Steam-Boiler."

Evening Session at 8 o'clock, Paper by Carl Hering, "Transmission of Power."

Discussion by William Stanley, Jr., H. Ward Leonard, L. B. Stilwell, Elihu Thomson and others.

WEDNESDAY, FEB. 24.

Morning Session at 10 o'clock.

Paper by D. Ashworth, "The Allied Powers."

Paper by William Stanley Jr., "The Alternating-Current Motor."

Paper by Erastus Wiman, "Electric Lighting from a Financial Standpoint."

Afternoon Session at 2:30 o'clock.

Paper by M. C. Sullivan, "Switchboards: Their Safety and Operation."

Paper by Charles A. Schieren, "From the Tannery to the Dynamo."

Paper by Allen R. Foote, "Municipal Franchises for Quasi-Public Corporations."

THURSDAY, FEB. 25.

Morning Session at 10 o'clock.

Paper by E. F. Peck, "Overhead Construction."

Paper by E. A. Leslie, "Operation of High-Tension Currents Underground."

Paper by J. B. Craven, "Underground Construction of Buffalo Railway Company."

Afternoon session at 2:30 o'clock.

Paper by L. B. Stilwell.

Report of Secretary and Treasurer.

Report from Executive Committee.

Election of Officers.

DAMAGE TO WIRES BY SLEET.

A severe snow and sleet storm accompanied by a heavy wind, on January 19, was very disastrous to telegraph, telephone and electric-light wires on Galveston Island, Texas. For three days the streets of Galveston were full of fallen poles and tangled wires, and the street-railway companies were unable to move their cars for 24 hours. The Telephone Company suffered the greatest damage and a great part of its system will have to be rebuilt.

THE BUFFALO ELECTRIC RAILWAY.

One of the attractions of Buffalo to the members of the National Electric Light Association will be the electrical industries of the city. Besides the electric-light stations the Buffalo Electric Railway will be of greatest interest to those in attendance.



GENERAL VIEW OF POWER HOUSE, BUFFALO ELECTRIC RAILWAY.

The Buffalo electric railway system possesses some novel features in electric railway practice, and a brief description of the system at this time will no doubt be of interest.

The lines of the company aggregate about 106 miles of single track. Nearly half of this track represents new extensions to the old system, which was purchased by the company. About one-third of the entire system has been completed up to the present time, and the rest of the work will be carried on as rapidly as possible. On the complete system there will be about 300 cars in operation; they will be mainly 32 and 34 feet eight-wheel vestibuled cars. The power-plant of this company is located near Fort Porter, on the Niagara river. The ultimate capacity of the plant will be 5,500 horse-power.

Buffalo is particularly adapted by location to have overhead construction which will be an ornament to the streets. Most of the streets radiate from a common centre, and curves on the line are very few. About one-third of the line will be equipped with centre-poles and the remainder will be cross-suspension. The best type of iron poles will be used throughout. The feed-wires in all portions of the city, except the outlying districts, will be run in underground conduits, the work on which is now in progress.

The power-house of the Buffalo Street Railway Company, a view of which is given, has inside dimensions of 87 x 144 feet. In the construction of this building the main object desired was to obtain a building which would present a substantial appearance and be appropriate to the neighborhood, and at the same time make it as fire-proof as possible. This power-room is said to be one of the largest and finest in the country. The roof is sustained by iron trusses, and a travelling crane, which runs the whole length of the room, has a capacity of eight tons. The crane is operated by a 5 horse-power motor and has two hand trolleys. The walls of the building are of brick and of 20 inches in thickness, with buttresses along the sides 18 feet apart. There are no windows in the sides of the building.

The present engine installation consists of six cross-compound engines, furnished by the Ball Engine Co. of New York. The power of each of these engines is 250 H. P., and each drives a 225 H. P. Edison generator. The balance of the power up to the aggregate capacity of 5,500 horse-power will be added as required. The engines run at 210 revolutions a minute.

The boiler-house is 55 x 180 feet. Only one-third of the entire capacity has been installed up to the present time. The present plant consists of two batteries of Babcock and Wilcox sectional water-tube boilers, with an aggregate heating surface of 12,000 square feet, and designed to carry a working-pressure of 175 lbs. The boilers are fitted for natural and forced draught. Fuel economizers have been put in to raise the temperature of the boiler-feed. Roney mechanical stokers have been adopted for the purpose of feeding the coal to the fires, and the steam-piping is all led to the boilers in underground conduits. The smoke-stack is 150 feet high, with a cross-sectional area of 50 square feet.

The electric machinery is located in the power-house on a gallery, which is shown in the accompanying illustration. From this gallery the control and operation of the generators through switches and regulators, also the control of all the feeder lines leading into the conduits, is brought under the control of one man, and from his position he has an unobscured view of the entire engine-room. Above the dynamo and feeder-switches a double bus-line is run with switches placed between them, permitting the connection of any dynamo or feeder with either one of these two bus-lines, and on the wall behind are located the dynamo, feeder and main ampèremeters. The cable shaft, through which the cables run to the basement connecting the dynamos with the underground system, is located under the gallery.

The system is so arranged that each line of track will have its own independent feed-wires. These feed-wires are connected up to the trolley from underground at every eighth pole, or about 1,000 feet, and the connections are made from manholes. In the underground system two lines of tubing have been used, namely, the wood-pulp pipe of the Indurated Fibre Pipe Company and the cement pipe of the Standard Underground Cable Company. The conduits consist of from two to eight tubes, of 2½ and 3 inches in internal diameter. The manholes are 380 feet apart, and the drawing in of cables is a matter of much facility. All joints are made at the manholes, where they will be accessible in case of necessity.

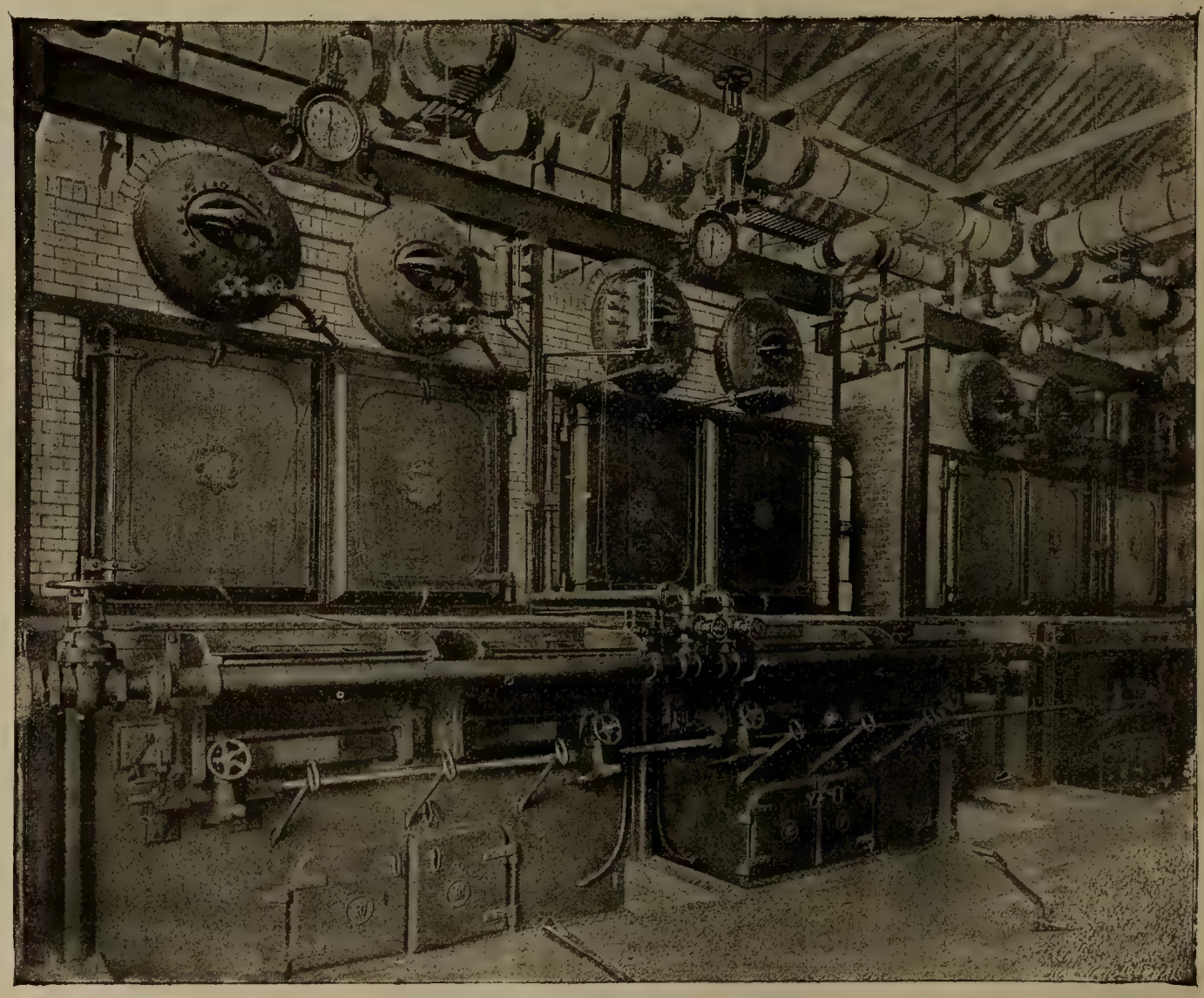
The best insulated lead and jute covered cables are used throughout in the underground conduits. In the first installation of 15 miles of double track there are about 10 miles of conduit, in which there will be 40 miles of No. 0000 conductors; to this must be added about 25 miles of feed-wire of No. 000 in addition to overhead conductors.

The track is being reconstructed and built in a most substantial manner with 56 and 60 lb. girder-rails with a grooved tread. The ties are of heavy Georgia pine placed 2½ feet between centres.

The Gilbert Car Works, of Troy, New York, is filling a large order for cars for this line.

All the construction work of this model railroad, including the buildings, power-plant complete with steam and electric equipment, line construction and conduits, has been carried on under the supervision of the Field Engineering Company, of New York. The work of this company includes everything except car and track work. The plant was designed by the Field Engineering Company under the particular direction of Mr. E. F. White, mechanical engineer of the company, and E. J. Cook, construction engineer. The construction work at Buffalo has been under the direct charge of Mr. A. B. Craven, one of the assistant engineers. Mr. C. J. Field has general supervision over the different parts of the work, and his reputation for carrying to a successful completion all undertakings of this class is well known.

The Buffalo electric road, no doubt, will attract the attention of the attendants at the Convention, and the foregoing facts will be of interest at this particular time.



BOILERS, BUFFALO ELECTRIC RAILWAY.

BUILDING AND CARE OF DYNAMOS.

In erecting large dynamos the magnetic joints must be made as perfect as practicable. The surfaces must be clean and "fairly" bolted so as to come into general contact. Dowel-pins are generally furnished in such joints, and also in the basis of the bearings, so as to insure proper alignment. Warping of castings may occur by reason of unequal foundations. This is a very bad fault. Warping may, however, be caused by the bolting down of other parts than the base. In erecting it is best to observe the rule that no two portions of the iron-work are to be forced into contact by means of bolts or nuts. Joints should lie perfectly "fair" prior to bolting. Foundation-rails, or belt-tightening rails, must be very carefully levelled and free from warping through their length.

Bearings of axis, if not dowelled into alignment, must be so set that the periphery of the armature occupies an exactly central position in the armature-chamber. On no account must the armature be allowed to touch either of the pole-pieces. The shaft should not only turn quite freely by hand, when the boxes are bolted down, but should be allowed an end play of at least one-fourth of an inch. This assists in distributing the oil. As the armature-shaft becomes heated in working it must not be fitted quite full into the boxes, otherwise the expansion will cause binding. The boxes should have spiral oil-distributing channels cut in them, or at the least one longitudinal channel in connection with the lubricator.

Armatures admit only of the most careful handling. They should be lifted by means of the shaft, and in no case rolled over a floor. Brush-holders must be properly bolted together, care being taken that the insulating sleeves, washers or timbers are put in their proper places. Brushes should be trimmed square, so as to bear equally upon the armature segments. They must be free from twist, which might cause them to bear upon the bars with one corner only. The touch must be flexible, and not too heavy. One of the most frequent causes of the destruction of commutators is the too heavy touch of the brushes.

When in work a new commutator should be frequently wiped free from copper dust, and lightly touched with vaseline, or a mineral lubricant, until it acquires the hard, burnished surface which practically eliminates the chance of further wear. The best compound dynamos are now made so perfect that there is no sparking at the brushes, so that mechanical wear is the only matter to be looked after. Attrition, or dry cutting, is always due to a heavy touch of the brushes, and to allowing copper dust or grit to accumulate beneath the point of contact, and to the want of lubrication.

Connecting up of the coils and brushes and terminals will depend entirely upon the nature of the machine. A series dynamo is very easily connected.

When a dynamo is first started a strong current is passed through its field-magnet coils, in order to impart to the core a certain polarity, and leave therein a certain residual magnetism. It is upon this feeble magnetism that the machine begins to excite; and because it is feeble it is easily destroyed by knocks, or it may be reversed by accidental contact with other magnets. In such a case the dynamo will either fail to excite or will give a current in the wrong direction in relation to the terminals. Complete failure of the residual magnetism is rare, but in such a case a sufficient current must be passed from some other source. The massive cast-iron pole-pieces of dynamos or the cast-iron yoke of the field-magnet may generally be relied upon to retain sufficient magnetization.

In "connecting-up" as it is termed, some difficulty is frequently experienced by beginners in determining the proper course of the current, so that it shall correspond with the direction of rotation and the marked direction of current from the terminals. In such case it is best to ascertain, first, the polarity of the field. This can be done with a pocket compass, or a very small bar-magnet, for a N. pole will repel a similar pole, according to the law of magnets. Many rules are to be found in text-books for finding the relative direction of the polarity and the current. If, however, we pick up an ordinary screw-bolt and look at it, end on, that extremity will be a S. pole, if we suppose the current flowing from us, in the direction of the screw. The course of the windings upon the magnet are easily traced, and the connections made accordingly. In making connections a good contact must be insured and the set-screws made sufficiently tight. Connectors are not generally insulated, so that they must be kept well away from field-coils or any of the metallic work.



VIEW ON BUFFALO ELECTRIC RAILWAY.



ENGINES AND GENERATORS, BUFFALO ELECTRIC RAILWAY.

In alternators there is no + and −, so that it is not of any consequence to which of the two collector-rings the beginning or end of the coils is attached. The field-magnets in these being separately excited, do not require residual magnetism for starting, and it is generally of no consequence in which way the current flows around them. The "direction" of the current from any dynamo can be readily ascertained by means of a pocket compass. The operator (facing the north), standing with his back to the machine, places his compass *under* the leading wire. If the current is flowing *from* the dynamo in that wire the N. pole of the compass will turn to his left hand. It is assumed that the normal position of the needle, when out of the influence of the current, is parallel to the wire to be tested.

Before measuring for a belt let the dynamo be screwed upon its slides, as near to the engine or driving-pulley as they will allow. The belt should have an inch of width per horse-power (which is only applicable for moderate powers) to be transmitted, if running at 1,000 feet per minute. For dynamo work thin, flexible belting should be used, and it should have a butt-joint, and in no case a lap-joint. The butt-joint may be made with any of the metallic fasteners, but a well-arranged lacing is to be preferred, and is more flexible. New belting stretches very much, and gives a great deal of trouble until it settles down to its work. For this reason new belts are generally stretched beforehand, or run upon the machine for a time for this purpose. The dynamo is moved away from the driving-pulley to tighten the belt, by means of the slides. Slight slip of the belting, when new, is unavoidable. The belt must not be too tight.

Rope-driving is coming rapidly into favor for dynamos of considerable size, a single or multiple rope being used upon a multiple grooved pulley. There are several advantages in this method of driving, and there is less liability to loss by slipping, or stoppage by the belt coming off the pulley.

BUFFALO NOTE.

J. N. Adams & Co., whose place is opposite the Iroquois Hotel, Buffalo, are putting in a Mather plant with over 100 "Ward" arc lamps. Mr. S. N. Blake, the agent for the Mather Electric Company is installing the plant.

NEW ELECTRIC RAILROAD SYSTEM.

In our last issue we described a test made at Coney Island of a new system of electric street-car propulsion, under the auspices of the American Engineering Company. The system is the invention of Mr. Granville T. Woods, who made an arrangement with the American Engineering Company to put his invention into practical operation. The relations between the parties have, through a misunderstanding, been severed, and Mr. Woods now claims that the company's possession of the patents on his invention were obtained in an irregular manner.

The system is known as the "Multiple Distributing Station System," and possesses features that are novel and distinct from anything ever devised for street-car work. Between the rails, 12 feet apart, are laid iron blocks or "heads" about the size of an ordinary granite paving-block. Each of these iron blocks is connected electrically by an underground wire to the distributing station near by. The distributing stations are built in the form of lamp-posts. In each lamp-post is placed the distributing apparatus, which consists of an automatically operated switch, which connects the feeder-wire with the "heads" as the car passes over each of the latter, and after the car has passed, the "head" becomes disconnected with the feeder and becomes "dead." In this way, only the "head" immediately under the car is alive as the car passes over it. The connection between the "head" and the motor is formed by contact-brushes attached to the car, and when the front brush strikes a "head" the rear brush is just leaving one.

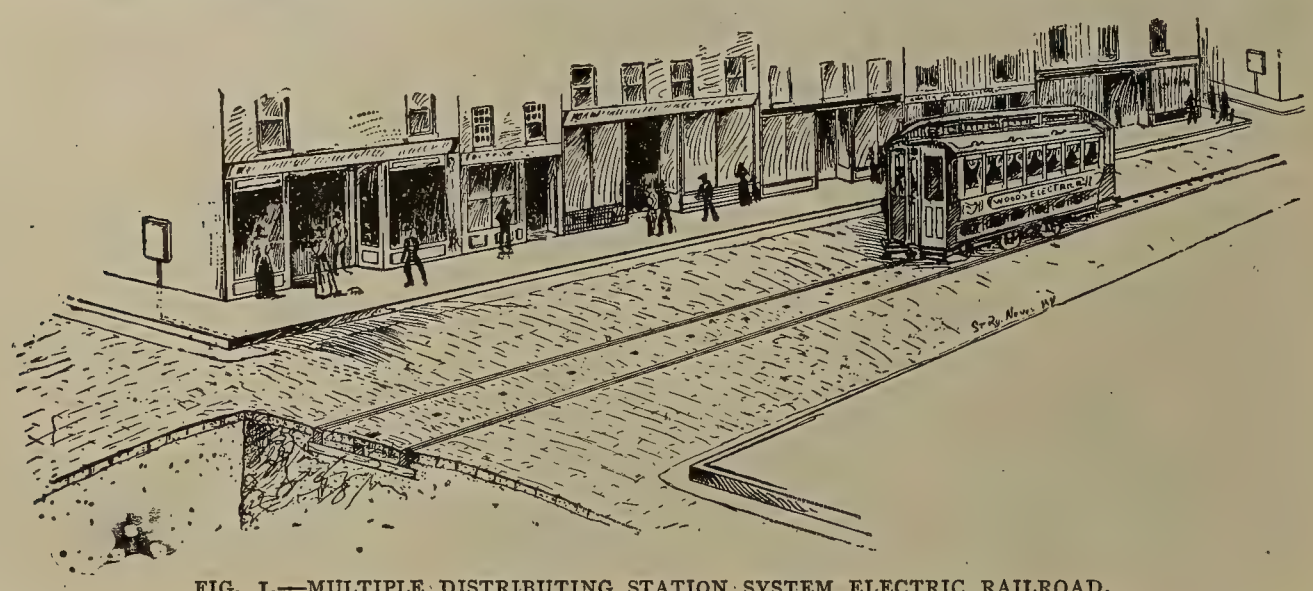


FIG. 1.—MULTIPLE DISTRIBUTING STATION SYSTEM ELECTRIC RAILROAD.

In figure 2 A and B represent two of these distributing stations, showing the contact-pointers, which are turned automatically. In the diagram at the left hand is shown the position of the motor car on the "heads," and the "head" directly under the car, it will be noticed, is connected with the feeder through the automatic switch.

The main features of this system are that there are no wires exposed; no portion of the line is alive except the "head" beneath the car, and a block or derangement on any portion of the line does not affect the operation of the rest of the line.

The system employing distributing stations located a block apart, provides a means for lighting the street along the line with electric lights, without having exposed wires at any point. The same motors and generators now employed on electric lines can be used on this system, the only expense being the installation of the underground wires and apparatus.

The test referred to, from all accounts, was very successful and made a very favorable impression.

It may be mentioned incidentally that Mr. Woods is a colored man of extraordinary ability and intelligence. He was born in Australia, and came to this country when very young. He is the inventor of other electrical apparatus besides the one referred to above, and has received special training in electrical and mechanical engineering. In regard to the litigation which will likely ensue affecting Mr. Woods' patents on his electric system, the affidavits printed in our advertising columns will be of interest. In these a good many facts are set forth, which seem to substantiate Mr. Woods' claims and assertions. Mr. Woods' address is 7 Murray street, New York City.

A large company is projected to take over all of Mr. Woods' electrical devices.

SEARCH-LIGHT FOR ARMY USE.

From a journal published in London, England, we learn that experiments have been made on the exercise ground at Satory, with a new electric light, with a view of adopting it for use in the army, with satisfactory results. The lamp bears a resemblance to the search-lights used by the navy, and the object of its use is to facilitate night attacks.

Through the agency of the light, the movements of the enemy are made plainly visible, whilst those of the attackers remain invisible. This enables the firing upon the enemy without furnishing any guide for them in returning fire excepting of course the flash of their rifles.

The lamp is mounted on a light carriage with high wheels, so that it may be easily transported from place to place as occasion requires.

INCANDESCENT WIRING.

BY THOMAS R. TALTAVALL.

Incandescent wiring is no longer an uncertain factor in an electric-light installation. The vast amount of experience of years is now summed up in the various rules for the determination of the proper size of wire to be used, and the proper method of laying the same. Rules are now laid down which enable the electrician to determine exactly what size wire to use under given conditions and the manner in which it should be run. Of course, one method of wiring will not answer all conditions; wires are sometimes run in damp places, and sometimes in extra warm places; in short, the wiring of any one installation may be affected by half a dozen or more different external conditions. All of these must be duly considered in laying plans for wiring, and any failure in this respect means possible danger to property.

Too much care cannot be bestowed upon the wiring of a building. It is easier to avoid damage than to repair it, and if electric wires are run properly at the beginning there need be no fear of damage by fire. Short circuits may occur, but by the use of the proper protective devices no other damage than the temporary suspension of the current need occur.

Although the rules are now pretty well established, it would not be out of place to give a few of the important principles to be observed for the guidance of those who may not be familiar with methods now adopted in carrying out this class of work.

For inside wiring for incandescent lighting, copper wire must be used, and it should not be less than 95 per cent. in conductivity. The smallest wire that should be used for inside work is No. 16 B. & S., or No. 18 B. W. G. The safe carrying capacity of these sizes is about eight ampères. In the matter of conductivity, the New York State Board of Fire Underwriters, and similar boards in other States, will not grant permission for the use of lights unless the wire comes fully up to the standard of conductivity required by the rules.

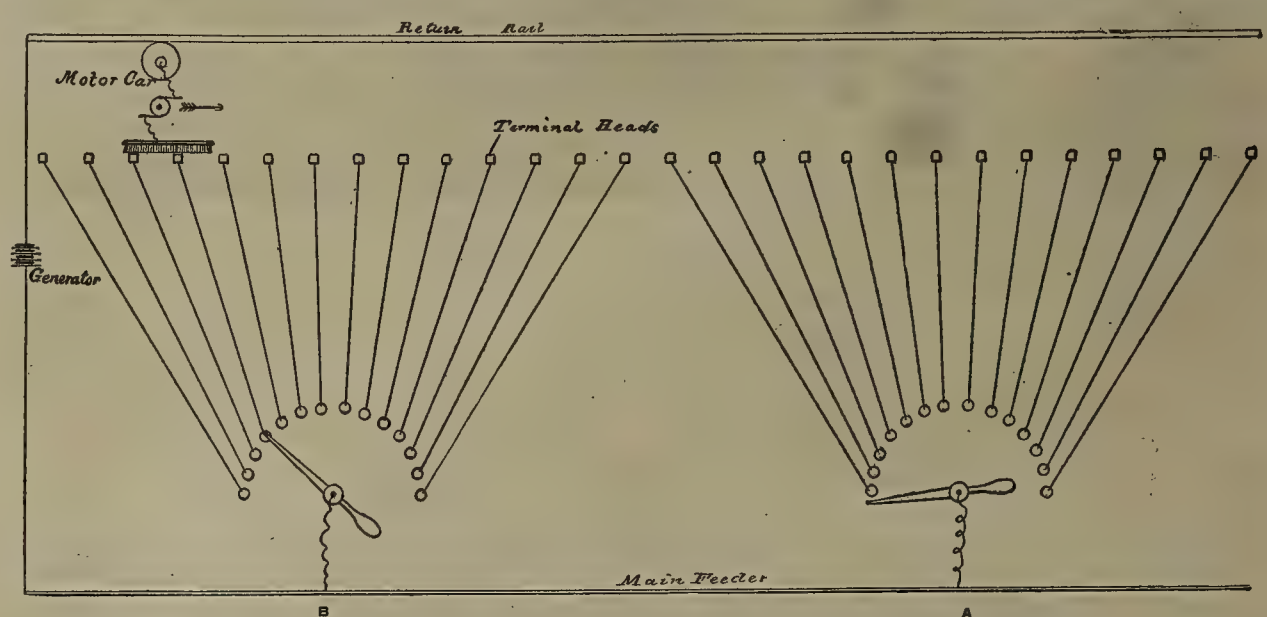


FIG. 2.—DIAGRAM OF CONNECTIONS BETWEEN FEEDER AND "HEADS."

Wires with lead covering, or a covering containing paraffine, should not be used; their use is strictly prohibited by the various Boards of Underwriters. Lead-covered wire for inside work is undesirable, for the reason of possible short circuiting between the conductor proper and the lead covering, and paraffine is objectionable on account of its inflammable nature.

In running wires in wood moulding along walls and ceilings, the wood should be of sufficient thickness to interpose a backing of at least one-fourth of an inch between the wall or ceiling and the wire, and the backing should be protected by at least two coats of waterproof paint. The moulding should in all cases be of such shape as to protect the wire as much as possible from moisture.

In running wires in new buildings, where they are to be concealed from view by walls and ceilings, they should be separated from each other by at least 10 inches, whenever it is possible to do so, and they should be run singly on separate timbers, studding, etc. Cleats should not be used in this work. All concealed wires should be supported on insulators, such as porcelain knobs or other equally as good and non-combustible insulating substance. Wherever it is possible, wires should be kept from coming in contact with any part of the building by means of such insulators, and entire dependence should not be made on the wire insulation itself.

Sometimes it is possible to completely separate the wires from the walls of the building by air-space or insulators. In such cases the wires should be insulated with a waterproof and non-combustible substance. To meet such conditions non-combustible and waterproof tubes made of suitable insulating material can be obtained. These tubes give excellent results, and render the putting in of new and taking out defective wires a matter of easy accomplishment, besides insuring entire safety to the building in case of short circuiting, etc., of the wires.

Great care should be taken in running wires in the neighborhood of metal pipes or other conductors. In crossing such pipes or other conductors the wires should be separated from the same by an air-space of at least half an inch, and means should be provided against their coming in contact with each other. The wires should be run over water-pipes where possible.

Wood moulding should not, in any case, be used in wet places. Wires in buildings or places that are liable to dampness from moisture should be separated from each other by a space of at least 6 inches, and should be supported by glass or porcelain insulators. Too much care cannot be given to the running of wires in such places.

Whenever it is desirable to pass wires through partitions, floors, etc., they should have an extra protection in the shape of glass insulators, or an outer covering of hard rubber.

Wires should never be left exposed where mechanical injury is likely to occur, and they should not be disturbed in any way.

Metallic staples should never be used in wiring for incandescent lighting. There are insulating staples now on the market, and if staples must be used these should be selected. Never run in one groove, or through the same tube, or in the same slot in a cleat, wires of the same polarity but belonging to different circuits, or leading to and from a double-pole switch.

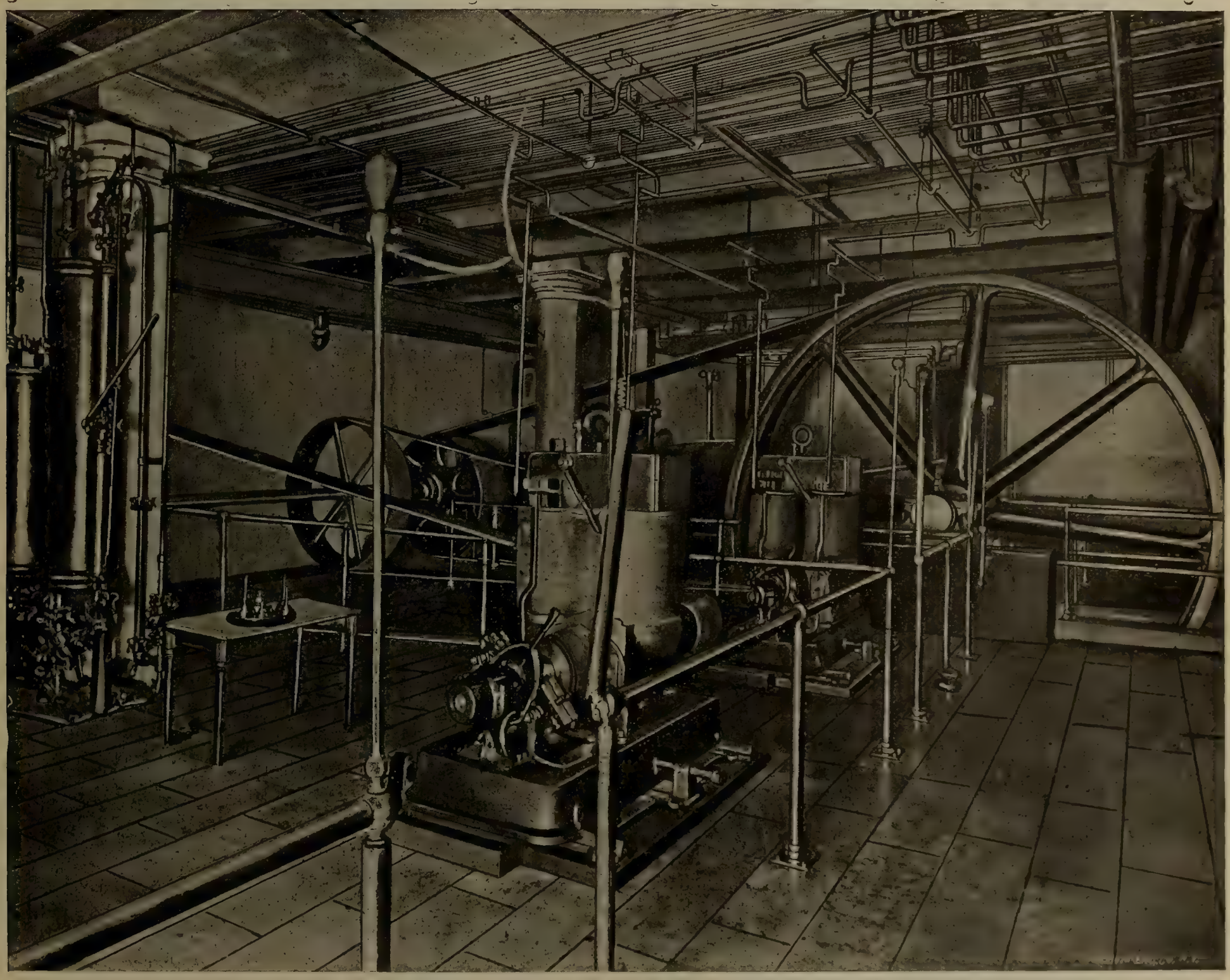
Where wires are placed in situations exposed to acid fumes, vapors of ammonia, etc., they should be insulated with a substance which is not affected thereby.

Too much care cannot be bestowed upon splices, and each must be soldered. Do not overheat the wire, as it is rendered brittle thereby. The insulation of every joint should be as good as that at any other part of the wire.

As the wiring of buildings is really the most important part of an electric-light installation—that is, as far as the safety of the premises is concerned—too much care and attention cannot be given to the work. Contracts for wiring should not be given to any one unable to furnish a certificate or proof of his fitness to undertake work of so important a character. The rules and regulations of the various Boards of Underwriters, require that all parties, firms or corporations, proposing to do construction work or wiring, must be able to give proof of their ability to do the work in a safe and acceptable manner.

ELECTRIC PLANT IN THE PLAZA HOTEL, NEW YORK.

One of the most interesting parts of the large modern hotels of to-day is the steam and electric plants. As a rule the best of mechanical appliances are found in these plants, and no effort is spared to get the very best results.



DYNAMO-ROOM, PLAZA HOTEL, NEW YORK CITY.

As the hotels are improved both as regards to the building itself and interior finishings, so is the electric system which is put into each. The electric-light plant of the modern hotel represents the highest development of the electric-light business in every particular, and, owing to the nature of the service, it is of essential importance to have everything first-class, both as to material and workmanship.

One of the most elegant caravansaries in existence at the present time in New York City is the Plaza Hotel, which occupies a site unequalled by that of any hotel in the country. It faces the famous Central Park, and has an abundance of space around it. A site more favorable could not have been selected anywhere.

The electric-light plant and the interior fixtures for the lighting of this hotel are the most complete of any hotel in the world. The house is entirely lighted by electricity on the Edison system. There are five 600-light Edison dynamos, four of these machines being driven by two Whitehill Corliss engines of 175 H. P. each, and the fifth one is driven by a 50 H. P. Wright engine. The latter machine is used for night lights after 12:30 in the morning.

One of the interesting features of the steam plant is the method of connecting the shafts of the two engines with the dynamos. Three clutches are used on the main shaft, one close to each engine and one in the centre of the shaft. By this arrangement it is possible to connect the entire shaft to either engine with the other engine disconnected, or both engines may each run half of the length of shaft, or they may run both together, the entire power being supplied to the shaft in this case.

The wiring of this hotel was an immense job. About 50 miles of White Core Grimshaw wire of various sizes, from No. 16 B. & S. to No. 0000 were used, and considerable tubing of the Interior Conduit and Insulation Company was used in the installation.

The electric light and bell wiring was done by the Tucker Electrical Construction Company, of New York, which concern also furnished the switches, cut-outs and speaking-tubes.

The hotel is wired for 5,500 lights, and the fixtures were furnished by the Edison General Electric Company. These fixtures were made expressly for the Plaza Hotel, and they are most beautiful pieces of work in this line.

In the restaurant and dining-rooms elegant side-brackets and electroliers are used, and along the corridors the electroliers are of unique design and attract the eye at once by their elegance.

The globes surrounding the incandescent lamps are of elegant cut glass, and were supplied by the Phœnix Glass Company, of New York and Pittsburg.

One of our illustrations shows one of these elegant electroliers in the main entrance of the hotel.

The fixtures throughout represent the highest degree of the art.

Mr. P. Pryival, of 512 to 524 West 42d street, New York, put in all the shaftings, pulleys, hangers, etc., for the Plaza's plant. His extensive establishment is fitted with the finest appliances for the construction of special machinery, and his work is done well.

We give, besides the view above referred to, two views of the engine and dynamo plant of this large hotel, which show in an excellent manner all of the apparatus, and give a faint idea of the magnitude of the plant.

The Plaza may be taken as a fair sample of the excellence and beauty attained it the art of electric lighting.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

A largely-attended meeting of this society was held at its rooms, 12 West 31st street, New York, on the night of February 16. A paper was read by Lieutenant F. Jarvis Patten, entitled "A Proposed New System of Alternating Direct-Current Transformation." After the reading of the paper an interesting discussion took place.

On the evening of February 17 the American Institute of Electrical Engineers and the New York Electrical Society inspected the new operating-rooms in the reconstructed portion of the Western Union Building, corner of Broadway and Dey street, this city. Mr. Alfred S. Brown, the Electrical Engineer of the Western Union Telegraph Company, was present, and explained to the members of both societies the improvements made in this great telegraph plant, also the operation of the various systems of telegraphy.

The Negaunee & Ishpeming Electric Light Company, Negaunee, Mich., was incorporated February 9, with a capital stock of $20,000. Incorporators: Alex. Maitland, John B. Maas, Negaunee, Mich.; and H. O. Young, J. Jones, Ishpeming.

EDISON COMPANY'S NEW PITTSBURG OFFICE.

The Edison General Electric Company has leased a spacious building on the corner of Wood and Diamond streets, Pittsburg, which it now occupies as a branch office and supply depot of the Eastern District. The offices have been most elaborately fitted up and finished, and the store-rooms are being supplied with a complete stock of all kinds of railway and lighting supplies and fixtures. A stock of 25,000 electric lamps of various candle-powers and voltages will be kept on hand, and local dealers or individual consumers can be supplied with any quantity immediately on receipt of orders. This branch is in the charge of Mr. I. H. Silverman.

CONTRACT FOR EQUIPMENT.

The Edison General Electric Company has signed a contract with the Uniontown, Pa., Street Railway Company, to supply that line with five car equipments and a complete station outfit, consisting of two generators aggregating 270 H. P., and all necessary appurtenances. The equipment is to take the place of that recently destroyed by fire.

CORRESPONDENCE.

PRIMARY BATTERIES.

Editor Electrical Age: In your issue of January 30, I pointed out two important errors in the construction of primary batteries that are almost universal in batteries intended for strong and constant current. I wish now to show that many purchasers are misled by statements that may be technically true and yet practically very disappointing.

In Professor Carhart's book upon primary batteries, page 59, we have the following statement, which is doubtless correct: "The copper oxide battery invented by Lalande and Chaperon has a capacity for work, per *unit weight*, greater than any other, either *primary or secondary*." (The italics are mine.) The impression would be made that the battery named would be a very economical one for almost any kind of work, whereas the fact is, it is the most costly to maintain of any yet offered to the public. The E. M. F. is so low that cells must be multiplied largely in order to obtain the required voltage. Its voltage is only two-thirds of the Daniell cell, or .66 volts as given by Thompson.

This low voltage is a fatal defect for closed circuit work, it requiring from six to ten cells to operate a common sewing-machine, as stated in the illustrated catalogue of the manufacturers. It is also misleading to many to state the capacity of the cell by *ampère-hours* instead of *watt-hours*—the impression is made that the cell has double its actual capacity when compared with cells of high E. M. F. It is also the most difficult to manage properly. Much trouble has been experienced in recharging, the destructive nature of caustic potash requiring the greatest care in handling. A layer of paraffin oil must be used to cover the liquid and exclude the air or there will be a loss of two-thirds of the life of the cell.

All these defects and inconveniences, not being properly told, have caused great disappointment; and then the cost of the cells makes the original outlay too great for closed circuit work.

I believe that they are now only recommended for open circuit work where small current is sufficient, their chief value being that no waste is suffered while the circuit is open, which is important.

Another very important matter which is also misleading in Professor Carhart's book is the omission of instruction in regard to the best form and material for diaphragms or porous cups for batteries for strong and constant current. The fact is stated simply that in certain batteries a porous cup is used.

This certainly leaves an incorrect impression, for



ELECTROLIER, MAIN HALL, PLAZA HOTEL, NEW YORK CITY.

I affirm that a proper diaphragm is *indispensable* in batteries of the kind under consideration.

That such a porous cup has been invented and in use is not mentioned. The general teaching upon the subject is that in porous-cell batteries for strong current, it is only a question of time when the depolarizing solution will get through the porous cell, attack and consume the zinc, if the circuit is left open any length of time, while numerous trials have demonstrated the contrary.

We have seen a cell left with open circuit for weeks with no loss of energy or consumption of zinc, and yet the statement given above is being continually made, which is certainly incorrect.

What I have now said, and all of which I hold myself bound to sustain, seems to cover the defects that have generally been met with in the use of primary batteries for closed-circuit work, requiring strong and constant current.

I may safely affirm that the following has been achieved:

A cell of high E. M. F.
A cell of low internal resistance.
A cell free from polarization, at low cost.
A cell without waste of material on open circuit.
A cell with an indestructible diaphragm.
A cell easily managed, with long life and no offensive fumes.

If any one inquires where such a battery can be found they may learn by watching the pages of the ELECTRICAL AGE in the near future.

NEW YORK, Feb. 15, 1892. D. N. K.

BUFFALO—ITS ENTERPRISES AND ATTRACTIONS.

Buffalo may be properly entitled at the present time, "the Convention City." As many of those who will attend the Convention of the National Electric Light Association probably have never visited Buffalo before, we propose to give a few historical and other facts in connection with the city and its growth, which no doubt will be of general interest.

Usually the name of a city has some direct connection with some event or person in the early history of the place, but in the case of Buffalo an exception to the rule seems to exist. The origin of its name seems to be lost in obscurity, and it is a point on which there is considerable difference of opinion.

The site of the present city was inhabited by Iroquois of the Seneca tribe of Indians, who had their chief village here. The name of this village was Tu-Sha-Wa, which, translated, means "Pealed basswood bark," of which the wigwams were constructed. It will be seen, therefore, that the Indian name and its present name bear no relation to each other.

Buffalo is an old city. As a village it was incorporated on April 2, 1813, and on December 30, of the same year, it was burned by the British troops and their Indian allies, who crossed the Niagara river, just above the city. In 1832, Buffalo was incorporated as a city, and its growth up to the present time has been very rapid. On account of its location with reference to the chain of lakes, it is a natural depot for merchandise from the east and west *via* the lakes. It may be titled the Eastern Gateway of the Lakes, and on account of its position with reference to these great inland oceans it will likely always hold its supremacy in the carrying trade.

The first vessel which ever navigated Lake Erie, or any of the western lakes, was built by La Salle, in 1679, near Buffalo, and the first steamboat that ever navigated Lake Erie was built near the city in 1818.

Buffalo at the present time has a population estimated at 250,000, and the reputation for the hospitality of her citizens is national. The city ranges as third in the State, in size, but in commercial importance, is second.



IROQUOIS HOTEL, BUFFALO.



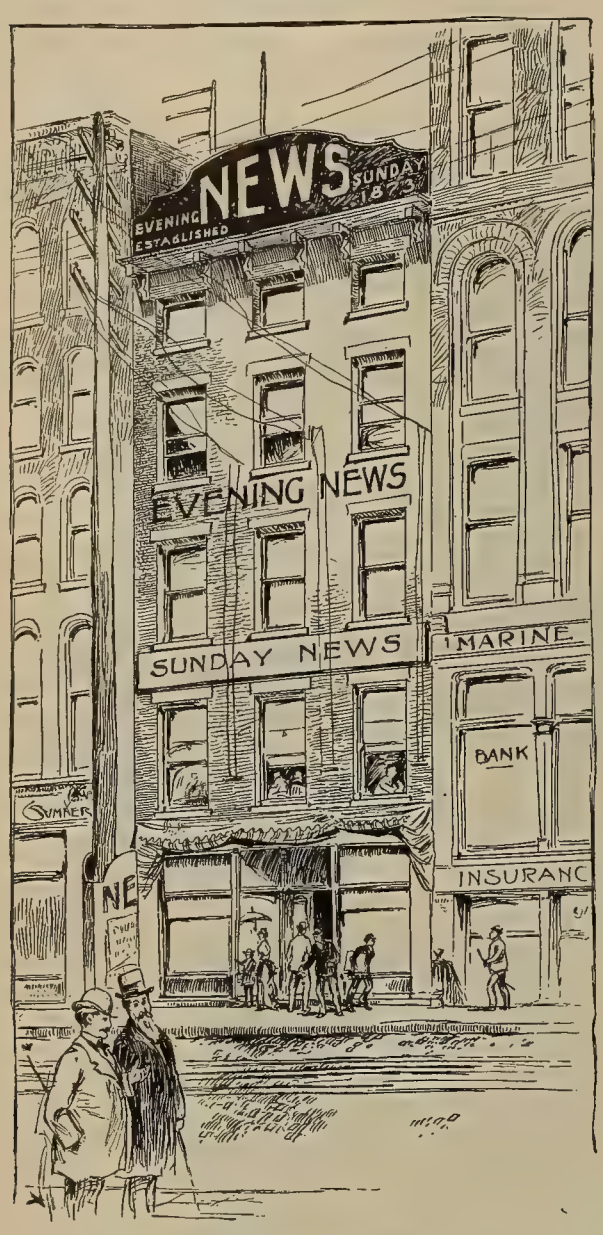
LIBRARY BUILDING, BUFFALO.

Though Buffalo covers a large territory, it is a matter of facility to reach any one point from any other, and the transportation service is quite good. Belt-line trains, street cars, electric cars, herdics, omnibuses and ferries, make the principal places readily accessible.

Buffalo contains many elegant buildings, which show the enterprise and progress of her citizens.

Illustrations of some of these will be found in this paper.

The Buffalo Library Building, in which the meetings of the National Electric Light Association will be held, is shown in an accompanying illustration. It is two blocks from the Iroquois Hotel, and has ample space for the holding of large meetings. It is a substantial, fire-proof structure, built of brick, and cost $378,000. It ranks among the foremost libraries in America and contains 60,000 volumes.



"NEWS" OFFICE, BUFFALO.

Our first view is of the Iroquois Hotel, the headquarters of the Association. It is one of the most important buildings in Buffalo, and is in every way a modern structure. It cost $800,000, and is substantially built, and every means possible were taken to render it fire-proof. Every room throughout the hotel is illuminated by electric light, and the location of the building is a cheerful one, everything necessary for the comfort of guests has been introduced and adopted, and in every way this hotel is first-class. The Iroquois is located on Eagle, Main and Washington streets, and covers an area of 20,000 square feet, with a frontage of 200 feet on Eagle and 100 feet on Main and Washington streets. The hotel is within easy distance of the Library Hall, where the meetings of the Association are to be held.

Among the enterprising concerns in Buffalo is the *Evening News*, an illustration of whose building is given herewith. This journal is the leading evening journal in Buffalo, and is as enterprising as any in the land. Its plant is a modern and complete one, and everything so far devised for the facilitating of handling a large newspaper business has been adopted by the *News*. The establishment throughout is a model of ingenuity and completeness.

Our fourth illustration gives a view of another of Buffalo's important institutions, namely, the operating-room of the Western Union Telegraph Company. This office is one of the most complete in the United States, and 156 employés are necessary to handle the large volume of telegraphic correspondence which passes through this office every day; 205 wires run into the office from every direction, and there are 15,700 cells of battery used for the generation of the current necessary for the operation of the wires.

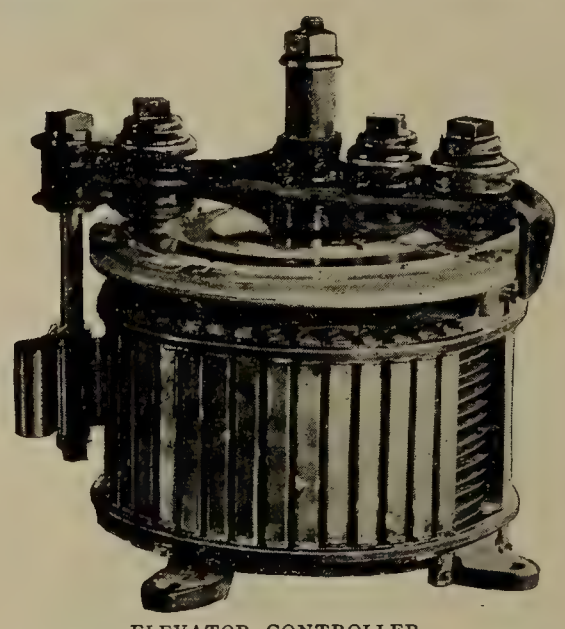
Niagara Falls, as every one knows, is but a few miles from Buffalo, and no doubt many of the members of the Association will take advantage of their close proximity to the Falls and visit this beautiful spot. Trains run frequently from Buffalo, and it is an easy matter to make a visit to the Falls and get back within a few hours.



OPERATING-ROOM, WESTERN UNION TELEGRAPH CO., BUFFALO.

EDISON ELEVATOR CONTROLLER.

The Edison General Electric Company has recently designed and put on the market a new controlling rheostat for use with electric motors running elevators, hoists, and in other places where the conditions require that the motor be started, stopped and reversed continually. The controller consists of a resistance-box of special form as shown in the cut. By the movement of a lever, resistance can be gradually thrown in or out of the motor circuit as required, thus increasing or diminishing the speed of the motor. The lever also carries the contacts required for reversing the motor. This controller can be employed with either shunt or series-wound motors, and possesses the great advantage of an arrangement whereby, before the motor can be reversed, the whole resistance is thrown into the armature circuit. By this means the possibility of burning out the armature by too sudden reversal of the motor is prevented, and



ELEVATOR CONTROLLER.

fluctuations in the voltage of the line wires, by too swift an accession of power, reduced to a minimum. The controller is constructed to carry continuous currents of 15 ampères with all the resistance in circuit, but currents up to 60 ampères can be passed through it without injury, for a short time, when starting the motor. The contact-lever can be worked by a handle or a pulley-wheel, as conditions require. For elevator work, it is fitted with a pulley, around which passes the steel rope which, in the hands of the elevator man, controls the movement of the elevator.

The resistance consists of a continuous series of sheet-iron convolutions, with mica insulation between the convolutions, divided into sections, each of which is connected to a vertical brass bar arranged around the iron convolutions, so that a special contact-shoe on the lever-arm makes a perfect frictional and flexible contact with the brass bars. The lever operating this contact-shoe works over a slate table fitted with brass rings for the main and armature connections. Carbon contacts are used on these rings. As iron, brass and mica are the principal materials used in the construction of the controller, it is able to withstand a very high degree of heat, without risk of destruction. The controller occupies a space 2 feet 2 inches square and 1 foot 10 inches high.

This controller takes the place of the older motor rheostat, and its novelty of form and many advantages which it offers should bring it into considerable requisition in places where the older and more cumbersome styles have hitherto been used, and should make it essential to all new installations of electric elevators or hoists.

OTIS TUBULAR FEED-WATER HEATER.*

One very important object kept in view by the designer was to construct a heater that would not only boil the water when it was new, but continue to heat it to that temperature; and in order to do this, it was necessary to put in a large amount of heating surface, and construct it so that it would not get foul with scale. This was accomplished by doing away with the flat tube-sheet, which is used in all other tubular heaters, and substituting a tube-sheet in the form of a right angle. This tube-sheet is not fastened to shell, and between it and the shell there is ample space through which the sediment can settle to a cool settling-chamber below and away from the tubes, where it can be blown out through the



FEED-WATER HEATER.

mud-blow-off, or be easily cleaned out through the man-hole.

The tube-sheet also serves as the top of oil and water separator, which is something entirely new in a feed-water heater, and is a device, as the name implies, for separating the oil that is carried over from the cylinder and the water of condensation, from the exhaust, which does away with the necessity of a separate or independent eliminator or oil separator. By the use of this apparatus it is practicable to use the exhaust steam (after passing it through the heater) for heating the buildings or for other purposes, and return the condensation from heating system to boilers.

Another object the designer had in view was to overcome the trouble from contraction and expansion caused by using straight tubes fastened to rigid tube-sheets at both ends. This was thoroughly overcome by using a lower tube-sheet which is free to rise and fall, as it is not attached to the shell or bottom of the heater except by the brass waste-pipe which passes through a stuffing-box. The slight unequal expansion and contraction is overcome by the tubes being bent at an angle of 45 degrees, to make proper connection with the water and oil separator.

In operation, the exhaust steam enters the exhaust inlet in the top of the heater, passes down through one section of the seamless brass tubes into the water and oil separator, where the water of conden-

* Stewart Heater Co., 100–112 Norfolk ave., Buffalo, N. Y.

sation and the oil that has been carried over from the cylinder is extracted. The exhaust steam then passes up through the other section of tubes, and can then be used for other heating purposes or exhausted into the atmosphere. The water enters the heater near the bottom (which keeps the settling-chamber comparatively cool, and prevents the impurities forming into hard scale), gradually passes upward in contact with the heated tubes, and is discharged as near the top as practicable, so as not to carry the scum that is on the surface of the water into the boilers.

These heaters are constructed of the best materials the market affords, and are thoroughly tested before leaving the factory. They are shipped on their merits, and if they are not as represented, or fail to do all that is claimed for them, they can be returned, and the manufacturers will pay all a trial has cost.

OFFICERS OF THE ELECTRIC LIGHT ASSOCIATION.

CHARLES R. HUNTLEY, PRESIDENT.

Mr. Huntley, the president of the association, is a resident and prominent business man of Buffalo, being secretary and general manager of the Brush Electric Light Company of that city. He has been with this company since 1888, and it is mainly through his enterprise and energy that the Brush Company in Buffalo has attained the foremost position that it now holds. Under his management the company has made great progress and been very successful.



CHARLES R. HUNTLEY.

Mr. Huntley was born in Winfield, Herkimer county, N. Y., October 12, 1854, and is consequently in his 38th year. He is well known in the electrical fraternity, and is very popular.



M. J. FRANCISCO.

M. J. FRANCISCO, SECOND VICE-PRESIDENT.

Mr. Francisco is a native of Vermont, and he believes in Vermont now and for all time. He is president of the Rutland Electric Light Company, Rutland, to which position he was elected in 1887. Mr. Francisco is closely identified with many financial and manufacturing institutions, not only in his own State, but in Connecticut and New York as well. He is a member of the American Institute of Electrical Engineers and the Electric Club of New York, and is well known in the electrical fraternity. He is one of the enterprising spirits of the National Electric Light Association, and jealously guards its interests.

Mr. Francisco was born August 5, 1835, in Westhaven, Vt. All through his business life he has been closely identified with prominent enterprises, and his vast experience entitles him to occupy the first ranks in the electrical industries that he does.

A. J. CORRIVEAU, MEMBER OF THE EXECUTIVE COMMITTEE.

Mr. Corriveau's features are familiar to all the members of the association and he is the Canadian member on the Executive Committee of the National Electric Light Association. He is a Canadian by birth, and is at the present time president and general manager of the Canadian Electrical Construction Manufacturing and Supply Company, Montreal, Can. The success of the Convention at Montreal last September was very largely due to Mr. Corriveau's efforts and enterprise, and it will be remembered that he spared no pains to make the meeting a success as far as lay within his power. He is the first Canadian elected as member of the Executive Committee of the Association. Mr. Corriveau is now in his 40th year, and since he went into business for himself he has been identified with prominent enterprises in Canada.



A. J. CORRIVEAU.

CROWN SOCKET.*

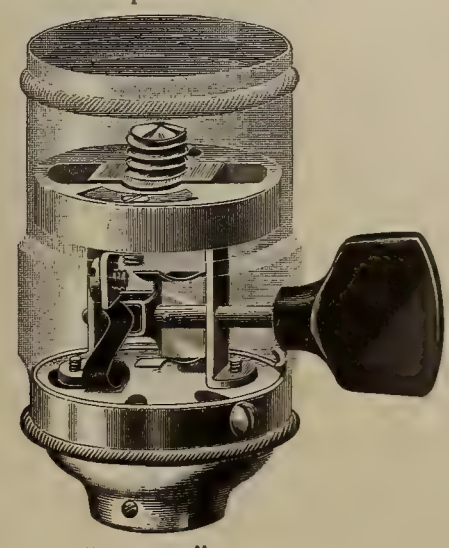
The "Crown Socket" made in two types, with or without key, illustrated herewith, is claimed to be the most perfect yet placed in the market. The claim to superiority over all others is based on its quick and sure break and contact and the perfect locking arrangements of the "Contact Block" which prevents arcing and burning out of terminals. The metal parts are placed in such a manner as to obviate all danger of "short circuits." A point which has been considered faulty in other sockets has been avoided in the "Crown Socket" by the manner in which the centre or lamp screw of the T-H. type is secured to the yoke, which prevents it from being turned when the lamp is screwed on or off. Both key and keyless sockets are made to fit lamps of any system.

"CROWN" KEYLESS SOCKET.

*Crown Electric Mfg. Co., Bridgeport, Conn.

EDSON PRESSURE-RECORDING GAUGE.*

The use of a steam-pressure recording gauge in connection with a steam-generating plant enables the managers of such plants to determine exactly what results they are getting from their coal, and it enables them to run their plants economically.



"CROWN" KEY SOCKET.

The pressure-recording gauge described and illustrated herewith records the pressure carried day and night on a chart moved by clock-work. By referring to this chart it can be determined what the previous pressure has been and the precise time that any excess of pressure, or any other irregularity, occurred. Whenever the specified limit of pressure allowed to be carried is reached, the safety-alarm is sounded, and this instrument will also cause an electric bell, placed at any distant point, to sound simultaneously with it. Attendants at the Electric Light Convention at Buffalo may see these recording and alarm gauges in use in the Buffalo Brush Electric Light Station, of which company Mr. C. R. Huntley, President of the National Electric Light Association, is the secretary and general manager.

These instruments have been in use for many years for recording fluids under pressure ranging from 0 to 1500 lbs. per square inch, and among the leading manufacturers and steam-users who have adopted these gauges may be mentioned the United States and Foreign Governments. These instruments have established a reputation for "maintained superiority" which has given them a preference over all others. They are thoroughly reliable, and may be depended upon to perform unfailingly the important duty of standing sentinel over the pressure of steam.

The steam-boiler is a magazine of stored energy of enormous power, and those in charge, by reason of long immunity from accident, frequently under-estimate, and so grow careless and neglectful. By the use of a reliable recording gauge, however, every delinquency in this direction is checked and a record made of the same.



EDSON RECORDING GAUGE.

Inattention to the firing, which allows the pressure to fluctuate 10 or 20 lbs. at short intervals, strains and weakens the boiler, and those guilty of such mismanagement are often the first to pay with their own lives the penalty of their temerity, and the possible damage to property resulting therefrom cannot be estimated. It is with exact reference to such

*Jarvis B. Edson, 87 Liberty street, New York City.

fluctuations of pressure that this Recording Gauge effects economy, owing to the fact that from 5 % to 20 % of fuel is very generally wasted in the production of a given quantity of steam, simply through such careless and indifferent methods of replenishing fuel and water. Steam-pressure which fluctuates 5 or 10 lbs., up or down, affords the best evidence of such waste.

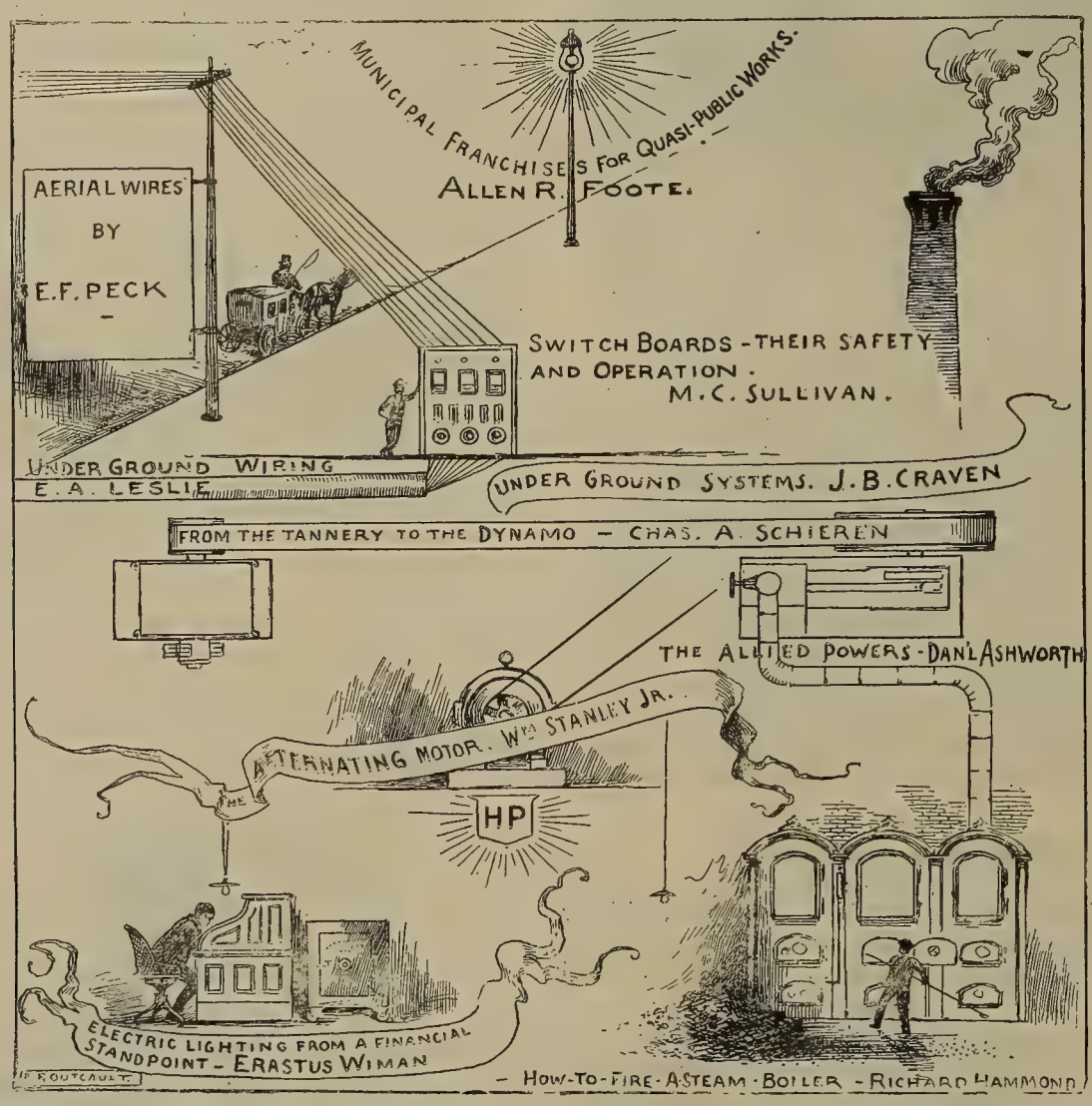
Uniform steam-pressure implies uniform and careful attention to the fires, and this means a saving of many tons of coal per week. The fireman, knowing that the record of steam-pressure he carries is continually inscribed, will be especially watchful. A continuous record of the pressure also enables the authorized inspector more clearly to determine the boiler's condition and limit of safety.

In the use of this register a moment's glance will reveal to the proprietor or superintendent the pressure record of the day, and consequently the fireman will more closely watch his steam-gauge to make his record as directed. Such increased watchfulness means perfect security against high steam or low water.

The value of this apparatus in connection with steam-generating plants cannot be over-estimated.

THE PROGRAMME ILLUSTRATED.

The accompanying diagram represents the "Central Station" of the National Electric Light Association which will be opened at Buffalo on the 23d instant.



"FROSTINE" AND "COLORINE" FOR LAMP BULBS.

Under the names of "Frostine" and "Colorine" the E. P. Gleason Manufacturing Company, New York, has introduced an enamel for either roughing, giving a ground-glass effect, or coloring incandescent lamps, as the names indicate.

Experiments were begun about a year ago with various dyes and other coloring matter, but it is only within six months that the present mixtures were finally adopted as standards. It is important that an enamel should stand a fair amount of both heat and cold, resist the weather and not scratch or leave the glass in handling. For effect, it should be easy of application, dry smooth, even and brilliant so that the rays of light will pass straight through, and have the appearance of being colored glass. These properties are possessed by "Colorine," which is bottled in five colors, viz.: Ruby, Blue, Green, Amber and Canary, though a combination of two or more of these colors will produce almost any other. Ruby and blue, for instance, will make purple, canary or amber, and blue various tints of green, etc.

"Frostine" possesses all the desirable properties of "Colorine," but instead of coloring lamps it gives the glass a very fine, even ground or frosted surface, resembling the new styles of "satin finish" globes introduced on gas and electric lights by the Gleason Company last spring. The glare of the incandescent filament is reduced and diffused, as in the ground-glass lamps, but instead of cutting off 30 per cent. of the light only about 20 per cent. is lost.

The liquid can be poured over the glass of the lamp, or a quantity may be poured into a goblet and the



lamps dipped into it up to the desired distance, either in part or whole, and suspended for a few moments, so that the drops will fall from the sealing point. "Frostine" dries in about 40 seconds.

When applied to arc-lamp globes, a camel's-hair brush is used. The enamel can be removed by pure grain alcohol and muscle.

A bottle of either of the enamels will cover one hundred lamps, costing about one-half a cent each. Several large stationers, however, buy "Frostine" by the quart, as in that quantity it costs much less.

The formulæ is the concoction of Mr. E. F. Gennert, second vice-president and superintendent of the E. P. Gleason Mfg. Company. This company is the sole owner of this very valuable and welcome adjunct to the equipment of a well-regulated electric plant.

NEW THOMSON REFLECTING GALVANOMETER.

Messrs. Queen & Co., of Philadelphia, have just added another to the list of high-grade electrical test instruments of their manufacture, for which they have justly acquired a national reputation.

In the Thomson Reflecting Astatic Galvanometer, with four coils, described here, Queen & Co. lay claim to nothing more than to having combined all the best features of construction suggested by theory or embodied in other instruments. In designing the instrument, four objects were held in view as necessary to attain: 1st, Maximum insulation of the strictly electrical portions of the instrument; 2d, Maximum sensibility; 3d, Application to a wide range of use; 4th, Convenience in adjustment and quickness in working.

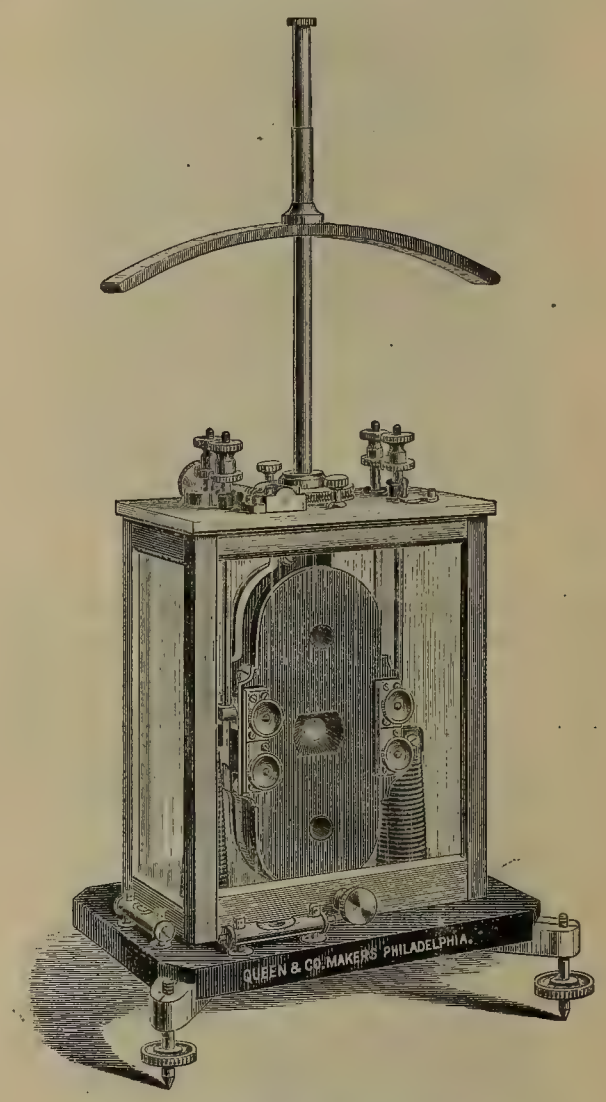
To attain the first desideratum, that of high insulation, the entire framework of the instrument, to which are fastened the coils proper, has been supported by two highly-polished corrugated rubber pillars, each $3\frac{1}{2}''$ in height, the corrugations so increasing the insulating surface of the pillars as to make them each equivalent to a *plain* pillar 7 inches high. The terminal binding-posts of the coils, also, instead of being screwed direct to the base, as is the usual practice, are so arranged that they go direct to the coils themselves without touching the base or outside case of the instrument.

To secure maximum sensibility the upper and lower sets of coils have been separated a little more than usual, and the mirror placed between the coils; this allows the conical space usually left in the upper coil (to allow the reflected ray to go to one side or another of the normal) to be completely filled with wire, this space being, of course, utterly lost in the usual pattern of this Galvanometer. To secure even greater sensibility the bounding surfaces of the coils have been carefully calculated out and the wire "graded."

All parts of this Galvanometer are made exactly to gauge, and the coils are so arranged that they can be easily and quickly taken off and replaced by others of a lower or higher resistance.

In place of the usual box-level are two hermetically-sealed and brass-encased spirit-levels set at right angles to one another.

Other portions of the instrument are much the same as in the usual patterns.



NEW REFLECTING GALVANOMETER.

This Galvanometer has been completed for several months, but Queen & Co. would not allow it to be sold until their tests upon it were thoroughly completed. These tests have now, however, all been made, and full information will be furnished to those desiring it.

The tests upon this Galvanometer have shown it to be superior in every way to any Thomson Galvanometer which has ever yet passed through Queen & Co.'s hands. The best Galvanometer of which they have record is one sold through them some time ago, which gave a deflection of one scale division with scale 36″ from mirror through 5,700 megohms, with 1 Daniell cell, or about 52,000 megohms, with 1 volt, the resistance of the instrument being about 6,500 ohms. An instrument of Queen & Co.'s, of the same resistance, gave a deflection of 1 scale division, scale same distance from mirror, through 68,000 megohms, with 1 volt. In both of these tests the lamp and scale method was used.

In finish this Galvanometer is fully equal to the products of the leading European makers, while the workmanship throughout is of the very best.

Messrs. Queen & Co. also have a new and improved Tripod Galvanometer, lately made, which they are now testing and which they hope to be able to place before the public very shortly.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Feb. 20, 1892.

MR. J. STANFORD BROWN, the well-known electrical engineer, formerly of 136 Liberty street, is now the business manager of the *Electrical World*.

THE following-named gentlemen were in town during the past week: E. E. Higgins, general manager of the Short Electric Railway Company, Cleveland, O., and W. H. Beatty, of the Novelty Electric Company, Philadelphia, Pa.

MR. J. A. CROSS, who has had his office for some time in the Electrical Exchange Building, 136 Liberty street, this city, is making an enviable record as an electrical and consulting engineer, and whether as such for railway or lighting plants Mr. Cross will always be well in the van.

WE have to return our thanks to The Direct U. S. Cable Co., 40 Broadway, this city, for a very handsome and unique paper-cutter, on both sides of which is a calendar for 1892, and map showing the extensive cable system of its connection, the Eastern Telegraph Co., of London, England.

MR. ANDREW CARNEGIE has imported some electrical apparatus for use in connection with the scientific play, "A Trip to the Moon," which is being put on the stage at Carnegie Music Hall, 57th street and Seventh avenue, this city. This apparatus will produce realistic effects, which are unequalled by any other method.

THE HANSON BATTERY LIGHT AND POWER COMPANY, of Washington, D. C., is exhibiting at the offices of the W. S. Hill Electric Co., 514 Electrical Exchange, this city, a complete electric-light plant, composed of a number of special primary batteries set up in connection with a circuit on which a number of incandescent lamps are being run.

H. G. MADDEN, manufacturers' agent, 18 Cortlandt street, this city, is doing a large business along his special lines. By dealing directly with him jobbers and consumers avoid the necessity of paying large prices for the maintenance of bond-holders and high-priced officials. Mr. Madden deals in hard and soft drawn, water-proof rubber, insulated copper, and iron or steel wires and cables, and also carries a full line of electric light and railway supplies of high grade. Among his specialties are Conger tin shades and reflectors and Crown incandescent lamp-sockets for any system. He is constantly on the lookout for new and good things, so that he may be able to keep his customers abreast of the times.

J. B. EDSON, 87 Liberty street, this city, maker of the well-known steam-pressure recording gauges, reports active sales for the recording gauges in electrical and other fields where steam is employed. He states that all of the leading electric light and power plants in New York City and Brooklyn are now using his recorders with the best of satisfaction and results, and the same may be truly said with regard to other large cities where electric light and power plants are operated. In some instances two or three of these gauges are used on different nests of boilers. Mr. Edson has received many testimonials from his patrons giving figures showing where the use of his recording gauge has saved them money and annoyance, copies of which testimonials may be had for the asking. All operators of steam plants of any description should consult Mr. Edson.

THE "C. & C." ELECTRIC MOTOR COMPANY has established a branch at Chicago, where it will occupy the large ground-floor store at 201 Madison street, that city. The same admirable facilities for the convenience of its customers noticed in the New York house will be found duplicated in the Chicago establishment, where the company will carry in stock all sizes of the "C. & C." motors and dynamos; also parts of same for replacing worn or broken machines. Users of electric power located in the West are cordially invited to call. The intention in establishing this branch office is to extend the same privileges to purchasers in Chicago, both as respects prices and delivery of machines, that would be obtained by direct application at the company's factory in New York. The company has also opened a branch establishment in Portland, Oregon. It is admirably located at 53 and 55 North Front street, where all sizes of the "C. & C." motors and dynamos, and parts of same for replacing worn or broken machines, will be carried in stock. Parties located in that territory having business with the company will find the Portland branch a great convenience, as the same careful attention and satisfactory service will be given the wants of customers there as is noticeable in the New York headquarters.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,825,000	100 00	63 75
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 50
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	†20 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	107 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000		*102
Brush-Swan E. L. Co. of N. E	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Commercial Cable Co	7,716,000	100 00	150 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	113 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*190
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	81 00
Edison Electric Light Co., Phila	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	99 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	44 00
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	14 75
Franklin Electric Co., N. Y	5,000,000	100 00	†83 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	51 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*92
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	109 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., N. Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	21 00
Laclede Gas pref	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s	20,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P	50,000	100 00	110 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	20 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P Co. 6s, Ohio	50,000		*95
North American Railway Co	39,767,200	100 00	16 75
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	55 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Ongley Electric Co., N. Y	250,000	100 00	85 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500,000	100 00	80
Thomson-Houston Electric Co	6,000,000	25 00	60 00
Thomson-Houston pref	4,000,000	25 00	28 50
T.-H. Electric Co. 5s, Boston	500,000		*100
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Vine Street Motor Co. 6s, Colo	100,000		*95
Western Union	86,188,852	100 00	87 50
Westinghouse Electric Co	7,000,000	50 00	14 50
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	50 00
West End L., Boston	13,550,000		18 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

CROCKER-WHEELER ELECTRIC CO.

The Crocker-Wheeler Electric Company, New York, has just shown a full line of motors, fan and pumping outfits, automatic switches, etc., at the Crystral Palace Exposition, through its agents, the General Electric Company, Ltd., of London, and has come out as usual with flying colors. It has been the policy in time past for English manufacturers of motors to decry machines of American manufacture, but the General Electric Company now has an acknowledgment in writing, from Messrs. Crompton & Co., makers of the best English dynamos and motors, that their various attempts at making small motors have been failures when compared with the machines put upon the market by the Crocker-Wheeler Electric Company. Theyhave also made arrangements with the General Electric Company to publish a list of Crompton & Crocker-Wheeler motors. One part of the list will deal entirely with the Crocker-Wheeler motors, and on the frontispiece they will state that they have taken up their sale by special arrangement with the General Electric Company, who is the sole representative of the Crocker-Wheeler Electric Company in London. This is a great victory for goods of American manufacture.

IN BUSINESS FORTY YEARS.

While the electrical industry is of comparatively recent growth, yet it is interesting to note that a few of the leading companies engaged in it date back a good many years and were well established in business before electricity claimed the public mind to any considerable extent.

Prominent among such houses is the establishment of Queen & Co., Philadelphia, who, for nearly 40 years past, have been the leading scientific instrument house in the country.

The readers of this journal doubtless know Queen & Co. only as makers of high-grade electrical apparatus, such as ammeters, voltmeters, galvanometers and resistance-boxes, and it may be something of a surprise to learn that besides goods of this character, they manufacture or import everything scientific, from an opera-glass to a surveyor's transit, and from a photographic camera to an equatorial telescope. The business is divided into eight distinct departments, each one of which is conducted by a separate management and like so many different firms doing business under one roof.

It takes sixteen large catalogues to advertise the products of this firm, and when bound together the volume presents the appearance of a good-sized encyclopædia, and is most valuable for scientific reference.

They recently removed their offices, show-rooms and warehouse from 924 Chestnut street, to 1010 Chestnut st., where a much larger building affords the desired facilities for attending to the vast business which comes from all parts of the world.

The factory in which Queen & Co. make their scientific apparatus is quite near the main building on Filbert street. Here 75 skilled mechanics are employed, and the machinery and special tools are of the latest designs. A foundry is part of the establishment, where all castings are made.

In connection with the electrical department, a new testing laboratory has recently been located at Ardmore, a few miles from the city. No expense has been spared to make this testing department so complete that every sort of work can be done with the greatest accuracy. Special dynamos, storage-cells, special galvanometers, resistance-boxes and standards of resistance, current and E. M. F., have been installed, and are in charge of competent men, trained specially for the work.

In consideration of all the important changes noted above, and which have been recently made in the establishment of Queen & Co., we predict for the house a great future.

EASTERN NOTES.

COL. BURNHAM, Vice-President and Manager of the Electric Gas Lighting Company, 195 Devonshire street, Boston, who is enjoying a short vacation in Bermuda, is expected back shortly.

I MET Mr. R. D. Nuttall, of R. D. Nuttall & Co., of Allegheny City, Pa., and 29 Broadway, New York City, also their general travelling agent, Mr. C. J. Mayer, last week in Boston. The firm of R. D. Nuttall & Co. is well known throughout the electrical and street-railway fraternity for its superior workmanship in fine machinery and tools, motor gears, pinions, bearings, etc. This company is the manufacturer of and agent for the celebrated Emmet Trolley.

THE EASTERN ELECTRIC CABLE CO., 61–65 Hampshire street (Roxbury District), Boston, is still being pushed day and night, to fill the ever-increasing orders. The "Clark" wire specialties, manufactured by this company, which are so well known, are constantly being used by the T.-H. Co., who, although being offered a guarantee, as is usual with the Eastern Electric Cable Co., refuse the same, upon the grounds that the products of this company require on guarantee.

D. L. T.

THE GREAT COAL DEAL.

The Reading Railroad's recent acquisition of the Lehigh Valley and New Jersey Central Roads, the most stupendous railroad deal ever consummated in the world and the most startling financial operation of the age, will have consequences so momentous and far-reaching as to be almost beyond the grasp of the average mind. Not only does it make the Reading Railroad the most powerful corporation in the United States and the largest employer of labor on the civilized globe, but it practically constitutes its president, A. A. McLeod, the dictator of the anthracite coal trade and the arbiter of the fortunes of the vast interests and industries dependent upon the trade.

No apprehension need be felt as to the effect of the new order of things upon the prices of coal. While it is expected that the aggregated net profits of the unified Reading system from this source will be increased $6,000,000, neither furnace nor foundry nor poor man's hearth will be taxed a penny to bring about this result.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued February 16, 1892.

468,818. Multiple Switchboard. Walker Moseely, London, England, assignor to the Western Electric Company, Chicago, Ill. Filed Dec. 26, 1888.

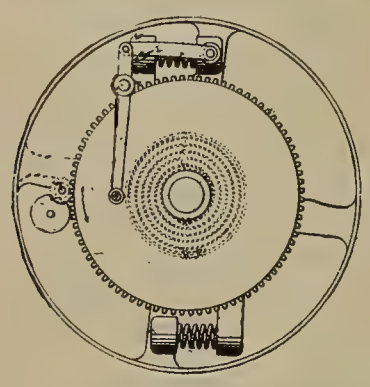
The combination, with two or more switchboards with which telephone lines are connected, of chain-toggle devices, one for each of the telephone lines, each of chain-toggle devices being drawn taut by the insertion of a plug in any switch of the line corresponding thereto to lock the other switches of line on the other boards out of employment.

468,880. Electrolytic Cell. Ernest A. Le Sueur, Ottawa, Canada. Filed June 6, 1891.

An electrolytic cell having a bell of earthenware, a positive electrode within bell, a supporting-rod for positive electrode projecting through the bell, and a collar or bell-shaped part rigidly secured to supporting-rod and having the space between the downwardly-projecting edge thereof and the top of the bell sealed.

468,887. Electrolyte or Depolarizing Solution for Galvanic Batteries. Samuel Miller, London, England, assignor to Evelyn Glover, same place. Filed Oct. 16, 1891.

An electrolyte or depolarizing solution consisting of or

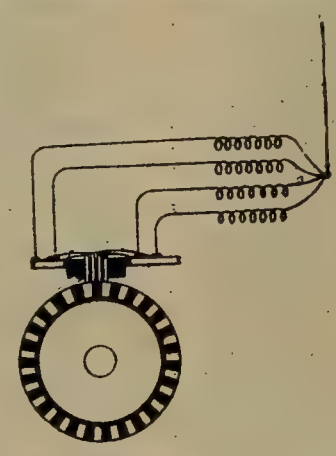


468,947.—DYNAMOMETER.

containing nitrate of soda, bichromate of potash, chloride of sodium, and a suitable acid.

468,903. Electric Elevator. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Company, Chicago, Ill. Filed Aug. 28, 1891.

The combination, with an electric motor, of a reversing-switch, resistances operated by switch, independent additional resistances in the armature-circuit, a contact-brush for additional resistances, positively connected to the main switch during the first part of the travel of the switch but free to move when released, electrical devices controlling contact-brush, means to move the contact-brush against the action of the current in electrical device, and means to



468,950.—COMMUTATOR-BRUSH.

increase resistance in the field-magnet coils after all other resistances are cut out.

468,938. System of Distribution of Electrical Heating Currents. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed May 14, 1891.

In an apparatus for distributing electric currents for heating purposes, the combination of an electric converter, conducting-rods extending therefrom, adjustable clamps on conducting rods, conductors leading from clamps to different electric heaters, and rheostats disposed in the branch circuit of each heater.

468,947. Dynamometer. Edgar J. Wood, Brooklyn, N. Y. Filed Nov. 27, 1891.

In combination, a load-carrying shaft, a record-receiving disc free to rotate independently of the load-carrying shaft, an arm fixed to rotate with the shaft, a movable part having a yielding connection with the arm and thereby with the shaft and serving to transmit power from a source of power to the shaft, a traverse-arm under the control of the movable part and carrying a marker, and means for rotating the record-receiving disc independently of the load-carrying shaft and its actuating power.

468,950. Commutator-Brush for Electric Motors and Dynamos. Thomas A. Edison, Llewellyn Park, N. J. Filed April 4, 1891.

EMPIRE STATE EXPRESS.

The Christmas number of *Harper's Weekly* contains a full-page cut of the "Empire State Express" of the New York Central & Hudson River Railroad. This is the fastest train in the world. The cut was made from a photograph taken by A. P. Yates, of Syracuse, while the train was running sixty miles an hour. It shows distinctly the locomotive, No. 862, and four coaches. It is a perfect picture of the train. Some idea of how rapidly a photographer's camera works may be gained from the fact that a train running at the rate of sixty miles an hour moves eighty feet in a second, and the shutter of the camera has to be opened and closed in the eightieth part of a second, in order that the picture be not blurred on the plate. That is quick work; but photography has reached that degree of perfection that it can be done. "The Empire State Express" leaves New York daily at 9 A.M., and makes the run from New York to Buffalo, 440 miles, in 504 minutes, the actual running time being 52⅓ miles an hour. It is a pleasure to ride in such a train.

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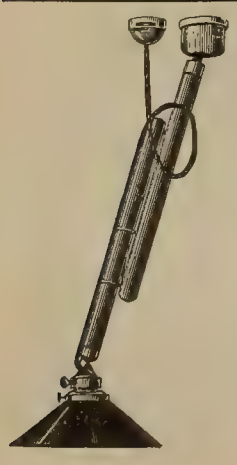
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THE ELECTRICAL AGE.

VOL. X. NEW YORK, MARCH 5, 1892. No. 10.

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NEW YORK, MARCH 5, 1892.

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THE BUFFALO CONVENTION.

"We close this Convention with the firm conviction that it has been the most successful one in our history," are the closing words of a resolution passed unanimously on the last day of the Convention of the National Electric Light Association at Buffalo last week.

That the Convention was the most successful ever held by the Association is not a matter of personal opinion alone, but the fact has been recorded officially, and it is fair to presume that it was in every point superior to all preceding ones, else there would not have been any occasion for so unusual an endorsement.

To express our own opinion, it was a remarkably successful meeting, and every one whom we interviewed on the subject had but one word to say in regard to it—that word was "successful."

What made it so eminently successful?

In the first place it had a man as president who is energetic, full of life and business, and who had the welfare of the Association at heart. Besides this, he has great popularity, and the members did not hesitate to do their part in aiding him to make the meeting a success.

In the second place, there were a greater number of prominent electricians present than ever before attended preceding conventions, and this fact gave the meetings wonderful interest. Everything seemed to conspire in favor of a large attendance of these "giants" in the profession, and we trust that it will be practicable to secure their presence at the next and subsequent meetings.

In the third place, the character of the papers read was of an extraordinary high degree, and practical in the extreme.

The whole thing was planned with great skill and jndgment, and the result reflects great credit upon the man who was at the head of the Association. It required a vast amount of work, time and persuasion on his part, and it was a grand tribute to his popularity to rally to his support as was done.

The new president is a man of like character, and extremely popular, and we hope he will receive as much encouragement and support as did his predecessor.

There was the utmost good feeling from beginning to end, and we trust that the Association may continue its grand work for many years to come

We congratulate Mr. James I. Ayer on his election to the presidency of the Association, and bespeak for him the hearty good-will and support of all the members, and to the retiring president we extend our sincerest regards, which sentiment, we opine, is shared in heartily by all who know him.

EXHIBITS AT THE CONVENTION.

The exhibits at the Buffalo Convention were more numerous than was generally expected they would be, although none was particularly extensive. They consisted, in the main, of samples, and as far as they went they were very creditable indeed. Exhibitors kept straggling in all through the Convention, some coming to the front even on the last day.

For the most part the exhibits were placed in the parlors and rooms of the hotel; some, however, were displayed in conspicuous positions in the hotel lobbies and attracted considerable attention.

One usually hears it said at these conventions that the central-station men do not attend them to transact any business, but go to teach and to learn. This, no doubt, is the primary motive of their attendance at conventions; nevertheless, some of them do give orders for supplies and apparatus, judging from all reports. We heard of quite a number of sales of goods of various kinds. If there was no business to be secured at a convention, probably the supply men would not go to all the expense and trouble to exhibit goods; but if the aggregate results of the business at these meetings could be ascertained, it is more than likely that the gains would far more than offset the losses.

OUR HEADQUARTERS AT BUFFALO.

The headquarters of the ELECTRICAL AGE in Buffalo during the Convention last week were in Parlor K, at the Iroquois Hotel, and were for a great portion of the time thronged with callers. Each visitor was invited to record his name in the ELECTRICAL AGE register, which was kept open at all times for inspection, and delegates naturally referred to it when they desired to ascertain if any particular one of their friends or acquaintances was in attendance at the Convention.

While one portion of our staff was busy entertaining our friends and callers, another portion was at the printing office hard at work on the daily edition of the ELECTRICAL AGE, which was issued during the three days of the Convention.

Our daily edition, as usual, was one of the features of the Convention, and its appearance each afternoon was as eagerly looked forward to as a hungry man looks for the coming of his dinner. It kept everybody posted as to who was in attendance at the Convention and what was going on each day. It was entirely successful in its mission, and the staff, upon whom so much labor devolved, greatly appreciated the hearty reception the paper met with. There is compensation for every effort put forth in any direction, and ours came in the shape of kind words and encouragement.

PARENT COMPANIES AND CENTRAL STATIONS.

The relations between "parent" electric companies and central electric light stations have been referred to during the discussions at the last two conventions of the National Electric Light Association. There seems to be a strong sentiment in the Association in favor of drastic measures against alleged unfair dealing on the part of parent companies, although no action of an official nature has yet been taken.

President Huntley referred to the matter in his annual address at Buffalo last week, and while some of the members are inclined to take a pessimistic view of the situation, he looks at it in a more hopeful light. Very few of the fundamental patents in dynamo and lamp construction remain, he says, and every day brings us nearer to the time when generator building will be as universally practiced as engine building. When the last of these patents expires there will be a more healthy competition, and if one style of dynamo or lamp does not suit the requirements of central stations there will be others to select from. Time will certainly right these matters complained of, but if any advantage can be gained in the meantime by any proper means, the central-station men ought to have the benefit of it.

FIFTEENTH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

BUFFALO, N. Y., FEBRUARY 23, 24 AND 25.

FIRST DAY—MORNING SESSION.

A few minutes after 11 o'clock President Charles R. Huntley called the meeting to order and introduced Mayor Bishop, of Buffalo, who delivered a few words of welcome.

Mr. Huntley then read his annual address as follows:

GENTLEMEN AND FELLOW-MEMBERS OF THE ASSOCIATION:

In behalf of the National Electric Light Association I am glad to welcome to our meeting to-day those who represent the city and public of Buffalo, and as a citizen of Buffalo and president of this body, I am not less happy in adding my own welcome to those which greet the visit of the Association to this, the Queen City of the Lakes, a city far enough west to have all the bustle and energy of Chicago, but still far enough east to exhibit the dignity and solidity of New York.

As becomes one who fills this chair, there are certain topics of immediate interest and importance that I will venture to call your attention to, and if I do not touch all the questions that affect our great industry, it is because I made allusion to them in Montreal last September, or expect that you will get enough of them before you go home.

The meeting of this Association so near to Niagara seems to afford a fitting opportunity for discussion of the problem which is attaining great importance day by day, namely, the electrical transmission of power. Whether we are engaged in the distribution of electric light by arc or incandescent lamps, or in generating current for stationary or railway motors, or for heating, we are essentially engaged in generating, distributing and converting power into its various forms; hence any method by which the initial power can be obtained in a manner or from a source of greater economy deserves our most serious consideration.

The question may, therefore, naturally be asked: What would be the effect of the utilization of Niagara or other large water-powers, so far as concerning outlying cities? How far will it be possible to transmit this power, not theoretically, or in an experimental way, but commercially, so as to insure a fair dividend to the investor? At what point does it become cheaper to carry current than to carry coal? Now these are large questions. They are in fact the largest problems in modern engineering. When you come to deal with such an immense and incalculable source of power as Niagara, our previous plans and methods and successes sink into nothing, as indicative of final results and realizations. Our attitude toward such a taming of nature is very much the same as that of the first electrical experimenters when they interrogated her with the help of pith-balls and little chips of amber. Even the late demonstration at Frankfort teaches us little, for there we had the utilization of only such a water-power as a well-to-do American citizen puts in his back yard for ornamental purposes; and the experiment was tried in summer-time, when winds are light and skies are clear. Moreover, that plant was run as an exhibition, with the Emperor of Germany and other dignitaries lending a patriotic hand and subscribing patriotic dollars. Now, gentlemen, when you and I who operate stations come to use such water-powers, or distant coal-beds, we shall not be able to fall back on kindly emperors for timely donations. Some of our fellow-citizens will be quite ready to help us, but with the instinct that is born in every American, they will want the dollar they pay out to bring another back with it.

Our field of work, in short, with its newness and rawness, is one in which experience must always moderate enthusiasm. To me perhaps more than to many of my fellow-members, this question of long-distance power transmission is fraught with large possibilities and grave responsibilities. It is imperative that I should know the truth and the facts; and if ever the time comes when I can be humbly instrumental in giving Buffalo a sparkling midnight firmament created by yonder Falls, I shall ask no grander task. I have ventured to make this momentous subject one of the leading topics here, and my call for information has been responded to by some of the most authoritative workers and thinkers in this direction. To them I shall leave the exposition of its details, with the conviction that you will forgive me if, under a sense of duty, I have indicated the practical limitations that must govern every man of affairs.

In this connection I cannot help pointing out again that, after all, the cost of coal to operate an electric plant is only one among many items, and frequently a small percentage of the total cost at that. For instance, in electric railway work, the cost of coal comes to about 10 per cent. of the total operating expenses, while in electric lighting it does not probably exceed from 15 to 20 per cent. In these days when municipal plants are the subject of frequent discussion these facts are generally lost sight of, and the cost of electric lights is calculated by reference to the amount of coal burned under the boiler; thus ignoring the fact that firemen, engineers, linemen, trimmers, etc., are required; that carbons require daily renewal, and globes break; that, like all other machinery, engines, boilers, dynamos and lamps are subject to depreciation, require repairs, that the building must be insured, and that a sinking fund must be established for renewals.

Cheap power in itself would therefore influence the cost of electric lighting very little, even if the electric current is distributed in the immediate vicinity where it is generated; while its distribution to any considerable distance in large power units on a commercial basis seems to be awaiting its demonstration here rather than in Europe. Hence I would recommend a study of the facts pointed out, which ought to make any community falter before investing in a municipal plant simply because it may happen to have what is supposed to be a cheap source or power around the corner.

Municipal ownership is, as I have just intimated, a topic that some of you have to deal with directly. This Association has always been a forum to which new ideas in the industry might be brought, and our efforts have done not a little in clearing away the haze and confusion on the subject of municipal control and operation. I have made a special effort, as evidence of our impartiality, to get together at this meeting some of those who believe in the abolition of private enterprise and in the surrender of all the ideas that make us crave for a home of our own and the accumulation of a few dollars for a rainy day. If we are wrong in the supposition that self-help is the best help, and that ten well-to-do citizens count more for the community than twenty superfluous office-holders, it is time we knew it. Some people want the government to run the railroads and some want it to buy up the telegraphs and telephones. Others want the municipalities to own street railways, gas-works and electric-light plants. In Boston there is, I am told, a demand that the city shall collect more taxes and put it into public coal-yards. I am reminded of my reading as a boy at school, when I learned that the foredoomed population of a great city once sent up a howl for free bread and free tickets to the circus. Now, let me say right here that public franchises are a public trust. In return for them we are to do something or agree to something, that the community wants. In my humble judgment it has yet to be proved that such a way of introducing improvements and benefits is wrong or foolish. I am a busy man and have been earning a livelihood all my life, but I have had time enough to observe that the whole vast industrial development that has added so enormously to the comfort and happiness of life has come from the investment, under public franchises, of private capital, skill and enterprise. The public has thus been made the partner in all the great works of the age, and has thus gained infinitely more than it could have secured if it had raised an equal amount of money by taxation, and had placed the proceeds in the hands of a vast body of office-holders for the same purposes.

Among the questions that interest us are those that concern the relations between the so-called parent companies and ourselves, the local companies, operating the apparatus that the parent companies sell. I am aware that in some quarters the consolidations that have been effected from time to time are viewed with anxiety, and that in others the cry of bad faith has been raised—not perhaps, without warrant. But consolidations have their hopeful, better side. At one period our respective territories were practically open ground for thirty or forty competing manufacturers, each of whom had the best system in existence. That fierce and wasteful local competition should be engendered under such conditions was inevitable, and even to-day the industry is hampered by the central stations that came into being under this unwholesome outside stimulus. We were, I might say, peaceful farmers whose early and promising crops were an invitation to every raider that could reach us. But at the present time the situation is clearing. The various consolidations let us see pretty clearly with whom we were dealing, and we know, too, something of the value of the claims made for the apparatus or the patents that protect it. We have also learned that much apparatus essential to good work is free from patent royalties, and that the moment prices go beyond the point of paying a fair manufacturer's profit, a dozen big engineering firms are ready to invest with their capital and brains. My esteemed friend and predecessor, Mr. Weeks, has even suggested that we should combine and manufacture for ourselves. But there is no need for that. Dynamo and lamp construction has made a place for itself already as one of the arts, very few fundamental patents are left, and every day brings us nearer to the time when generator building will be as universally practised as engine building.

Meantime, we who run the stations have been learning hard lessons in the school of experience, and that training is as valuable a part of our enterprise as are the franchises under which we have been induced to put our savings into the business of supplying light and power to our fellow-citizens. Unfortunately much of that experience remains a sealed book, and it is with the view of exchanging practical ideas that this Association carries on its work. I never meet one of my fellow-workers in this field but he teaches me something; possibly I give him a little in return. Now, apply that principle on a broad scale, and see how beneficial it must be to find out from each of two or three hundred earnest men their best way of doing things. That means progress, prosperity, perfection. But as long as only a few of us get together; as long as a feeling of apathy is allowed to control, our central-station practice will fall far short of what it ought to be; it will not be as near standardization as it should be; and we will not make as much money as we ought. My political and social economy teaches me that the greater profit I can get out of any enterprise, with fair service and due satisfaction to the public, the better citizen I am. The rewards of society are for those who can increase its wealth and raise its degree of comfort and convenience. Now, the central-station man who stays home is not doing his share to promote economical operation. I will go so far as to state that if once a year half the central stations of the country were represented in our gatherings, the average dividends would be increased, while not a few stations that now struggle on in dreary debt would reach a basis of solvency. I am very thoroughly in favor of one meeting a year for this Association, and of a systematic, energetic effort to get everybody there. Every member should make it his business to interest his neighbors in the work we are doing, especially the smaller stations.

As an inducement to the smaller stations I would be glad to see the dues somewhat reduced so that they can come in without feeling that they are paying dearly for their whistle. There is no valid reason why the dues should be high, and if cutting them down will bring in the stations most to be benefited, no hesitation should be felt in taking such action. I would like to see our membership ten times larger. As it is, the influence of the Association is by no means insignificant; but with larger membership its deliberations would be so much more valuable, and when it approved or disapproved, the matter would be at once settled for the entire industry.

It is important that we should interest ourselves in the World's Fair. I surely do not exaggerate when I say that every patriotic New Yorker wishes Chicago the biggest kind of success in her great undertaking, and admires the genuine American fashion in which the Western metropolis has sailed in to win. It is not only our duty, but it will be a source of great pleasure to contribute to the importance and success of the Exposition. We ought to meet in Chicago next year. We must go there in a body. The Chicago Electric Club is ready to take care of us, the whole city has a welcome for us, and the electric exhibit will be the finest the world has ever seen.

We have a good programme of papers for this convention, and I ask you to do the authors the compliment of discussing them exhaustively. If you don't agree with them, tell us why. If you have any local problem, take us into your confidence. You will probably find that others here have laid awake nights worrying over the same matters, and have sometimes found a way out. If you have made some improvement in station practice and operation, ask for the floor; and if it is too good for everybody, we will go into executive session over it. In these and other ways, you will strengthen the hands of the chair, promote the cause we are here to advocate, and make this meeting the best we have ever had.

THE PRESIDENT—Within this city, something like three or four weeks ago a man who, perhaps, contributed as much in the early days of this Association as anybody, after a long illness, passed away. I speak of Mr. George Worthington. I think it is proper that this body take suitable action in regard to his death, as to no man is the Association more indebted for its early growth than to George Worthington. He was a friend to every one in the business, known to everybody, and, as a journalist, he ranked with any of them. I will be glad should a committee be appointed to draft suitable resolutions for this purpose.

The Secretary then read letters from the postal telegraph and the telephone companies, in which they extended courtesies to the Association, and a communication from the California Electrical Society, extending an invitation to the Association to meet at San Francisco, Cal., in February, 1893.

The communication was referred to the executive committee.

The report of the committee on underground conduits and conductors was read, placed on file, and ordered to be distributed to the members of the Association.

MR. HERING—I believe no mention was made of the system in use in London and Paris, in which bare wires are run in conduits on glass insulators, a system which seems to work satisfactorily, and seems to solve the problem of insulated coating. The wires are perfectly bare and supported in glass insulators under the sidewalk. They are easily accessible, as they are covered with flag-stones a few inches below the surface of the ground.

MR. FRANCISCO—In the course of correspondence, I was told that in Paris nearly all the lines are in the sewers on glass conductors. Such a method is impracticable in this country, and I paid no attention to it.

MR. HERING—I believe that is an error. I was there, and they told me that no electric-light wires were allowed in sewers on account of the telegraph and telephone wires. At the time I was there they were laying the electric-light wires under sidewalks in special conduits made for them. It was a concrete conduit of rectangular cross-section; the insulators were on iron rods extending across from one side of the conduit to the other.

MR. WILMERDING—I think Mr. Francisco takes a rather pessimistic view of the underground system of distribution. We think that we have succeeded in Chicago in transmitting currents underground without any trouble. The reason that there are so many failures in places where they are just beginning to do that work is because they do not do it properly. They try to do it at too small an investment. In order to economize in the first cost of construction, people will put in a wire that is too lightly insulated. The main point to be considered in the conduit is to get a certain strength and elasticity, so as to prevent the conduit from cracking with the action of frost and other causes, and yet be easily repaired. I believe that wood is one of the best substances for conduits we have. In Chicago we have had very satisfactory results with it.

In reply to a question Mr. Hering said that the system in Paris seems as equally applicable to high as to low tension. It is an aërial line running in the conduit underground. "I would also add that at the Frankfort exhibition last summer there was an underground cable, in which an alternating current of 20,000 volts was carried for a distance of about a mile."

MR. STANLEY—When a high-potential continuous current is placed in an underground cable there is a great strain on the insulating material, and this strain is all in one direction. As the result of that continued pressure in one direction the constitution of the insulator changes, and after six months—in some cases, I believe, in London, in even less time than that—the entire structure of the insulator changes, so that while the cable had a high specific resistance to start off with, that rapidly fell off in the same cable. In the case of alternating currents in these conductors this deterioration does not take place; but in this case the current reverses rapidly, and the work done by the current passing in one direction is quickly undone by the next wave passing in the opposite direction; and thus the effects are neutralized. The effects of the alternating current are more like those of water flowing through a pipe. If we had a long pipe, filled with water, and suddenly turned it on end, the water would rush to the far end, and strike a hard blow, and there would be a water-hammer effect. The longer the cable is underground, and the longer the distance, the greater is this condenser effect; and it was so great in the case of the Ferranti main, that it raised the pressure at London a great many volts higher than at Deptford, where the other end of the cable was. I think it can be generally stated that those insulations made from oil compounds are unfit for a continuous-current strain, while they are exceedingly good for alternating currents. In some cases in underground work we found that the cables did not have the capacity they were figured for; the capacity being always reduced. The resistance of the cables for alternating current was considerably higher than it ought to be; in some cases ten per cent. higher, and we were worried a great deal about it. We found that the external resistance in this cable was due mainly to the work that was done in the iron pipe which enclosed the cable, the resistance function outside of the wire and not inside, and also that the current in the

wire was not evenly distributed; a result which had been predicted long ago by Sir William Thomson. These difficulties were overcome by adopting a certain small standard size of conductors and putting in more cables.

T. C. MARTIN—I think, Mr. President, that your remarks in regard to Mr. George Worthington, struck a responsive chord in every heart in this room. I therefore beg to move you that a committee be appointed by the chair, to consist of three members, to draft resolutions of regret, and that they report at the meeting this afternoon. I do not think that I express other than the sentiments of my colleagues on the electrical boards in regard to our friend now gone, when I ask that you will appoint on that committee those of us who labored with him.

The President appointed Mr. T. C. Martin, Mr. W. J. Johnston and Mr. Charles W. Price.

AFTERNOON SESSION.

Mr. Stillwell read the report of the committee on the relation of size and efficiency in transformers.

MR. WM. STANLEY, JR.—The paper is so clear that it hardly requires much discussion; but there is one point which it seems to me might well be noticed, and that is Mr. Stillwell has assumed that a non-heating transformer is what we desire. Now, as a matter of fact, the most efficient transformer that could be made, I believe, would be the hottest transformer. I know that Mr. Stillwell understands the subject thoroughly, and qualifies that statement by saying that it should not be so hot as to endanger its lighting. The problem of building a transformer, is to build a coil of wire and get as much iron in it as you can; that is, to surround a given amount of iron with as many turns of wire as you can; or, to surround a given size or coil of wire with as much iron as you can. I think the table that Mr. Stillwell has given as to the efficiency of the various sizes very good. We have had occasion lately to design transformers of very high voltage, as high as 15,000 volts, and we are now designing some to deliver 40,000 watts of 50 horse-power each. We find no difficulty in keeping the temperature of these transformers within reasonable limits; they will get hotter than a small transformer; it is better that they should; but I do not believe any well-insulated transformer is in danger of its breaking down; it depends on the kind of insulation; if you put in mica, or if you put in paper or any stratifying insulation, and subject it to a high potential, it will most certainly break down with that potential by either a dynamic current or static charge or stroke of lightning; but if you fit it with a homogeneous insulator, such as oil or some solid insulating compound, you can use any potential you want, provided the discharges do not take place that occur in stratified insulation. I think the heat has very little to do with the breaking down of a properly insulated transformer.

PROF. THOMSON—Mr. President and Gentlemen of the Convention: I think I agree with Mr. Stanley in the statement he made in opening his remarks, that the paper is so plain that there is really not much room for discussing it. It states facts, and facts which I have reason to believe are not far from the facts of truth. I do not exactly agree with Mr. Stanley in the statement that a transformer is better when it is hot. I would rather modify that statement in this way: that a transformer would run best if the iron would run hot and the copper as cool as possible—that is, the hysteresis losses of the iron would be diminished by the heat, and the resistance losses in the copper would be lessened by keeping it cool. If we could insulate the core of the transformer so as to prevent the escape of heat, and let it get hot, and keep the copper cool as possible by ventilating it thoroughly, we should then have the ideal transformer. I hardly agree with the statement that Mr. Stanley made that the insulation would not be injured by being hot. It is our experience that you cannot have a machine, a dynamo or any other electric apparatus run too cool, as regards the preservation of its insulation, provided it does not run so cool as to condense moisture from the atmosphere. The absolute resistance, the dielectric resistance, is highest when the substance is cool—that is, the tendency to puncture insulation is much less if you can keep your insulation cool. If you allow the insulation to heat up, its power of resisting puncture certainly decreases. The matter may be briefly stated in this way: if you take a good conductor like copper, and run the temperature down, its resistance almost disappears at very low temperatures; hundreds of degrees below zero copper is almost a perfect conductor. If you heat it up it becomes more and more resisting. Let us take glass—a good insulator—or any insulating material, and run its temperature up, it loses its insulating power, and if we run it up until it gets to red heat it approaches a conductor; so that all substances are conductors when they are hot enough.

MR. STANLEY—I did not mean to imply that it would not injure the insulation of a transformer if you had it hot enough. What I did mean to say is, that so far as the efficiency of the apparatus went, it would rather, on the whole, be improved by heating it. I think Prof. Thomson agreed with me. Of course, we can heat a transformer up so high that it will get on fire; but there ought not to be anything to burn. I question if the transformer of the future will have cotton or any other inflammable material in it. We are making transformers in which, if the coil is cut in two, the copper wires will be found embedded in a solid dielectric, and the section would resemble the section of a well-constructed cable; there is nothing to burn there. A temperature change of 30 or 40 degrees would hardly affect the dielectric strength, while it would materially affect the efficiency of the apparatus.

MR. STILLWELL—Prof. Thomson has fully covered the points of Mr. Stanley's first remark, to which I applied the same criticism as the professor. With regard to the possibility of making a transformer, using for insulation only such substances as are not affected by heat, while that may be a theoretical possibility, I do not think that any transformer is now offered in the market which will be found to embody that kind of insulation. If you use only mica or something of the kind which is not affected by heat materially, then, in general, I should agree with Mr. Stanley, it is well for efficiency to let the transformer run at high temperature. As it is, however, nearly every transformer, so far as I have examined them, does use insulating tape, or an insulating substance resembling tape, in one form or another. It may not be necessary, perhaps, to be guided to any extent by foreign practice in these matters; but in so far as the foreign practice is found to be in line with correct theory, I think it is of some use to us; and it is very noticeable that in the specifications of foreign engineers that they limit, both in machines and in transformers, to a comparatively low temperature. Anything that is done in the direction of reducing the temperature, either in generators or in transformers, by the manufacturing companies is a direct gain to the purchaser; because I do not think it will be disputed that, taking the apparatus as it is built, such a policy tends to prolong the life of the apparatus.

A motion extending a vote of thanks for the paper was carried.

The Committee on Safe Wiring, by M. D. Law, chairman, then reported the following proposed amendments to the rules on that subject:

INSIDE WIRING.

Art. 7. Inside conductors must not be laid in plaster, cement, or similar finish, without an exterior metallic protection.

SPECIAL WIRING.

In rooms where inflammable gases exist, the incandescent lamp and socket must be enclosed in a vapor-tight globe. This is not understood to include rooms where illuminating gases are used in the ordinary manner.

Art. 2. The word "water-proof" changed to "moisture-proof," so that the article will read: "provided with a durable moisture-proof covering."

INTERIOR CONDUITS.

Art. 2. Interior conduits must not be of such material or construction that will be injured by plaster or cement or other surrounding material, or that the insulation of the conductor will be ultimately injured or destroyed by the elements of its position.

After a brief discussion, the amendments were adopted as read.

Mr. Allen R. Foote read a Report of Fires and Injuries Caused by Electric Currents During the Year 1890, being data obtained from 425 cities in the United States.

Number of members on fire force, regular and volunteer	56,498
Total number of fires for which the force was called out	39,847
Total number of fires caused by electric currents	518
Total number of injuries received while on duty	1,719
Total number of injuries received while on duty at fires caused by electric currents	35
Total number of injuries caused by electric currents while on duty	31
Total number of fatal injuries received while on duty.	60
Total number of fatal injuries caused by electric currents while on duty	1

In the brief remarks following the reading of the data above, it was elicited that in the case of the single fatal injury caused by electric currents while on duty, that the man fell from a pole thirty-five feet high, and as there was no autopsy, it could not be learned what was the exact cause of death.

Mr. D. Ashworth then read a paper on "Allied Powers."

Invitations from the Brush Electric Light Company at Niagara Falls, to visit the Falls, and from the Buffalo Railway Company, to inspect its power station and plant, were read.

The meeting then adjourned, and the delegates spent the afternoon in inspecting the power house and plant of the Buffalo Railway Co.

EVENING SESSION.

Mr. Carl Hering was introduced by President Huntley, and read a paper on "Transmission of Power with Special Reference to the Frankfort Plant," an abstract of which is given below.

TRANSMISSION OF POWER WITH SPECIAL REFERENCE TO THE FRANKFORT PLANT.*

BY CARL HERING.



CARL HERING.

A year or two ago the subject of electric railways was the most prominent branch in the later developments in the field of electrical engineering, and the almost phenomenal growth of this branch is well known to all who have given the subject any attention. Just as that was the leading subject during the past year, so the subject of the transmission of power in large quantities over great distances seems likely to be the chief field of development in the near future; a bold beginning having been made during the past year in the form of a very successful public experiment, made at Frankfort, in Germany, on a scale far beyond anything before attempted. I am informed that much attention has been given by promoters of the Niagara Falls power plant to this experiment at Frankfort, and its success will doubtless lead to the adoption of the same or somewhat similar system for the Niagara-Buffalo transmission. It may be said, in fact, that as far as our present knowledge goes, any other system than a high tension alternating-current transmission has hardly any chance of adoption for the long-distance work in this undertaking.

* * * * * *

Coming now to electrical transmission, let us see which of the various methods stand a chance of success for long distances. To be successful at all for long distances requires beyond question the use of very high potentials, as otherwise the cost of the line will make it impracticable. If continuous currents are to be used, they must be generated directly by the dynamo at that high potential, as there is no means at present known for converting a low-tension continuous current into one of high tension without the use of moving machinery; continuous currents would therefore require that very high-tension currents be produced directly from a dynamo with a commutator. Long experience and frequent attempts have shown that it is not practicable to exceed five or six thousand volts at the very most on continuous-current dynamos, and even then there are many objections. As this would be a comparatively low voltage for long-distance transmission, continuous-current systems stand very little chance of being used for more than comparatively short distances. Another disadvantage is that the motors also must be run at this high potential, unless the current be transformed by a motor dynamo, which is awkward and expensive, as it involves the use of moving machinery, requiring attendance. The starting of a motor at such high voltages also introduces difficulties. A point in favor of continuous currents is in the fact that the line is not charged and discharged continuously.

The field is therefore left tolerably clear for alternating currents, which owe it to two features: one, that the alternating-current dynamos require no commutator, and the other, that such currents may readily be converted from a low tension to a high tension and the reverse, with but a small loss of a few per cent. in each transformation. An alternating-current dynamo for generating low-potential currents, is the simplest kind of a dynamo, and a transformer requiring no moving machinery is a very simple thing to take care of, if indeed it requires any attention at all. Simplicity alone, therefore, is very much in favor of alternating currents.

The only serious objection to the use of simple alternating currents for the transmission of power is that they are not so suitable for running motors as direct currents are. There is a class of motors called synchronous motors, which are, as a rule, simple alternating-current dynamos used as motors, like in the case of direct currents. These must be run at a speed which must synchronize with that of the dynamo as precisely as if coupled to the shaft of the dynamo. They run very well after they are started; but many of them come to a dead stop if overloaded sufficiently to retard their speed below that of synchronism, even if only to a slight amount. Their chief fault, however, is that they cannot be started readily; furthermore, all the load must be taken off before they can be started at all. Various methods are used to start them; but although they accomplish the object, they can hardly be termed satisfactory solutions of the problem, at least so far as they have come to my notice. This makes them unfit for many purposes—as elevators, street cars, shops, etc. When there is only one large dynamo which is started, say only twice a day, it can be done by a small motor, or by starting both the generator and motor together, or by some other similar means; but when it concerns the distribution of power as distinguished from mere transmission, this disadvantage becomes of great importance. But this objection may not continue to exist very long, because with the amount of attention given this subject at present, it is not unlikely that some solution will be found before long, if it has not been found already. Several methods have already been devised for overcoming it, one of which was shown in the Frankfort transmission. Others are being at present worked out, among which may be mentioned that of Mr. Stanley and others; also that of Leblanc, which, I understand, is being experimented with on a large scale in the interests of the Rothschilds of Paris. It is therefore likely that before very long this problem will also be solved by several methods, so as to leave very few objections to the use of alternating currents.

One of the prominent features of the Frankfort transmission was that this motor problem was solved, as motors were there run not only with the same ease with which continuous-current motors are run, but with additional advantages which make them far preferable even to the best continuous-current motors. The only objection to this system was that three wires had to be used in place of two, an objection which appears to be in many respects small as compared with the advantage gained.

There are, in general, two methods for transmitting to great distances by alternating currents. One is to generate the high-tension currents directly at the dy-

*Abstract of paper read before the National Electric Light Asssociation, Buffalo, N. Y., February 23, 1892.

namo; this is the system used at the Ferranti station, in Deptford, London. At the distant end these currents are then transformed to low-tension currents, suitable for distribution to consumers. The second system is to generate *low*-tension currents at the dynamo, then to transform these at the dynamo station into high-tension currents by means of transformers, which high-tension currents are then sent-through the line to the distant station, where they are transformed a second time back to low-tension currents. This is the method which was used at Frankfort. The advantage of the former is that there is only one transformation; but a disadvantage, which appears to outweigh the objection to an additional transformation, is that the high-pressure current must be generated on moving machinery, and that it must be controlled by switches and other apparatus, which must be handled by the attendants. The dynamos and switches are thereby rendered very much more complicated, and as they must be handled, there is a constant source of danger to the workmen. This source of danger and the complications are overcome almost entirely by the second system. In the one used at Frankfort the dynamo was the ideal of simplicity in its construction, and the high-tension circuit contained, with one exception, no switches or any apparatus whatsoever that required to be handled.

To recapitulate, it appears probable that the solution of the problem of long-distance transmission will be solved by the use of high-tension alternating currents originally generated at a low voltage, then transformed into a high voltage, then sent over the line, and finally transformed back to a low tension; this will furthermore be done by some system which will enable motors to be used on the circuit. The system exhibited at Frankfort was such a one, and it appears to have been a perfect success in every way. It seems, therefore, that the problem has not only been solved, but also demonstrated by a practical illustration on quite a large scale.

Among the transmission of power plants in this country may be mentioned the following: one at the Dalmatia Mine in California, in which the power is about 100 horse-power transmitted about one and one-half miles at 1,800 volts by direct current. Another in Virginia City, Nevada, in which about 500 horse-power is transmitted a distance of about one-third of a mile with an efficiency of 70 per cent. Another at the Calumet and Hecla Mines, in which 400 horse-power is transmitted about one and one-half miles at about 1,000 volts, and at an efficiency of 73 per cent. These are all direct-current systems. Another was installed by the Westinghouse Company at Telluride, Colorado, in which about 120 horse-power is transmitted two and three-quarter miles at 3,000 volts, and at a commercial efficiency of 75 per cent. This is of special interest, because it is an alternating-current plant in which the motor and dynamo must run synchronously. The difficulty of starting the motor is overcome by the aid of a small motor of 10 horse-power, which is first run to bring the large one up to speed, after which it will remain in synchronism with the generator. The cost of this plant, exclusive of erection and line, is said to have been $10,000, or about $100 per horse-power delivered.

A fair idea of the cost of transmission of power plants may be obtained from the following table of figures given by the Oerlikon Company, and taken from plants actually installed by them, mostly in and about Switzerland. The table was copied from a paper read by Mr. Saunders Morris at the Engineers' Club of Philadelphia.

Distance in Miles.	H. P. Delivered.	Cost in Dollars.				
		Generators.	Motors.	Line.	Total.*	Per H. P. Delivered
6.25	11	647.00	540 00	2350.00	4,700.00	42.60
.43	510	.....	.....	.....	33,250.00	65.30
3.75	220	5190.00	4700.00	3135.00	14,500.00	66.20
1.56	150	3720.00	3525.00	1615.00	10,020.00	67.20
.56	71	2155.00	1960.00	294.00	5,100.00	71.60
1.87	85	3135.00	2741.00	2155.00	9,220.00	108.50
2.20	51	1761.00	1567 00	1469 00	5,595.00	109.40
5.00	41	1174.00	980.00	1682.00	55,000.00	121.10

* * * * * * *

I received a letter this morning form the Zurich people, the Oerlikon Co., who you may know have put in a bid for the transmission of power from Niagara Falls to Buffalo. The letter was rather long; I will only read a few of the figures and a few of their statements. They propose that the current generated at the Falls is to be such that both motors and lamps—arc lamps as well as incandescent lamps—shall be used. That is, the current shall be fit for motors, arc and incandescent lamps. They say, as the drehstrom (that is, the rotary) current is at present, and will be for a long time to come, the only practical form of current to run large motors of a fair efficiency, we have proposed the use of the drehstrom. They propose to use 50 periods in place of 40, which were used at Lauffen, because they say that 40 is too low to run arc lamps. Fifty is said to be the lowest at which arc lamps will run satisfactorily. The generating station would be composed of units of 5,000 horse-power each. The dynamos must, therefore, be of 5,000 horse-power. According to the wishes of the turbine designers the number of revolutions has been fixed at 250 per minute. The diameter of the armatures has been fixed at $3\frac{1}{8}$ meters—that is, about 10 feet. The armature is to be drum wound. I suppose that means the drum winding on the surface of the cylinder—that is, not across the ends as we usually wind drum armatures here, but wound as they very often do in European multipolar machines. The currents are to be 2,000 ampères in each of the three circuits, and the voltage 600 to 700. It has been found advantageous to revolve the armature instead of the magnetic field, in order to have a minimum weight on the vertical shafts. The weight on one of those shafts, by the way, is something great. The shafts are twenty feet long, and the weight of the shafts together with that of the armature and turbine is a very great weight, and must therefore be considered. The generator will have 24 poles. They will be separately excited. The efficiency will be in the neighborhood of 96 per cent.—that is, the efficiency of the dynamo including exciting power. There will be two transformers, as it was not found practical to build a single transformer of 5,000 horse-power. The transformers will be artificially ventilated, and only the high-pressure coils will be placed in oil. These transformers will raise the potential to 25,000 volts.

"This," they say, "is no longer to be looked upon as a venture." The cost of the line will be about 100,000 francs—that is, $20,000—an almost trifling part of the whole.

"As to the line, we propose not to carry any more than one or two units of 5,000 horse-power on one line of poles for a number of reasons." A 5,000 or 10,000 horse-power can be conducted on wooden poles at a very moderate initial cost of plant. "The lines would terminate in one or more step-down transformer stations that would supply current of 1,800 to 2,000 volts for municipal and street lighting in the shape of alternating currents to be transformed down to the suitable lamp voltage, as is the case in the present transformer systems. The cost of the electrical part of the proposed plant, including the generators, exciters and transformers at both ends of the line, would be about $180,000 for each unit of 5,000 horse-power, with an efficiency of 84 per cent. at the low-pressure terminals of the secondary transformers." This reduces to $36 per horse-power, which is lower than the lowest one in the table that I read to you. "The cost of the line is about $4 per horse-power, which is about 10 per cent. of the whole."

Prof. Elihu Thomson, of Boston, opened discussion on the subject. He cited the cable railway as a common example of wire-rope transmission of power. He said it was well known that the most power was used in hauling the cable around, and the load of cars upon the line made but little difference. In electrical transmission this is not the case. It has been properly said the commutator stands in the way of electrical transmission. For high voltages we need to divide up the commutator, but that necessitates more and shorter winding, and this is very difficult. The only question to his mind was whether the voltage of 15,000 to 30,000 should be taken overhead or underground. The latter way would probably be a little more expensive in the beginning, but it would be safer. If the wire is put in a pipe and thoroughly insulated with oil you will be free from trouble for some time to come, free from leakage from wet insulators and similar causes. "It seems to me," said the Professor, "a great many things can be obtained from the three-phase alternating currents. Not only can a perfectly synchronous alternating dynamo be run from the same line, but also those which are not synchronous and which will not run at full speed when a load is on. Continuous currents can also be converted from them.

L. B. Stilwell thought it should be borne in mind the exhibition abroad was paid for by the government, and it was certain that many firms in this country would undertake even more daring schemes if they were paid for their undertaking by the State. He cited an instance where power was transmitted about $2\frac{1}{2}$ miles and used to operate a stamp-mill. This motor had been out of operation only about 16 minutes in the 24 hours of a day once it was established.

William Stanley, Jr., said: "I am certain that while 15,000 volts can be laid on the wire at Niagara Falls, yet I am also certain no great amount of power can be delivered in Buffalo with commercial success."

H. Ward Leonard then followed with a paper upon the same subject. Mr. Leonard's paper follows.

THE TRANSMISSION OF ELECTRICAL ENERGY BY ALTERNATING CURRENTS AND ITS UTILIZATION BY CONTINUOUS CURRENTS.

BY H. WARD LEONARD.

For more than ten years we have had at our command the means, through the agency of the continuous current, of transmitting electrical energy in unlimited quantities over short distances and converting it into mechanical power for any desired application. The hundreds of three-wire systems illustrate this statement.

For more than five years we have had at our command, through the agency of the alternating current, the means of transmitting electric energy in unlimited quantities over almost any desired distance; but we have not had the means of converting such energy into mechanical power for commercial uses, for there is but little commercial use for a motor which is not self-starting and which when started can be operated at but one speed. Hence, the commercial use of the alternating current has thus far been confined to the operation of incandescent lamps.

During these past years the companies promoting the sale and use of continuous-current apparatus have been making plans and estimates of continuous-current transmissions, using several thousands of volts directly from commutator to commutator; but neither they nor the public have had the necessary confidence in the result to install the plants. The developing and perfecting of a continuous-current constant-potential generator of 1,200 volts has forcibly impressed at least one company with the difficulties likely to be met with in constructing similar apparatus of 600 volts and upwards.

At the same time the various companies promoting sale and use of alternating-current apparatus have devoted all their efforts to the development of an alternating-current motor, which should possess the essential qualities of variable torque and variable speed under variable work. Thus far, neither line of development has resulted in the production of commercial apparatus for the transmission of power over great distances. I believe that prejudice is largely the cause of this condition of affairs. Each side of the continuous *vs.* alternating current controversy has been bitter in its denunciations of the rival apparatus, and has apparently considered that it would be fatal to admit the necessity of using the rival apparatus to secure the result.

So long as incandescent lighting alone was under consideration it made but little difference. Either the continuous or alternating current would give satisfactory results. But not so with the transmission of power over great distances.

The High-Tension Alternating Current says: "How easy it would be to get there if somebody could only utilize me." And the Low-Tension Continuous Current says: "How easy it would be to use me for any application if somebody could only get me there."

I stand here to make the claim that the transmission of power over great distances necessitates the use of both the alternating and continuous currents, and that by the combined use of the systems the result is commercial to-day over any reasonable distance and for the transmission of any amount of power.

I arrive at this conclusion as follows:

The economical use of electric energy with automatic control of the speed and torque demands that the voltage be varied as the speed, and the current as the torque.

It will be evident that for merely transmitting electric energy from a prime motive-power of constant speed there can be nothing simpler or better than the synchronous alternating-current motor of constant potential. But nearly every application of the transmitted power demands not only a variable torque, but a variable speed, as will be evident when we consider hoists, locomotives, pumps, ventilating fans, etc. The synchronous character of the alternating current is therefore unsuited for such work. We should have means of varying the voltage in proportion to the speed desired, and means of varying the current in proportion to the torque of the power to be supplied. We should also have a current adapted to charge storage batteries and to deposit metals electrolytically. All these conditions point directly and conclusively to the continuous current. It would seem, therefore, that both theoretical and practical considerations demand that we should transmit our energy over the great distances demanded for commercial applications by means of the alternating current, and that we should then convert our electric energy into a continuous current in order to best utilize it in the actual performance of the work met with in practice.

Under this plan we shall be able to undertake the transmission of power at any distance and on any scale by apparatus manufactured by half a dozen companies to-day.

Let us suppose, for example, that we have a water-power at a distance of twenty miles from a mine where it is desired to utilize 2,000 horse-power for various purposes.

Let us start with 10,000 volts and lose 22 % in the conductor. The cost of our generator, conductor and synchronous motor will be about $90 per H. P. at the point of work. The synchronous motor will drive the necessary continuous-current generators of 500 volts and less to supply hoists, pumps, locomotives, ventilating fans, air compressors, incandescent lights, arc lights, crushers, mills, etc.

If the total power installed be 2,000 H. P. the cost of the working motors will be perhaps $50,000. With 2,000 H. P. installed the maximum demand for power will not exceed 1,500 H. P. The cost of continuous-current generators and conductors for this service will be about $52,500, and the cost of the synchronous transmission system about $135,000.

Allowing $42,500, as an average cost for the development of the water-power and the construction, we have a total cost of plant of $280,000, or $140 per horse-power represented in the electric motors at the point of work. The starting up of the synchronous alternating-current motor without load can be readily accomplished by any of several simple methods, such as the use of a small storage battery supplying current to one of the continuous-current dynamos and operating it as a motor to drive the alternator up to synchronism, or the utilization of the energy of a weight upon a hoist in its descent to operate its motor as a generator, which in turn will drive the continuous-current generator as a motor, and thus bring the alternator up to its synchronous speed.

With such simple efficient and cheap apparatus made by many companies to-day, why should we wait for the solution of such difficult problems as commutators to stand 10,000 volts, or alternating-current motors which will be self-starting and efficient and at any speed and torque?

Even if we had such motors, it is evident that we must interpose some kind of converters to reduce the 10,000 volts to a reasonable pressure for applications in mines, and we would still require continuous currents for commercial arc lamps, storage batteries, electro-deposition, etc., and a special current for electric drills.

It seems to me that we should install a plant at the mine exactly as though we were going to drive it by a steam-engine, and instead of doing so use the syn-

(*Continued on page* 117.)

* This includes regulating apparatus, instruments, poles, insulators, lightning-arresters, erection and supervision.

FROM THE TANNERY TO THE DYNAMO.*

BY CHAS. A. SCHIEREN.

Very strange and erroneous ideas prevail among those who use leather, and have no knowledge of the art of tanning. Certainly it is an art, and one of the old-



CHAS. A. SCHIEREN.

est handed down to us. The general opinion prevails that leather made in "ye olden time" is superior to ours of the present time, but such is not the case; in



TRIMMING HIDES FOR LAY-AWAY VATS.

fact, the fundamental process of tanning to-day is precisely the same as that of a thousand years ago, except that we enjoy improved machinery and appliances which further the process and improve the material. What took our forefathers from fourteen months to about two years, we accomplish in from four to six months, and the quality of leather is as good, if not superior to the leather made a hundred years ago; with with the aid of steam and power we can facilitate the process and shorten the length of time to produce the leather. The "olden time tanneries" had the lay-away vats in the yard exposed to the elements, and in rainy and inclement weather, as well as during the winter, the tanners could not do any work, and left the leather lying in the vats, generally to the detriment of the stock. In our present improved and model tanneries everything is done under cover, even the bark is put under sheds to keep it dry, and good leather is tanned within four months; however, belt and prime harness leather generally takes six months.

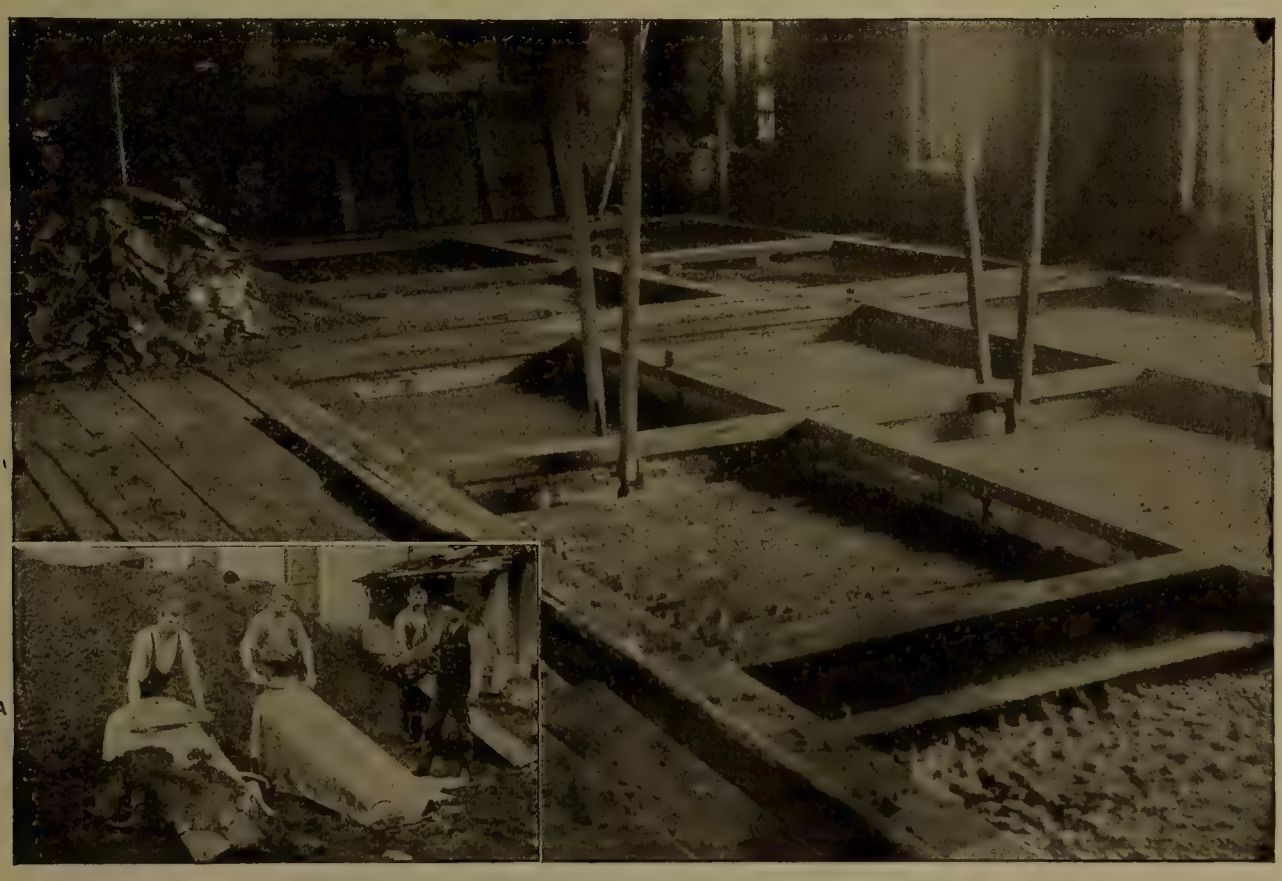
When the leather is taken from the last layer of bark, it is oiled on the grain and hung up in a darkened room to dry; to obtain a nice clear russet color the place must be kept at an even temperature, and very little heat used. After the leather is thoroughly dried it is put up in rolls containing five butts (hides) each, and whenever a carload is ready it is shipped to New York; here it is again examined and weighed, and all butts not suited for belting are thrown out and finished into sole leather for shoe purposes.

The perfect hides for belting are soaked in warm

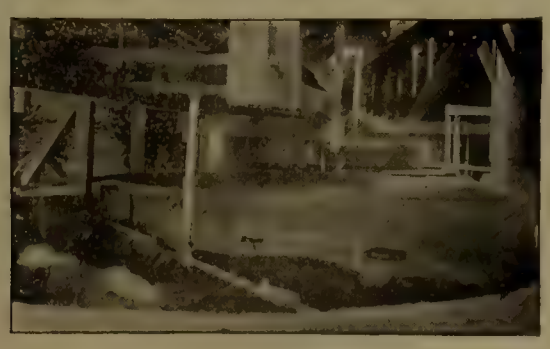


UNHAIRING HIDES.

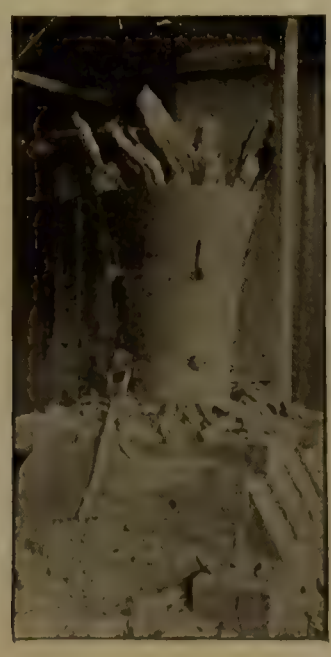
water, and the centre part cut out and used for prime belting; the waste or offal is finished and rolled for shoe purposes. When the pieces are thoroughly scoured and cleansed they are oiled on the grain and hung up to dry, and when in a semi-dry condition, they receive a coat of stuffing made of equal parts of cod oil and beef tallow. This is done to preserve the leather and make it pliable for the transmission of power. After the stuffing has entered the pores, which takes about twenty-four hours, the leather is subjected to great strain in large stretching machines; great care and good judgment must be manifested in this part of the process, each piece of leather must receive an equalizing strain because of the peculiar formation of the hide, the fibres being very fine and closely knit together on the back of the animal, and running coarser and



A.—FLESHING HIDES. B.—HANDLERS.



LEECHING BARK.



BARK MILL.

thicker towards the flanks. It is of the highest importance, for belts intended for electric light plants, to have an equal tension over the entire surface of the belt; therefore, the stretching process of belt leather needs the utmost care, and should receive the closest attention. After the pieces of leather are thoroughly stretched, they are worked smooth on the grain side, and both by hand and machine labor are set down as solid and compact as possible; then they are put into a drying-room and thoroughly dried. Afterwards one edge of the pieces is straightened, and they are then cut into whatever width of belt they are best suited for; the pieces of each width are matched accurately as to thickness, and then the laps (joints) are cut by a machine, the edges of the laps are feathered, and the joints cemented (glued) together, and pressed under a hydraulic press, which pressure is considered the best by all first-class belt-makers.

Rivets are now rarely put into belts; a double belt well cemented is good for all ordinary purposes, and rivets are superfluous; however, certain fastenings,



TAN PITS AND FEED TANK.

such as endless copper-wire screws, which do not obstruct the surface or unnecessarily stiffen the belt, are a benefit; especially when the belt comes in contact with water or too much oil, this fastening prevents the belt from coming apart, and holds the leather firmly together.

All main driving belts over forty inches in width have to be made in sections, consisting of two or more pieces of leather cemented together; the average hide for belting does not contain more than forty inches in width of solid leather suited for belting, very rarely over that; therefore, wide main belts are made in sections. Ordinarily the pieces are not lapped parallel, but simply butted. For example: A sixty-inch double belt receives two thirty-inch pieces for the first layer, laid side by side, and a thirty-inch piece over the centre of the two lower pieces to break the joint, and two fifteen-inch pieces on top of each edge of the lower layer to complete the width; thus the belt is cemented together. However, for electric-light plants where belts are run at high speed and with variable power (which produces sudden strain), the seam of these butted joint belts, in several instances, broke, doubled up and destroyed the belts completely. To guard against such a calamity it is considered advisable to make wide main driving belts with parallel joints. For example: A sixty-inch double belt will be made of two thirty-three-inch pieces joined parallel, with a three-inch lap, making one solid piece sixty inches in width, and on the upper part put a thirty-three-inch piece in the centre, and two eighteen-inch pieces on the edges, all joined with parallel laps; this cemented together will make a sixty-inch double belt with unbroken surface, and as one solid piece of leather having a uniform tension and able to withstand an equal strain over the belt transversely as well as parallel, and thus will prevent such large, heavy driving belts from collapsing at the parallel joints. Every one must admit that main belts made on this plan are superior, and



DRYING LOFT.

more reliable, and would come into general use if it were not for the additional cost of labor and material in making them.

Leather being by nature an absorber of moisture, belts must be guarded against exposure to oil. In electric light and power plants much mineral oil is used, and the great velocity at which the belts are run seems almost imperceptibly to suck or draw the oil from the journals of the engines and dynamos, and allow it to be absorbed by the belts, which get completely saturated with oil, and in a short time rot and destroy the fibre of the leather. Various methods have been used to overcome this difficulty. One of the most successful is a certain composition or belt dressing which is rubbed over the surface of the belt, and closes the pores of the leather. No foreign substance can penetrate a

* Abstract of Paper read at the Convention of the National Electric Light Association, Buffalo, Feb. 24, 1892.

belt treated with this compound, and the belts last much longer and give better service. With perforated belts this compound does not seem to be so effectual, because the perforations naturally expose the inner part or the heart of the leather which is very porous; however, the surface of the belt being covered it shields that part of the leather which comes in contact with the pulleys, and the current of air passing through the perforations protects the belt to a certain extent, and that class of belt runs smoother, with less friction and is more reliable.

And now, gentlemen, we have reached the point where another curious and erroneous idea prevails among many engineers, namely, that belting should be made of pieces only four feet in length; as if all hides were of the same length and texture; it will surprise these men to learn that there are no two hides alike, they vary in some particular point. Hides exist which will make almost six feet of sound solid leather below the shoulder, and again some hides will not make four feet of solid length; the only safeguard is to specify belting made of leather cut below the shoulder of the hide, irrespective of length.

UNDERGROUND CONSTRUCTION OF THE BUFFALO RAILWAY CO.*

BY J. B. CRAVEN, BUFFALO, N. Y.



J. B. CRAVEN, BUFFALO, N. Y.

Underground construction for railroad use brings us many problems to solve. Whilst not using a high-tension current, we have one side of our system always grounded, so that between the many miles of cables in use and the earth we have a difference of 500 volts; thus you see at once the necessity of having and keeping up the highest insulation possible. This question of ground return requires that the insulation resistance of a railway circuit be twice that of an arc or incandescent underground system, where you have a metallic circuit; then there are the constant and excessive strains that one does not meet either in arc or incandescent lighting, due to the throwing off and on of the cars. It is almost impossible to figure your feeders to carry the maximum current, so that at any time you are liable to have your cables over loaded, bringing very heavy strains upon them.

Another question is the one of connecting overhead with underground wires. This brings lightning to the field to be guarded against, for the large surface of trolley wire offers an attractive path for lightning, and how to protect the underground feeders and mains has been quite a problem. Lightning has little regard for insulation, seeming to want a path only to earth; this path is offered by the underground cables, so that we have to introduce some arrester at the junction of the underground and overhead wires to give it some other path.

We have in this city about 11½ miles of subways, divided into two trunk lines, which branch off, carrying feeders to the outlying districts. Our conduits are laid in cement, 30 inches below the surface of the street. They are crowned in the centre, so that the water will drain to the manholes, which in turn drain to the city sewers, with a bell-trap to prevent sewer gas coming back.

Lately, on account of natural gas finding its way into subway and manholes, we have found it necessary to attach a blower at the station, which ventilates the whole system. Manholes we have placed every 400 feet, and have tried to make that distance standard, as pulling a greater distance brings an excessive strain on the cable when drawing in.

After careful consideration before this work was started, we decided to depend on our cable for insulation, not on conduits made of insulating material. To me it seems impossible to prevent moisture from penetrating the latter system, thereby lowering the insulation. We depend on our ducts for mechanical protection alone.

The cables in use here are lead-covered, provided with an exterior fibrous jacket or covering saturated with pitch, the purpose of which is to protect the cables whilst being drawn in the duct. We have some 45 miles of cables, which have been in use since July last. These are of two classes—one for insulation depends on pure Para rubber, the other on a composition, our shortest feeder being two and a half miles in length, some of the longer ones reaching a distance of eight miles, yet the insulation on none at the present day is below 120 megohms, the short ones testing as high as 1,100 megohms. In laying this cable all tests were made in the testing-room at the station; this was made feasible by the use of a telephone circuit throughout the underground system, so that a workman making a joint in a manhole was in communication with the man making the test, and could always find out if his work was satisfactory. The joints made were the Standard joints used by the companies from whom the cable was bought.

Thus far we have looked upon the difficulties and disadvantages of the underground system. No arguments have been advanced in its favor, but I think you will agree with me that it has some. First, it does away with the public objection of disfiguring the streets, obstructing firemen in their duties, and, in the case of high-tension currents, a menace to life itself; and then the liability of wires falling, causing a suspension of traffic, and, in case of a storm, causing a delay and loss of thousands of dollars to the company themselves.

ALTERNATE-CURRENT MOTORS.*

BY WILLIAM STANLEY, JR.



WILLIAM STANLEY, JR.

Mr. President and Gentlemen of the National Electric Light Association:

It is not my purpose in the present paper to enter minutely into the details of the various attempts that inventors have made to produce an operative motor.

The historian who shall collect the data necessary to trace the rise and growth of the alternating current-motor will find that the subject has been pursued by men of science in all parts of the civilized world, and he will be obliged to chronicle the fact that, up to the present year, no thoroughly practical motor system has been worked out. The various plans suggested by inventors and by engineers may be classified into three types, they are: First, motors operating in synchronism with the current alternations, having a field magnetization, produced by continuous currents with alternate currents applied to the armature circuits, a type originally demonstrated by Hopkinson, in 1883; second, motors actuated by the inductive effects of a rotating field upon closed armature circuits, first suggested by Mr. Tesla, in 1887, and, third, motors operated by alternate currents, in both field and armature, constituting one of the types investigated by Mr. Kelly and myself. As far as I know, the first work on alternate-current motors in this country was undertaken at Great Barrington, 1886 and 1887, when I designed and built a synchronous motor, and a motor acting under the repulsive currents obtained by periodically short-circuiting armature coils, while they were under induction from the field. One of these motors was designed in January, 1886. Professor Thomson, in 1887 and 1888, also produced motors of this type, and, what was of still more importance, he read a paper before the Institute of Engineers memorable for the clearness with which he treated the subject.

In order to more clearly explain the troubles found in designing these and other alternating-current motors, I wish to call your attention to two of the properties possessed by circuits traversed by alternate or variable currents. When dealing with continuous currents, we are accustomed to consider that the resistance of a circuit is determined by the area and length of the conductor and by the specific material composing it. In dealing with alternate currents, it is desirable to extend the definition of the term "resistance" to a fuller meaning. The term "resistance," as you all know, is that property of a circuit which determines the amount of electrical energy disappearing per unit of current. The value of this property or "resistance" being obtained when the energy in circuit is divided by the square of the volume of current flow.

When steady currents occupy a circuit, the resistance value is confined to the conditions which exist within the conductor, viz., the "resistance" is proportional to the length of the circuit inversely proportional to its area, and dependent upon the kind of material employed. When variable or alternate currents are applied to a circuit, the resistance proper may not be confined to the interior of the conductor, but may extend to its surrounding neighborhood, for, with these changing currents, work may be done outside of the conductor as well as inside of it, and, as the losses by hysteresis and by induced currents cause a disappearance of electrical energy, they may be defined in terms of the current flowing and a resistance factor. When alternate currents are used, this factor is always greater than when steady currents flow, and while in particular cases the disappearance of electrical energy taking place outside of a conductor may be small, there are cases in which the energy lost outside far exceeds the loss within the wire itself. Another point may be noticed. We are accustomed to think of the resistance of a wire as a fixed quantity; we say, a circuit has ten ohms resistance, and we are in the habit of thinking that this value of ten ohms is approximately constant and independent of the current flow. While this supposition is true for steady currents, it is not true for those of changing value. If the conductor carrying an alternate current is of small section, less than one-quarter of an inch diameter, the internal resistance of the circuit remains nearly constant for alternate currents of the frequency we are accustomed to handle, while the external resistance, if I may be allowed to use such a term, increases with an increase of current and may increase as the square of the current, or faster. While I am aware that this treatment of the term "resistance" is not in ordinary use, yet it is quite orthodox; it has been defined by the mathematicians, and its use may be justified, as it is often instructive in comparing the losses taking place within and about a conductor occasioned by the flow of alternate currents. In designing alternate-current motors, for instance, the loss of energy exterior to the circuits has to be very carefully watched; for example, an alternating motor armature wound in the ordinary manner might carry one ampère of current with very little loss other than that due to its interior or ohmic resistance, while ten ampères might cause a loss exterior to the wire by hysteresis and eddy currents several times the ohmic loss in value, or the exterior resistance might become so great as to practically prevent the flow of current to the value desired.

The other property of a circuit carrying an alternate current, to which I wish to allude, is its so-called inductance, which is the property of inducing upon itself an electromotive force. The electromotive force thus produced combines with the other electromotive forces in circuit to determine the *direction and value* of the current at any time. It is not necessary for the purposes of this paper to trace out just why or how it happens that these electromotive forces are developed, or why they do not coincide in phase.

Let us now briefly examine the various types of motors that have been suggested, and which I have classified in three types.

It is well known that if an alternating dynamo be run until its speed of alternation or frequency is approximately the same as that of the generator from which it is to be supplied, and if its field is properly magnetized, it can be coupled to the generator by simply closing a switch; it will then fall into step with the generator and will take load and behave in a very proper manner; the trouble is to get it into step without employing costly or complicated appliances. If one attempt to start such a machine by commutating the current in the ordinary manner, he will find that the current will refuse to flow in the field circuit, the inductance of the circuit keeping most all the current out. How to start a synchronous motor is a problem still unsolved, but Mr. Kelly and myself believe that we have found a solution.

It is not to be understood that all dynamos will run as synchronous motors with equal satisfaction, for while the machines made in this country will so run, they are not to be compared for this or multiple connected service with the Mordey machines made in England, which, by the way, I consider to be the best designed alternators yet produced. The reason why the Mordey machines excel as sychronous motors, is, that the inductance or self-induction of the armature circuit is so low that the slightest tendency to fall out of step is instantly corrected by the necessary current flowing in the armature.

If one attempt to couple two or more of our American alternators in parallel (I refer to surface-wound machines) he will find that a large false or useless current will surge to and fro between the armature circuits; this false current is due to the fact that when two alternators are put in parallel, there are always short intervals of time during which one machine leads and does work upon the other; this interchange of current between the machines tends to bring them into more perfect step. Mr. Mordey's machines may be said to be always alert to correct any difference of phase, in fact, they may be imagined to correct each other at the first intimation of the lagging machine, while the American machines allow the laggard to fall a considerable distance behind before the necessary correcting current passes.

While many inventors were eagerly following their various lines of investigation for the purpose of producing an operative motor, Mr. Tesla had quietly worked out a new solution of the problem on an entirely novel basis, by inventing the rotating field—that is, the field produced by shifting magnetism, and producing it by alternate currents. Mr. Tesla's motor is so simple and so beautiful in theory that many have doubtless wondered why it has not been brought into general use. If I correctly understand the subject, it has not been commercially adopted because of the difficulties in operating it at the frequency generally in use in this country, viz., 130 ≈ p. s., and especially because thus far special generators and circuits having phase-differing currents must be employed; there have been many attempts to subdivide alternating currents into two or more currents differing in phase. Special arrangements of condensers for producing phase differences from a single source of supply have been worked out by M. Leblanc in France and by Mr. Kelly in this country. As regards the motor itself, there are two drawbacks to its use which have not thus far been entirely removed; they result from the inductive effects of the currents upon themselves and upon each other.

To understand this matter in a practical sense, let us assume a Tesla motor having 300 pounds of iron in its field and armature to be magnetized; suppose it be supplied with a 16,000 alternate current at 300 volts pressure. We have 300 volts then applied to each of the two field circuits. We can count on the motor being magnetized to at least 20,000 C. G. S. lines per square inch of iron, which, with a loss of one watt per pound, would then represent an external resistance loss—that is, a loss outside the wire, of 300 watts, and a resistance of $\frac{300 \text{ watts}}{C_2}$. In this case the internal resistance of the copper coils may be made low and may be neglected.

Now, it is evident that the magnetization produced in the field will react upon the field-coils and will develop an electromotive force of self-induction, and this electromotive force will be 90 degrees, or half a semi-

* Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., February, 1892.

* Paper read before the National Electric Light Association, Buffalo, N. Y., February 23, 1892.

period from the electromotive force urging the current against the resistance; let the value of this induced electromotive force be 250 volts, then the electromotive force urging the current against the resistance will be found by

$$\sqrt{(\text{applied E.M.F.})^2 - (\text{E.M.F. of Self. Ind.})^2} \text{ or } \sqrt{300^2 - 250^2} = 165 \text{ volts.}$$

That is to say, that of the 300 volts applied, 165 volts are used up in urging current to magnetize the motor when it is doing no work, and 250 volts are available for inducing currents in the armature. If, as we have assumed, the loss due to hysteresis is 300 watts, then the current flowing would be $\frac{300 \text{ watts}}{165 \text{ volts}} = 1.8$ ampères, and the resistance external to the wire $\frac{300}{(1.8)} = 92$ ohms.

I do not mean to say that these conditions are actual or cannot be improved; they ought to be. I present them simply to show that, with this type of motor, the full electromotive force employed is not available, as in the example when, with 300 volts applied, but 250 volts are available and 165 volts are lost.

Moreover, it is necessary that a strong field magnetization should be developed in a motor in order that a powerful starting torque may be had; as a consequence, the field circuits of this motor must be composed of a comparatively *small* number of turns of wire (the flux or magnetization in an alternating magnet being inversely as the number of turns with a given applied electromotive force and with a magnetic circuit of given reluctance). It might also be shown that the value of the field-producing current in these motors, viz., the current required to run the motor empty, is largely dependent upon the air gap between the field and armature, the current at no load being greater as the clearance between the field and armature is increased. The Tesla motor then must necessarily have a false or lagging current at no load, and must expend considerable energy in the production of the rotary field by hysteresis loss, until some one, and Mr. Tesla as likely as any one, shall find an iron without hysteresis and an air gap that does not require magneto-motive force. I understand that these motors require about .6 of the full load current when running free with a factor of lag of about .7 so that the actual per cent. of energy required to run them free is, approximately, .6 x .7 xen = 42, or, say, 40 per cent. of their full load energy. This is a rather serious matter when viewed from the stand-point of the station manager, for if the motor service requires .6 of its full load current to run free of work, then evidently .6 of the station capacity must always be in operation. There is another slight trouble with these motors, resulting from the fact that the co-efficient of mutual induction does not keep up as the motor is loaded; this may be explained by saying that the flux and, consequently, the electromotive force developed in the short-circuited armature coils, decreases as the motor is loaded; this decrease of induction affects the speed of the motor, causing it to fall off with load, while it requires a larger current in the field to furnish an increased amount of work; both of these difficulties, however, are very largely determined by the design and calculation of the motor itself, and may be brought within working limits. I see no reason why this motor may not be made successful and operative by proper designing and careful study.

The problem before those studying the alternate current motor is, however, entirely independent of these difficulties. Had we a reliable means of dividing an alternate current into two currents having the proper difference of phase, Mr. Tesla's motor would be made available and would be of great commercial value. Mr. Kelly and myself have found an entirely novel and complete solution to the problem. As far as we can discover, it has never been attempted by any other experimenters. By the use of a very simple invention, we are able to draw from a single transformer secondary two phase-differing currents, having any differences of phase we elect. These currents maintain their phases—that is to say, times of flow, independent of the ampèrage of the current and of each other. We can apply our invention at the station, splitting the primary current from the dynamos into two phase-differing currents, or we can lead the primary current through a transformer and split the secondary into two components.

HOW TO FIRE A BOILER.*

BY R. HAMMOND.

It has been said "That the waste of fuel due to improper firing is often of more consequence than any other loss which is produced in the operation of a steam plant," but in a great many cases the waste of fuel cannot be entirely charged to improper firing, as there are other causes by which a waste of the evaporating power of the fuel is produced. The principal of these is the improper construction of the boiler in relation to grate surface, tube area, heating surface and combustion chambers. Unless these proportions are properly worked out, it matters little whether the firing be done by mechanical means or by the more intelligent fireman; waste of fuel must necessarily follow.

A great many contrivances have been placed on the market, such as mechanical stokers and other means by which coal and air can be supplied to the furnaces of steam-boilers, for the purpose of obtaining good combustion without producing a waste of heat by allowing too much air to pass above the grates, or an insufficient supply below the grates. By this statement I do not mean that any particular method of firing will produce any more heat from a pound of coal than nature put into it; just as good results can be obtained from hand firing as have been obtained by the best mechanical means.

It is often the case that firemen are paid insufficient wages for the work they are expected to do. We should be as particular to have good firemen in charge of our boilers as we are in having good engineers in charge of our engines; a good fireman should be just as capable of manipulating the furnaces of his boiler so that his steam recorder and his coal and water records will show just as good cards as the engineer can show in the manipulation of the steam he uses in his engine. It is just as essential to good economy that the boilers should have the very highest initial or furnace temperature, and the highest possible steam pressure, and the lowest possible chimney temperature, as it is for the engine to be economical under similar conditions of high initial pressure and temperature and low terminal temperature.

Experiment has proved that bituminous coal requires 150 cubic feet of air per pound of coal for good combustion, an excess of air results in a waste of heat which it carries into the flues and chimney, and often a greater loss in an insufficient supply to produce good combustion. In firing anthracite coal, the coal must be spread evenly over the grate in all cases, and like bituminous coal must be burned at a high temperature with good draft.

The steam-users should see to it that all parts of their boilers and settings should be of equally as good proportions for strength and economy as their engines; employ good intelligent firemen as well as engineers, and see that both produce good indicator cards. By a little attention in this direction, steam-users will themselves soon become experienced firemen and engineers and can readily tell whether the firemen and engineers are doing their duty.

* Abstract of paper read before the Convention of the National Electric Light Association, Buffalo, N. Y., February 25, 1892.

ELECTRIC LIGHTING FROM A FINANCIAL STANDPOINT.*

BY ERASTUS WIMAN.



ERASTUS WIMAN.

The question of profit remains to be decided in very many localities. I have been favored during the last month or so with an enormous number of letters, in response to a request for information as to the condition of the electric lighting business all over the country. A great deal has been sent me of a confidential nature, and I can only give the general impression which the whole correspondence has made upon my mind. My conclusions are, first, that there is an enormous demand, only as yet partially developed and partially met, for electric lighting; second, that the public have been led to believe that it can be created for very little money; third, that in competition with gas, an insufficient price has been asked for a light infinitely more brilliant, infinitely greater in candle-power, far more healthy, and, as a rule, far more safe; fourth, that at the start of many electrical plants, the most meagre and insufficient foundations were laid for a business requiring the utmost precision and the most perfect material. If a mill for the manufacture of cottons or woollens were to be erected, the greatest possible skill would be required, the best material needed, and the most perfect engineering ability obtained. But in numerous electrical plants this kind of expense was thought unnecessary. The result has been, that numerous establishments have been created that needed almost everything in the shape of good construction that could make it a mechanical success.

* * * * * * *

As a matter of course the profitableness of any undertaking depends upon the price obtained. In my judgment electric light projectors are themselves to blame for loss of profit through false representations as to the economy of operation. If the truth had been told, and contracts refused except upon a paying basis, the electrical business throughout the country would now be upon a much better footing.

The promoters of electrical enterprises, and the sellers of electrical apparatus and appliances are rapidly killing "the goose that lays the golden egg" by falsely representing the great economy of operation, and consequently the great profits of such undertakings, thus falsely educating the public into the belief that anything like a reasonable price is extortionate.

The true policy of the friends of the electrical industry should be directed in just the opposite course to that which you propose pursuing, namely, to show that electrical undertakings upon the basis of the present prices *are not profitable*, and if they expect perfect service they must pay better prices, prices that have prevailed because the companies themselves have not heretofore appreciated and understood the cost of operation, and the great loss due to accidents and rapid depreciation.

These two extremes of success and failure tell the whole story of electric lighting in the past seven years. The companies that have succeeded have done so under favorable circumstances, with a freedom from ruinous competition, exacting good prices, and above all other requisites, with good management. If there is any department in human activity where brains and tact are required to a degree greater than any other, it is in the administration of an electrical lighting plant. This is evident, not only because there was great lack of experience and knowledge of a business that was in the production of an article that was in a certain sense mysterious and unknown, but because there has been an amount of misapprehension as to its cost on the one hand and its value on the other, hardly ever experienced regarding any article of merchandise.

Some attempt has already been made to account for a misunderstanding as to the cost of electric lighting, but it is proper to allude to the folly which has prevailed in selling it for less than cost. The insane competition with each other in localities where one company was needed and more than one was ruinous is well-nigh passed, but there remains the competition with gas companies and the effort made to constantly lower the standard of electricity to that of gas. It is true that in the early history of the effort to use electricity as an illuminant, it was necessary to get down to the standard of the fumes of coal, and in order to show the superiority of one over the other, to yield for a time in the matter of profit. But so rapid has been the growth in the use of electricity, so immeasurably superior is the current to fume, in health, in brilliancy, in beauty and attractiveness, that the time seems near when electricity can claim the rightful place, and demand the price just so much higher as it is an illuminant just so much better. It took sixty years to introduce gas and make it a reliable servant of man. Its early history shows losses quite in proportion to those in electricity, while its later progress shows that long ago it reached its limit of illumination, its possibility of moderate profit, its constancy of danger, and its maximum of unhealthfulness. It has remained for electricity to show in every new edifice, in every modern place of public resort, in almost every commercial centre, in banks and hotels, as well as in thousands of miles of street lighting, how immeasurably superior is the electric globe of light to the meagre and inefficient gas-burner. With this achieved, and a general verdict in the public mind as to the superiority of one over the other, is it not time to break away from a similarity of price, as we have broken away from a similarity of production? An advance in price commensurate with the superiority in the article produced, would add largely to the earning power of electric lighting companies, and it is time it was contemplated and acted upon.

* * * * * * *

In New York City, in Boston, in Brooklyn, and in such suburbs as Staten Island, there is no reason why electricity should not be substituted for steam. Steam-locomotives, built to carry their coal about, and to employ an engineer and fireman for each five hundred horse-power generated, cannot compete with the great compound, condensing stationary engine, whose forceful power can extend by a delicate wire distances of twenty-five miles and under.

It is only a question of time when numerous roads having a limited or circumscribed area, will consider the propriety of changing from steam to electricity, and, with that in view, electric lighting plants now being constructed should contemplate a sufficient enlargement so as to be able to sell power to nearby steam roads. It would indeed be a revolution of enormous proportions, if, from these central stations, a force sufficient could be furnished for operating suburban roads, whether steam or electrical.

In this connection it is impossible to contemplate the extension of the lighting and railway systems dependent on electricity without alluding to the consolidation now in progress between the two great organizations that, more than all others, have promoted these most important interests. After a somewhat careful study of the question of competition, of consolidation and the establishment of a strong and well-managed single concern, as compared with weak and numerous rival undertakings, my deliberate conviction is that all the dangers of monopoly, all the possibly increased charges for supplies and other fancied ills, are as nothing as compared with the waste of unbridled competition. In the consolidation of the Edison and Thomson-Houston companies a new and important era opens for all interests concerned in electricity, and with such experience, such skill, such business sagacity and such inventive faculty as has been developed within these companies, now that they are united in one nothing but good can result, not only to the companies themselves, but to the electrical community at large.

* Abstracts from paper read before the National Electric Light Association, Buffalo, N. Y., February 24, 1892.

THE OPERATION OF HIGH-TENSION CURRENTS UNDERGROUND.*

FROM A PHYSICAL AND FINANCIAL STANDPOINT.



E. A. LESLIE.

The underground conduits in New York City for high-tension currents are owned by the Consolidated Telegraph and Electrical Subway Company, who lease their ducts to the various electric lighting companies.

The prevailing type of duct is of iron pipe, mostly three inches in diameter, running along the sides of the street into manholes about two hundred and seventy-five feet apart. These are the so-called "trunk ducts." Over the trunk duct are superimposed from two to four distributing ducts, with four-way handholes about fifty feet apart. Many of these handholes are brought to the surface of the street and are covered over with an iron plate, which is easily removable, giving ready access to the wires in the distributing ducts. In many places, however, the handholes do not approach the surface, and, in order to get at the wires to make changes or connections, it is necessary to dig up the street. Again, on some of the prominent streets no distributing facilities whatsoever have been provided and the companies are compelled to make long and expensive subsidiary connections from manholes. This is particularly true of Sixth avenue above 18th street and Broadway above 34th street.

The Subway Company have also a number of miles of what is known as the "Johnstone System," which is made up, as you are all doubtless aware, of sectional iron castings and so framed together as to combine in one conduit both trunk and distributing facilities. These conduits have no surface handholes, and, in order to make changes or connections, it is also necessary to dig up the street. The manholes are about two hundred and seventy-five feet apart, as in the case of the iron pipe.

There is also a small amount of what is known as the "National Conduit Company's System" in use, which, in this case, is composed simply of cement-lined iron pipes, running from manhole to manhole, of about three inches inside diameter.

The cost of the New York conduits is an unknown quantity. The Subway Company guard the secret well, and, beyond the general statement that they have cost on an average nearly $5,000 per mile per duct, no reliable information can be gained. In these figures, however, are doubtless included the expenses of years of legislation and long and costly litigation. It is the universal opinion among electric light men in the city that the actual average cost should have been less than $3,000 per mile of duct.

The companies with which I am connected use, principally, cables insulated with a rubber compound, although we also have in use thirty-five or forty miles of the Standard Underground Cable, the insulating material of which is fibrous.

* * * * * * * *

The manner of laying cables is simple. It is first necessary to draw a rope through the duct to be occupied. To do this, rods about three feet in length are used, having brass male and female screw attachments, one at each end. The first rod is inserted in one end of the duct; then another is screwed into it and pushed forward, and this process is continued until the first rod emerges into the manhole at the other end, and you have an unbroken line of connecting rods through the duct. A rope is then attached to the last rod, and, as the rods are pulled forward and unscrewed in the manhole at the distant end, the rope is gradually drawn through. The cost varies considerably. To draw in two cables in a duct would cost in the neighborhood of from 2½ to 3 cents per foot of cable, but to draw in four or six, or even eight, as has frequently been done, the cost diminishes and will not average over 2 cents per foot, or even less, assuming that the men in charge have had experience and understand their work thoroughly.

The proper jointing of cables is a matter of paramount importance. Unless the joints are made by an experienced person, it is almost impossible to secure a joint which will give the same insulation resistance as the cable itself, and yet, unless the joints are so made, the object of securing immensely high insulation in the cables proper is entirely defeated and a large proportion of the original investment practically wasted.

We are required to test all underground circuits at least once per week. For this purpose a portable reflecting galvanometer is used. Where the cables enter the station, a test-room free from the jar of the building is usually provided in which to set up the instruments, but, in cases where the cables are reached from the station by overhead wires, it is customary to rent a quiet room adjacent to the junction pole and connect by a well insulated "lead" for permanent use. The total insulation of a circuit with all converters or arc lamps connected, will generally fall below the requirements of the rule above quoted, but, unless it is shown to be less than say one megohm per mile of cable, its condition, as a "completely connected circuit" is usually accepted. But, as a general rule, when the insulation falls below this standard what are termed "ex-converter" and "ex-lamp" tests are called for. These require, in the case of incandescent circuits, that every converter installation be cut out, the cable ends freed from all contact, and test of cables only be made, to ascertain their exact condition. The arc circuits are similarly treated by disconnecting all lamps and switches. Unless the results of such tests come within the limit prescribed by the rule, the circuits are not allowed to be operated until the defect has been removed and the insulation brought back to the required standard. Fortunately, defects are rare and tests of this character are not now called for with sufficient frequency to prove burdensome.

HOUSE CONNECTIONS.

House connections are built by the Subway Company, at the expense of the Electric Light Companies; but the Subway Company claims not to relinquish ownership therein and will not allow their joint use by two or more companies, except by special arrangement. The cost of house connections in New York City is appalling to the man of exclusively overhead experience.

In some cases, the cost of these connections exceeds the gross revenue derived from an arc lamp for an entire year, but, unless we resolve not to develop the particular territory in which these cases occur, we are obliged to invest our money and take chances for the future.

Fortunately, it often happens that one house connection will serve for two or three different installations, and in this way the average cost per installation or per arc lamp is very largely reduced. For instance: in the fall of 1890 our arc lamp connections cost us on an average, only $43.00; in the spring of 1891, an average of about $30.00, the ratio of new connections to new installations or lamps being as one is to two. In other words, for one hundred installations or lamps, we were required to make but fifty house connections. This ratio could be largely and safely reduced were we allowed by the authorities to use more than one hundred feet of overhead wire with each underground connection.

In laying cables it has been found desirable to place both "legs" of incandescent circuits in the same duct. When they are separated into different ducts, great loss results from self-induction.

The use of the subways makes it possible to employ much heavier single conductors than could be used overhead. There are in some of the ducts conductors having nearly, if not quite, 500,000 circular mils area and such sizes as No. 00 and No. 0000 are quite common. The conductor being composed of small wires stranded, affords sufficient flexibility for all purposes; but in sizes up to and including No. 2 B. & S., the conductor is generally solid.

THE FINANCIAL ASPECT.

A good system of underground conduits fairly covering the electric lighting territory of a large city will, in my opinion, cost on an average from $2,500 to $3,000 per mile, per duct, but in the case of a single duct in a trench, the latter figure is likely to be exceeded, depending largely upon the character of the digging and the engineering difficulties to be overcome. For the purpose of comparison, however, let us assume $3,000 to be the cost of one mile of distributing duct, and then consider the cost of one mile of construction for one arc and one incandescent circuit, by both underground and overhead methods, as follows:

Underground.		Overhead.	
Duct	$3000	50 poles prepared and set, at $12,	$600
11,000 ft. No. 4 cable, at 20 cents, laid	$2200	11,000 ft. No. 4 wire, at 4½ cents	$495
11,000 ft. No. 2 cable, at 30 cents, laid	$3300	11,000 ft. No. 2 wire, at 7¼ cents	$797.50
40 House Connections, at $75	$3000	40 House Connections	$480
Total	$11,500	Total	$2372.50

Hence, from these figures it must be assumed that the initial investment for an underground system will exceed by about five times the cost of an overhead system, and the fixed charges on this very expensive feature of investment in a central station plant must be correspondingly increased.

But in New York City, as before stated, the underground conduits are owned by a Subway Company, who have an exclusive franchise and who lease their ducts to the various electric light companies upon the following schedule of rentals:

Distributing Ducts,		$1000 per mile per annum.
Trunk Ducts,	3 inch,	900 " " " "
"	2½ "	800 " " " "
"	2 "	700 " " " "
"	1½ "	550 " " " "

These rates have the effect of increasing the usual and ordinary expenses of a central station enormously, and, although some overhead wires are still in service, and our field of operation is almost wholly confined to the more important streets and avenues, *the amount of the duct rental already equals the combined cost of coal, water, oil, waste, and the salaries of chief engineer, engineers, firemen, coal handlers, boiler cleaner and oilers employed in the engine department.*

As to maintenance, our experience with cables has not been sufficiently great to give us a definite idea as to their possible life. Aside from this, however, it costs no more to maintain the cables than it does to keep overhead wires in good order, say from $15 to $20 per mile, per annum, probably not quite so much; but unless the cables last at least twenty years, the cost of maintenance is also likely to be far greater.

* Abstracts from paper read by E. A. Leslie before the National Electric Light Association, Buffalo, February 25, 1892.

THE CONSTRUCTION, SAFETY AND OPERATION OF SWITCHBOARDS.*

BY M. C. SULLIVAN.



M. C. SULLIVAN.

In large composite stations, embracing arc and incandescent lighting, of both high and low tension, and the proper generators for street railways, condensation is one of the most vital features, not in the sense of crowding anything, but of utilizing every inch of space to install the apparatus necessary to do the work required. A most effective way to build a board for stations of this character is to have it arranged in the form of a square, so that one side could be devoted to each division of the service.

Stations occupying a large open floor with high ceiling present the opportunity for building the ideal switchboard. This could be raised above the floor a sufficient distance so as not to occupy any valuable floor-space. For that matter it might be suspended from the ceiling. The wires from the dynamos could run directly to this loft, thence through the switchboard, and from the latter to a cupola, arranged as nearly over the board as possible. This would give us a central starting point for our lines, enabling us to at once trace each and every wire in the system. However desirable such an arrangement as the above may be, the conditions are such that we cannot always do as our best judgment dictates, but rather have to make the best of things as we find them.

The prime necessity of switchboards in railway power stations is facility for rapid manipulation whereby any part it of can be reached in the shortest space of time. Here also the indicating instruments must be within plain sight, so that the movement of the current, with its rapid variations, can be readily noted.

In low-tension incandescent stations and plants, with their multiplicity of circuits, and the necessity for manipulating things quickly so that whatever interruption may occur will be reduced to a minimum, there is no limit to the refinements to be obtained.

All switches and apparatus, for whatever service, should be manufactured with a lug or extension of the contact so that the connection could be made from the back of the board. The resistance-boxes and all of the regulating apparatus which require considerable space should be placed behind the board and provided with a rod extending through the face of the board.

Rapid manipulation being essential in arc-light stations, although not in the same degree as the three other types of stations, this feature is one that must be considered. In designing a switchboard for this work we should keep before us the question of safety to the operator, for if we can make him feel comfortable, freeing him from the hazard of working on a board that is not insulated, he is going to possess more confidence. Many attempts have been made to design a board for this purpose that would do away entirely with cables, without being cumbersome. Complete success has not crowned these efforts.

A very convenient form of board for this service is to arrange two slabs of marble slate, or other form of insulating material, leaving a distance of six inches between the two. One slab, say the inner one, may have connections from all the dynamos, each dynamo circuit having its own bar. The outer slab contains holes through which the current from these dynamo circuits may be plugged into any circuit or circuits, making a sort of checkerboard arrangement, the square being defined by the line wires running horizontally and the dynamo circuits running vertically, or *vice versa*. The plugs by which the circuit is completed should have hexagon insulated handles so that a good hold can be had. All the lightning arresters, ammeters, etc., should be placed directly on the slate, or whatever may be used for the purpose, and the board should be completed in itself in every way before any wires are attached. Binding-posts can be provided for these connections, and the work of disconnecting any circuit from the dynamo-board is but the question of the moment. As cables will be necessary in the different combinations, a trough should be provided along the front in which the slack can rest to prevent them falling to the floor.

We now come to the most important feature of the whole question: What material should be used for our switchboards? As it must be fire-proof, the use of wood is prohibited; we must therefore look for something entirely different. Various efforts have been made to make wood fire-proof. This has been accomplished to a limited degree, but the element of doubt still remained. Slate, as many of you know, is the best thing which nature has yet offered us. For strength, lightness and insulation, it is the *only* material in sight. Unfortunately, however, slate is an alluvial deposit of a limited character, and often contains metallic substances which destroy its insulation, causing short circuits and other disagreeable features. When in the rough stone it is hygroscopic to a considerable extent,

* Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., Feb. 24, 1892.

and when it becomes saturated with moisture, makes surface leakage possible. Great care should consequently be exercised in selecting slate for switch boards, and only that which possesses absolutely no metallic properties be used. This can be determined by the well-known rules of electrical testing.

The drawbacks met with in slate have led some manufacturers to use marble for this work. Marble has only one-fifth the breaking strain of slate, and where it is used instead of slate, this must be taken into account. Marble presents the same hygroscopic nature of slate, and there is some metal in it, but owing to its peculiar formation, this metallic substance is not in any great connected quantities as it is between the laminations in slate.

Iron should be used for the framework of all switchboards, and in the case of high-tension circuits a wire should be run from this iron framework to ground which is entirely insulated from the circuit, so as to prevent the board from becoming charged and discharged through a person who happened to be near by.

FIFTEENTH CONVENTION.

(*Continued from page* 112.)

chronous alternating-current motor for this purpose and utilize as our original source of power the distant water-power.

In many instances this method will be of especial value where it may be necessary for a few weeks in a year to fall back upon expensive steam-power on account of the temporary failure of a distant cheap water-power.

If one comprehensive plant be installed of this alternating and continuous current type, I believe an enormous development in this line will immediately follow, and luckily the apparatus required can be turned out rapidly from any one of several large works without the delays incidental to the development of new apparatus and methods.

This closed the evening session, which was one of the most interesting and profitable ever held by the Association. The Convention then adjourned.

SECOND DAY, WEDNESDAY.

MORNING SESSION.

The President called the meeting to order at 10.30, A.M., and the first business was the reading of the paper on "From the Tannery to the Dynamo," by Charles A. Schieren, an abstract of which paper will be found elsewhere. After a short discussion a paper on "Alternate-Current Motors" was read by Wm. Stanley, Jr., which was followed by the reading of the report of the World's Fair Committee, of which Mr. B. F. Sunny is chairman. In Mr. Sunny's absence the report was read by Mr. C. W. Price. The report touched in a general way the progress being made at the fair grounds with reference to the electrical exhibition, It was ordered to be placed on file and the committee to continue.

The following resolutions were then introduced:

Resolved: The members of the National Electric Light Association, assembled at its fifteenth convention, desire to record their sense of the loss sustained by the association in the death of Mr. George Worthington.

He was the moving and leading spirit in calling together the company of gentlemen who organized this body seven years ago; and so long as health and strength remained to him he was foremost and unwearied in its service. From the first he appreciated the importance of the organization and its possibilities of usefulness. Busy as he was in his chosen field of journalism, he found time and opportunity to lend a hand on every occasion of service.

Highly as we regard the memory of his ability and usefulness as a working member of the Electrical Committee, we even more highly cherish the remembrance of his warmth of heart and his unselfish devotion to his friends. No one came within reach of his hand-grasp without becoming his friend. If he had an enemy, no one ever found it out.

Resolved: That the Secretary be requested to send a copy of this minute to the family of Mr. Worthington.

The resolutions were unanimously adopted and ordered to be engrossed and a copy presented to the family of Mr. Worthington.

The meeting then adjourned until 8 o'clock, P.M., the afternoon being devoted to a trip to Niagara Falls.

EVENING SESSION.

The first business of the evening was the reading of Mr. M. C. Sullivan's paper on "The Construction, Safety and Operation of Switchboards," by his brother, M. J. Sullivan. An abstract of this paper will be found elsewhere.

During the discussion which ensued, Mr. E. A. Leslie, General Manager of the Manhattan Electric Light Company, New York, described the switchboard in his company's station. It is made up of slabs of marbleized slate, and the machine connections are run horizontally on that board and connected up by wires running from the machines overhead, and the connection is made behind the board. The line wires do not come into the switch proper at all. There is an addition to the switchboard, on top; that is a peculiar switch—a final switch. I do not believe I can describe that without making a diagram. I am rather poor at descriptions in any case. But this switch is arranged so that it makes a connection on each side of the board. If you throw it up the +, let us say, will make connection on the face of the board, and the — will make connection on the back. Both the line wires are connected with this switch, but they are securely insulated from each other, so that there is no possibility of short-circuit there. The result is that we have a throw of about 18 inches, and no arc on any load that we have thrown there yet will follow it, although our lines are very long, and the arcing is very severe. The board, made up in that way, is exceedingly simple, and there is no possible chance for a cross or contact between different exciters or different machines. We use the plug system, and the board is arranged in two sections, so that if we are carrying our load on, say, 9 or 10 machines—we have 20 in the board—why we set up the other section with the other machines, so that in case anything happens, just the moment that you throw over those switches you will start the whole load on the other machines. There is no studying out how to do this, that or the other thing, but the board is always prepared for an emergency beforehand, and lies there in readiness for just the unexpected to occur. The whole success of the board is in that throw-over switch that I have mentioned—that final switch. It is quick; and we sometimes make switches there that are very difficult to detect in the effect on the lamp itself, it is so sudden and all that. The board itself, as I said before, is of slate, and there is no wood to speak of about it at all. We do not believe in wood, because we have been burned out on account of wood. We had bad luck with lightning arresters, so we discarded them, and although we have passed through two summers of very heavy lightning storms we have not suffered any more damage in the matter of armatures than we did previously, when we had lightning arresters.

After some further discussion, Prof. Elisha Gray, of Chicago, on invitation of President Huntley, described the plans of the World's Congress Auxiliary, and was followed by a paper by Mr. Erastus Wiman on "Electric Lighting from a Financial Standpoint."

Adjourned till Thursday morning.

THIRD DAY, THURSDAY.

The first business was the reading of the paper on "Franchises for Quasi-Public Corporations," by Allen R. Foote, which was followed, after a brief discussion, by the reading of a paper by Mr. Richard Hammond on "How to Fire a Steam Boiler." An abstract of this paper will be found elsewhere in this issue.

The paper was discussed by D. Asworth, J. B. Edson, J. A. Seely, Mr. Coggeshall, E. F. Peck and C. J. Field.

Mr. Armstrong suggested that it might be a good plan for the association to organize a bureau of firing; and then offered the following resolution:

Resolved: That the National Electric Light Association cordially endorses the plan of holding World's Congresses at the Columbian Exposition, and pledges its hearty co-operation to make the Electrical Congress under such auspices a success.

The resolution was carried.

The next business was the paper of Mr. E. F. Peck on Overhead Construction, which was discussed by Prof. Elihu Thomson, J. A. Seely, Messrs. Wightman, Law, Stanley, Lockwood and Leslie. Then followed the reading of papers on "Operation of High Tension Currents Underground," by E. A. Leslie, and "The Underground Construction of the Buffalo Railway Company," by J. B. Craven, abstracts of both of which papers will be found in another part of this paper.

After a short discussion adjournment was taken till 3.30 P.M. At the afternoon session a resolution was passed, thanking the Bell Telephone Co., of Buffalo, and the American Telephone and Telegraph Co. of New York and the Postal Telegraph and Cable Co. for courtesies in extending the free use of their wires to the delegates, and to the President of the Association and the citizens of Buffalo for hospitality extended during the meeting.

The association then went into executive session.

The following officers were elected for the ensuing year:

President, James I. Ayer, St. Louis, Mo.; First Vice-President, E. A. Armstrong, Camden, N. J.; Second Vice-President, C. H. Wilmerding, Chicago, Ill.; Secretary, George F. Porter, New York. Executive Committee: Three new members, H. H. Fairbanks, Robert Mackie, C. Lee Abell; old members, John A. Seeley, E. F. Peck, Chas. R. Faben, Jr., Frederic Nicholls, M. D. Law, A. M. Young. Adjourned.

The next meeting of the association will be held in St. Louis, Mo., February, 1893.

EXHIBITS.

THE SECURITY INSULATOR CO., of New York, was represented by its Secretary, Mr. A. S. Brown, who distributed samples of its valuable insulator.

THE RIES REGULATING SOCKET was again on top, and attracted fully as much attention as it did at the Montreal convention, where it was first introduced to the electrical fraternity. Mr. Elias E. Ries, the genial president of the Ries Electric Specialty Co., was kept busy explaining its many advantages to the members in attendance at the Iroquois, where it was on exhibition.

"C. & C. MOTORS" are fast becoming a household word. The American Electrical Supply Co., of Buffalo, is the agent for this popular machine, and exhibited a full line of them at its warerooms, 226 Pearl street. A handsome catalogue that we picked up at the Iroquois gave us this information. The main office of the C. & C. Electric Motor Co. is at 402 and 404 Greenwich street, New York.

C. A. WHITE, of the Eco Magneto Clock Co., 620 Atlantic Avenue, Boston, Mass., was in Room 174 at the Iroquois. This Watchman's clock operates from small magnetos set at any distance from the clock and indicator. Any number of stations or sections can be put on the indicator. An installation of this at the Russell-Irwin Mfg. Co., New Britain, Conn., has 120 stations. Mr. White thinks that every central station should have one of these clocks.

MR. N. S. POSSONS of the Eureka Tempered Copper Co., North East, Pa., sole manufacturer of pure tempered copper journal bearings, etc., had an exhibit in the main corridor of the Iroquois Hotel, and explained to all the unparalleled virtues of his tempered copper goods. A good assortment of commutator segments and parts of dynamos and motors were shown, also gear wheels and other specialties, valued for their hard wearing surface and high conductivity.

MR. W. F. CULLEN, representing the E. P. Gleason Mfg. Co., 181–189 Mercer Street, New York, manufacturers of electrical appliances for arc and incandescent electric lighting, had a line of shades of all kinds and designs from the ordinary glass shade to the beautiful cut and etched goods, in room 310, at the Iroquois. Also a line of porcelain shades of various designs. This company is one of the largest manufacturers of incandescent lamp bulbs. Mr. Cullen also showed a large assortment of metal goods for the incandescent system, including sockets, switches, shade-holders, sliding shells for ornamenting fixtures. This company also manufactures all varieties of electroliers, electric combination fixtures and everything necessary in fittings, joints, etc., for the incandescent system.

THE ELECTRICAL CONSTRUCTION & SUPPLY CO., of New York, was represented by R. B. Corey, General Manager, and J. C. Knight. They had on exhibition in Room 104 one of their new search lights and a photo-engraving lamp, also a few of their famous "Ward" arc lamps for low-tension circuits. It is stated that there are nearly 20,000 of these lamps in daily use in the United States and other countries.

F. P. LITTLE & CO., 141 Seneca street, Buffalo, displayed at their salesrooms a line of Crocker-Wheeler motors, also the new automatic switch for motor circuits that takes six seconds to cut in full current and cut out instantly; and a full line of Perkins incandescent lamps, of which they carry 10,000 in stock constantly. They also carry a large stock of Grimshaw insulated wires for immediate delivery; also Shield Brand insulated wire in all sizes and in any quantity, Western Electric office and household specialties, annunciators, etc.; and a full line of Bryant sockets, switches, etc. The members of the firm are F. P. Little, S. F. Eagan and P. P. Willer.

THE NEW YORK INSULATED WIRE CO., of 15 Cortlandt street, New York, had a full display, in parlor 66, at the Iroquois, of the various parts of the Vulca Electric wire duct system, including elbows, angle boxes, etc. In making the elbows great care is taken to secure smoothness of the bore. The porcelain used in the junction boxes is of extraordinary quality, and is surpassed in its insulating properties. It is not porous to the least degree, and will not absorb any moisture. The company was represented by C. A. Place, Vice-President; J. W. Godfrey, General Manager; Augustus Noll, Electrical Expert, and G. A. Meeker, the Western Manager.

PHŒNIX GLASS COMPANY, of New York, was represented by Mr. E. H. Peck, in Room 314, Iroquois, where a line of well-selected electric and gas shades of rich cut, cut and etched, and silver etched, also a choice assortment of rare cut-glass shades.

J. H. RHOTEHAMEL, St. Louis, Columbia Incandescent Lamp Co., was present with samples of his company's popular lamp. The company, it is said, took an order for 10,000 lamps in New York recently.

THE CUTTER ELECTRICAL AND MANUFACTURING COMPANY, of Philadelphia, was represented by Mr. H. B. Cutter, who had, in Room 174 at the Iroquois, a display of C-S. portable lamp-stands, with C-S. reflector shades attached, complete and in parts. Also a C-S. double-push switch.

THE EUREKA TEMPERED COMPANY, of North East, Pa., had an exhibit in the main corridor of the Iroquois of a sample-board of commutator segments, brushes, wires, etc. Mr. N. F. Possons represented the company.

MR. C. R. MORSE, general manager Buffalo Engineering Company; Buffalo, N. Y., through his sagacity and foresight, secured the eligible location where the Otis Electric Pump was exhibited in the main corridor of the Iroquois Hotel. Mr. A. E. Hall, of the Otis Brothers Co., New York, installed the pump which was on exhibition, and explained its merits, also of the Crocker-Wheeler motor which operates the pump, and the new Crocker-Wheeler automatic switch. This switch is an ingenious and valuable adjunct, it takes six seconds to cut in full current, overcoming all danger of sparking, etc. It will cut out the current instantly.

THE Thompson Recording Water Meter was on exhibition at Room 62, Iroquois.

W. H. WESTON & CO., Philadelphia, Pa., had an exhibit in the lobby of the Iroquois of their celebrated quick-break switches and cut-outs.

THE STANDARD ELECTRIC TIME COMPANY, New Haven, Conn., was represented by its general manager, Mr. C. D. Warner. Mr. Warner had some samples of Warner's patent electric gauge.

THE BRYANT ELECTRIC COMPANY, of Bridgeport, Conn., W. C. Bryant, general manager, was in possession of Room 215 at the Iroquois, and exhibited some of the well-known Bryant specialties, including switches, sockets, cut-outs, etc.

The Paranite Rubber and Insulated Wire Company, of Jonesboro, Ind., had a display of samples of aërial, submarine and underground wires, tubing, etc., and was represented by Mr. C. G. Butler.

Hart & Hageman, Hartford, Conn., showed a full line of their goods, which was attractive. The exhibit included a new 60-ampère double-pole switch. Mr. A. H. Pease, secretary and treasurer of the company, was in attendance.

The Electrical Appliance Company, of Chicago, was represented by its president, Mr. W. W. Low. Its display consisted of samples of the Swinging Ball Arrester, the new Acme single-pole switch, the N. E. switch, etc.

The Thomson-Houston Company, of Buffalo, had an exhibit of a new electric pole and switch. The apparatus was in practical operation in front of the company's office on Court street.

Benedict & Burnham, Waterbury, Conn., was represented by D. L. Hungerford. Mr. Hungerford had in Parlor D, at the Iroquois, some samples of water-proof and magnet wire. The "Benedict" wire, a new product of this company, is claimed to be the best insulated wire on the market.

The International Okonite Co., Limited, of New York and London, occupied Parlors E and C at the Iroquois, and had a display of samples of Okonite insulated wire, electric railway and submarine cables and Acme covered underground cable, which latter is receiving much favorable attention. Capt. Willard L. Candee and George T. Manson represented the company, and entertained their many friends and callers in a royal fashion. Their elegant Okonite cigars (made of fragrant Havana tobacco, not of Okonite) were enjoyed by lovers of the weed.

The Electric Engineering and Supply Co., Syracuse, N. Y., was fully represented by F. H. Leonard, J. L. Hines, J. D. McIntyre and H. J. Gorke. The company had an exhibit in the main corridor of the Iroquois of a line of switches for large currents, which attracted considerable attention by their elegant finish and massiveness. These switches ranged from 30 to 1,000 ampères, and were mounted on marbleized slate and pure marble.

The Utica Electric Manufacturing and Supply Co., Utica, N. Y., had a sample board of its specialties in Room 270 at the Iroquois, and was represented by Mr. W. D. Bossart, general manager. Among the company's specialties are a lightning-arrester for power and lighting circuits; a quick-break snap-switch, made in sizes from 50 to 1,000 ampères; porcelain fuse-boxes, cut-outs, carbon brush-holders, and many other devices for which this company is celebrated. A good deal can be said in favor of this concern and its goods.

The Saginaw Mfg. Co., of Saginaw, Mich., was represented by its President, Mr. G. A. Gilbert, who had on exhibition on the ground floor of the Iroquois Hotel a very fine specimen of a pulley which they specially manufacture for dynamo purposes. The company claims that this pulley is stronger and more durable than any on the market, and to demonstrate this fact it has issued a challenge for a test, open to all manufacturers. R. Hoffeld & Co., of Buffalo, N. Y., are the manufacturers' agents.

Mr. P. C. Ackerman, manager of the New York office of the American Electrical Works, of Providence, was at the Iroquois with a full line of samples of the celebrated wires made by the company. The American Electrical works makes patent-finished electric-light wire, magnet, annunciator and office wires, rubber-covered wire, lead-encased wire, telephone and incandescent cords.

The Edison General Electric Company had an exhibition of its goods at its ware-room, No. 41 Niagara street. There was a small Edison plant in operation for the purpose of displaying the electroliers in the fixture show-room. Mr. Henry B. Oakman is the enterprising representative of the Edison interests in Buffalo.

The Beacon Vacuum Pump and Electric Co., 15 High street, Boston, had a display in the main corridor at the Iroquois of Beacon incandescent lamps of various voltages, ranging from 16 to 250 C. P., with frosted and plain bulbs. This company claims that these lamps have longer life and greater efficiency than any other lamp on the market. The air is exhausted by mechanical process, and the filaments are carbonized, baked and treated under the company's own process. This company also makes a railroad lamp with supporting filament. These lamps are used on all the Pittsburg electric lines and on the West End Road, Boston, as well as on roads in many other places. Mr. S. S. Sherman represented the company.

R. Hoffeld & Co., of Buffalo, N. Y., manufacturers of leather belting, had an excellent exhibition at their store, Nos. 332 to 336 Washington street. It consisted of engine lathes, planers, shapers, drill presses, grinders, wood-split pulleys, emery wheels, drills, taps, dies, reamers, etc. The house is headquarters for everything mechanical.

The Mitchell Brant Copper Co., of Erie, Pa., was represented by Mr. A. L. Daniels. Mr. Daniels displayed at the Tifft House some samples of commutator segments. These goods are guaranteed to be made of pure copper and tempered to gauge.

The Dayton Fan and Motor Co., Dayton, Ohio, was represented by Mr. W. H. Ashton, who distributed elegant vest-pocket memorandum-books with Russia leather cover.

C. S. Van Nuis, of New York, of Ajax Switch fame, was on the ground with a neat little reminder that the "Fulmen" Lightning Arresters are of excellent merit. The reminder is in the shape of a Yale lock key, made of cardboard silvered, on one side of which is printed the word "Protection" and on the other the injunction "use 'Fulmen Arresters.'"

A. B. Laurence, New York manager Shultz Belting Company, of St. Louis, had his headquarters at parlor K, the Iroquois, and samples of his specialties at the Stafford House. His main specialty was Shultz Patent Sable Dynamo Rawhide Belting. These goods are now known by the Black Stain, and every ten feet is stamped "Shultz Patent Sable Rawhide Dynamo Belting."

The Keystone Electric Co., of Erie, Pa., exhibited reversible switches for elevator work, in the main corridor of the Iroquois. These switches were in practical operation, running in connection with the company's new motors.

Mr. Jarvis B. Edson, of New York, had one of his recording-pressure gauges on exhibition in Room 242 at the Iroquois. This instrument was fully described and illustrated in the Electrical Age of February 27—the Convention number.

The Detroit Motor Company, Detroit, Mich., had one 4 K. W. motor and two cut-out boxes on exhibition in the main corridor of the Iroquois. The company was represented by Mr. W. S. Armour, the Chicago agent, and B. R. Van Court, manager of the company.

H. T. Paiste, of Philadelphia, had a display of his celebrated china switches in the main corridor of the Iroquois. These switches are imported from England, and are hand painted in colors and tints to match all kinds of interior decorations. Mr. Paiste himself was in attendance.

The Gould & Watson Co., of Boston, was represented by Edward P. Sharp, and had a display of samples in parlor A, at the Iroquois, of waterproof Edison, Westinghouse, and Thomson-Houston sockets, the Smith Rosette cut-out and an insulated hanger for arc lights. A Whitney direct-reading voltmeter and ammeter were also exhibited. These instruments are low-priced and guaranteed to be absolutely reliable in the readings. By the use of a catch on the quadrant the pointer is brought to a dead stop at once, making it practically a dead-heat instrument.

Pass & Seymour, of Syracuse, N. Y., were represented by Mr. A. P. Seymour, who had a display of the celebrated electrical specialties made by this firm. The exhibit included china insulators, cleats, fixture cut-outs, ceiling rosette cut-outs, circuit breakers, tree insulators, trolley-wire insulator, wiring tubes, etc., etc.

J. J. Murray & Co., Philadelphia, Pa., the well-known manufacturers of incandescent shades, was represented by Mr. J. K. Martin. Mr. Martin had a display, in Room 151 at the Iroquois, of a general line of etched glass arc and incandescent shades, also opal, opalescent and rich cut shades, as well as a full line of gas shades. The incandescent shade with a twist and corrugated edge is very neat and artistic.

The Electric Secret Service Company, of 45 Broadway, New York, had an exhibit in Room 156 at the Iroquois which attracted a great deal of attention among Central-Station men. It was the individual arc light and motor cut-out, and a practical exhibition of its operation was given. Two electric arc-light selectors and cut-outs were placed on poles on Main street, leads running from them to Room 156, where another selector, cut-out and the transmitter were located, all on the same circuit. Any one of the lights outside could be cut out from the room, or central station, as it would be in regular practice, without disturbing the other lights on the same circuit. Mr. C. P. Mackie, the general manager, and Mr. S. S. Bogart, the company's electrical expert, were present and explained the operation of the apparatus.

The Consolidated Electric Manufacturing Company, of Boston, had a real novelty on exhibition in Room 174 at the Iroquois. It consisted of an arc lamp for incandescent circuits, of entirely new design. It is known as the Hamil arc lamp, and the patents are controlled by the C. E. M. Co. The lamp is remarkably simple in design, and it is claimed to be perfect in its operation. There is no flickering, and the arc is constant and burns free without flashing. There is no clock-work in the mechanism, and the feed is entirely automatic. These lamps will burn 10 in series on 500-volt circuits, or two in series on circuits of 110 volts. They are guaranteed to work every day in the week for years. The electric feed is constant, and will not stick. The lamp burns six ampères of current. Mr. C. E. Bibber represented the company, and he reports that the lamp is attracting a great deal of attention on account of its simplicity.

Mr. F. A. Lane, of the Standard Oil Company, Cleveland, had some samples of engine oils in the main corridor of the Iroquois.

J. C. Pierrez, of the Columbia Rubber Works, 65 Reade street, New York, exhibited some samples of hard-rubber tubes, rods, etc., and the celebrated tape made by this company, for which there is now a large demand.

NOTES.

Mr. E. L. Ross represented the Chapman Valve Manufacturing Co., of Indian Orchard, Mass.

The Crocker-Wheeler Motor Co. distributed a plentiful supply of literature concerning the company's celebrated motors.

The Partrick & Carter Co., Philadelphia, was represented by Mr. E. Ward Wilkins, who distributed a souvenir memorandum book.

Diehl & Co., 385 Broadway, New York, was represented at the convention by a handsome catalogue descriptive of their fan motors, etc.

Mr. N. V. Titus, Treasurer of the Economic Electric Manufacturing Co., Boston, was at the Iroquois, in pursuit of business and happiness.

Mr. Wilson, of the Francis & Bickford Belting Co., of Buffalo, N. Y., was seen at the Iroquois Hotel entertaining some of his numerous friends.

Mr. H. L. Shippy, of the Roebling Wire Co., was present, and received the usual welcome worthy of individuals of so distinguished a character.

Mr. Charles R. Huntley, the genial and popular president of the association, was here, there and everywhere where his services were needed.

The Buffalo Feed-Water Heater Co. mailed to all the delegates a circular descriptive of its heater. The company was represented by Mr. R. Laws.

The Falls Rivet and Machine Co., Cuyahoga Falls, O., distributed a circular containing a partial list of electric plants installed by that company.

The Lovell Manufacturing Co., Erie, Pa., was represented by Mr. M. N. Lovell. This company is the manufacturer of the "Niagara" dynamos and motors.

Morris W. Mead, electrical expert, mayor and city council of Pittsburg, Pa., was on hand, and made it pleasant for all those with whom he came in contact.

Miss Billings, the stenographer of the association, was in attendance. Her courtesies were fully appreciated by all. She is an efficient assistant to Secretary Porter.

Mr. C. A. Schieren, Jr., did not have an exhibit, but while his voice held out the merits of his goods were fully explained. He was assisted by Mr. E. P. Atkinson.

C. D. Shain, of the Edison Gen. Elec. Co., New York, and John I. Beggs, of the Chicago office of the same company, were prominent attendants to the convention.

Mr. C. Sturgeon, electrician and Superintendent of the Keystone Electric Co., Erie, Pa., had charge of the exhibit of Keystone motors and reversible switches in the corridor of the Iroquois.

The Weston Electrical Instrument Co., of Newark, was represented at the convention by Mr. Richard O. Heinrich, the gentleman who had charge of its exhibit at the Frankfort Exhibition last year.

The trip on Tuesday afternoon to examine the Hill clutches at the power house was a great success, and all those who attended were amply repaid for their trouble. Mr. S. S. Leonard had charge of the party.

The Jewell Belting Co., Hartford, Conn., occupied rooms 202 and 204 at the Iroquois, in which it had samples of the well-known Jewell belting. C. E. Newton, the secretary, and Charles Tolles, were in attendance.

Mr. W. D. Packard, of the New York and Ohio Company, Warren, Ohio, maker of the celebrated Packard incandescent lamp, was at the Iroquois. Mr. Packard reports trade good, and general satisfaction with his lamps.

Mr. A. S. Brown, of the Security Insulator Co., 136 Liberty street, N. Y., desires all persons who have not received samples of the company's valuable insulator to write to the New York office, and samples will be mailed at once.

Mr. Louis McCarthy, General Manager of the W. T. C. Macallen Co., manufacturers of solid mica insulators, and jobbers and wholesale dealers in mica, 161 High street, Boston, Mass., sowed seed in the interest of his company.

H. G. Issertel, of the A. B. C. Co., New York, carried with him wherever he went a black box on his back, which looked like a kodak. It contained a voltmeter, and he succeeded in getting a number of orders through his enterprise.

The American Electrical Supply Co., 226 Pearl street, Buffalo, was represented by its general manager, W. A. Fenn, who invited the delegates to his establishment to inspect the fine line of "C. & C." motors, Grimshaw wires, etc., etc.

H. A. Cleverly, the old-timer of Big C fame, missed many of the familiar faces of the old fraternity. He did not bring any stock with him, but seemed able, as of old, to convince us that he has plenty of good things at 1018 Chestnut street, Philadelphia.

The Rockford Electric Manufacturing Co., of Rockford, Ill., distributed a catalogue relating to the arc and incandescent dynamos, motors and power generators manufactured by it. The catalogue also included a great deal of valuable information.

The James Leffel & Co., of Springfield, Ohio, manufacturers of the celebrated Leffel water wheel, distributed at the convention a very neat *brochure* on water wheels. Over thirty years experience in the manufacture of water wheels makes this concern authority on the subject.

The cut used in our regular issue of February 27, illustrating the subjects of the papers to be read at the convention, was the idea of Secretary George F. Porter, and it was an excellent one. We have heard a number of favorable remarks about it, and we desire to give the credit to whom it belongs.

Mr. J. George Kaelber, of Rochester, N. Y., representing the Electric Light Department of the Western Electric Company, New York and Chicago, was on deck as usual, beaming with smiles and hustling after business. Mr. Edward B. Ellicott, of the same company, Chicago, was also about headquarters.

The Abendroth & Root Manufacturing Co., of New York, was represented at the convention by a very unique catalogue and a general circular of the famous Root safety sectional boiler. Many of our leading electric light plants and electric street-railway companies have adopted these boilers for their safety, economy and durability.

It made the young men on the New York special train feel very young to listen to the reminiscences of R. J. Sheehy, of New York, and Fred. Royce, of Washington. These two gentlemen can tell stories about the early days and struggles of electricians and their inventions that are positively charming to the younger generation.

Frank S. De Ronde, of the Standard Paint Company, 2 Liberty street, New York, and P. H. Hover, of Chicago, the Western representative of the same concern, were about association headquarters trying to find more places where they can apply their paint and introduce their other well-known goods, including P. & B. compounds, varnishes, insulating paper, etc., etc.

Mr. Harry Robbins, of the Robbins Electric Company, dealer in supplies for electric railway and lighting companies, 830 Liberty avenue, Pittsburg, was quartered at the Iroquois. This company is the agent in Pittsburg for the Perkins Electric Lamp Company and the Bryant Electric Company, of Bridgeport, Conn., and handles Okonite and K. K. wires, both of which are its specialties.

Wm. Jessop & Sons, of New York, probably the largest dealers in high-class machine tool steel in the United States, and a concern always favorably mentioned in connection with these wares, circulated a neat catalogue that slides easily into the pocket and possesses a fund of information that no manufacturer that uses steel can afford to be without. Send for one to 91 John street, New York.

MR. F. R. CHINNOCK, New York State Agent for the Edison General Electric Company, was seen about the Iroquois. He took a party of friends over to the Edison exhibit on Niagara street and showed them the beautiful line of electric fixtures on exhibition there. They afterwards visited the electric light plant in the Masonic Temple. The many installations about Buffalo testify to his great ability.

CAPT. WILLARD L. CANDEE and Mr. George T. Manson, of the Okonite Company, entertained a large party of their friends in their parlors at the Iroquois on Tuesday and Wednesday evenings, February 23 and 24. Marshall P. Wilder, the well-known humorist and mimic, entertained the party on each evening in his inimitable manner. The entertainment was exceedingly enjoyed by all present. There were quite a number of ladies present at each entertainment, who also enjoyed the fun with great relish.

THE distinguishing badges at the Convention were as follows: Officers, blue rosettes; executive committee, red rosettes; active members, red ribbon; associate members, blue ribbon; guests, white ribbon; honorary members, white ribbon; reception committee, yellow ribbon. The badges were composed of two parts, namely, the ribbon and the buttons. The ribbons were distributed free to the members, but in order to secure a button $1 had to be planked down. This innovatian opened the eyes of the members. Some objected to paying the dollar, and some did not.

F. P. JONES & Co., 225 Pearl street, Buffalo, N. Y. This firm has just completed the lighting construction work of the First Presbyterian Church, corner Wadsworth and Circle streets, which consists of 420 lights, as follows: 3 chandeliers of 80 lights each; the sanctuary lamp, which is very beautiful and artistic in design, contains 12 lights, etc., etc. There are 125 lights in the school-room. Each chandelier is controlled by a switchboard near the side entrance. Two wires are run from each switch to a cut-out board over the gallery, and there the circuit is divided into five branches, on each of which are 16 lamps for the main chandeliers. This firm is general supply dealer and agents for the Keystone Elec. Co., Erie, Pa. It had on exhibition at the Iroquois a 10 H. P. reversible motor of the Keystone Co.

THE electrical press was very fully represented, as follows: C. W. Price, H. T. Richards, S. L. Coles and M. J. Bulkley, *Electrical Review*; G. M. Phelps, T. C. Martin, Joseph Wetzler, F. R. Colvin, L. W. Collins, W. F. Collins and A. C. Shaw, *Electrical Engineer*; W. A. Kreidler, J. B. O'Hara and W. F. Osborne, *Western Electrician*; W. J. Johnston, Dr. Louis Bell, Carl Hering, J. Stanford Brown, Edward Caldwell and L. H. Hart, *Electrical World*; E. L Powers and E. E. Wood, *Electrical Industries*; H. M. Swetland and S. W. Hume, *Power*; N. W. Perry, De Veaux Powel and W. H. Temple, *Electricity*; M. J. Sullivan, *Street Railway Gazette*; R. W. Pope and A. E. Davis, *Electric Power*; Herbert W. Pool and Mr. Dickerson, *Street Railway Journal*; G. G. McDuff and C. T. Waugh, *Street Railway and Electrical News*, St. Paul, Minn.; J. B. Taltavall, T. R. Taltavall, N. D. Webster and W. T. Hunt, ELECTRICAL AGE.

ATTENDANTS.

The following is a list of those who were in attendance at the Convention:

Ackerman, P. C., Am'n Elec. Works, New York.
Alberger, Louis R., Worthington Pumps, New York.
Alexander, P. H., A. B. C. Co., New York.
Anderson, F. J., Morristown, N. J.
Andrus, W. M.
Armour, Wm. S., Detroit Motor Co., Chicago.
Armstrong, Hon. E. A., Camden, N. J.
Ashton, W. H., Fan Motors, Dayton, O.
Ashworth, D., Carnegie, Phipps & Co., Pittsburg, Pa.
Atkinson, E. P., Chas. A. Schieren & Co., New York.
Atwater, Chas., Stanley Elec. Co., Pittsfield, Mass.
Ayer, J. I., Municipal Lt. Co., St. Louis, Mo.
Ball, Frank, Ball & Wood, New York.
Baker, Jr., C. O., Platinum, Newark, N. J.
Balsley, A., Philadelphia.
Barre, Joseph.
Barstow, W. F., Citizens' E. I. Co., Brooklyn.
Bartlett, E. E., New York.
Bauer, A. H., Pullman Co., Chicago.
Beggs, J. I., Edison Gen. Elec. Co., Chicago.
Bentley, J. H., Sec'y Century Pottery Co., Camden, N. J.
Bibber, C. E., Consolidated Elec. Mfg. Co., Boston.
Blake, G. W., Perkin's Lamps and Mather Elec. Co., New York.
Bogart, S. S., Elec. Secret Service Co., New York.
Bostwick, F. H., T.-H. Elec., Akron.
Braddell, Alfred E., Electrician, Philadelphia.
Breithaupt, E. Johns Hopkins University, Baltimore, Md.
Brooks, H. H., Buffalo, N. Y.
Brophy, Capt. Wm., Boston.
Brown, A. G., New York.
Brown, A. S., Security Insulator Co., New York.
Brown, J. Stanford, *Elec. World*, New York.
Brown, W. S., Sec'y Penn Yan E. L. & P. Co., Penn Yan, N. Y.
Bryant, W. C., Bryant Elec. Co., Bridgeport, Conn.
Burk, Dr. W. H., Philadelphia, Pa.
Burnett, G. A., Mgr. G. N. W. Tel. Co., Buffalo.
Burrell, E. L., Chicago Ag't C. A. Schieren & Co.
Butler, C. J., India Rubber, Akron.
Byam, N. H., Munson Belt'g Co., Pittsburg, Pa.
Caldwell, Edw., *Elec. World*, New York.
Carter, E. D., Ball Engine Co., Erie, Pa.
Chaffee, W. A., Buffalo.
Chase, H. S., Boston.
Chase, O. D., Commercial Elec. Co., Detroit.
Chesley, C. C., Boston.
Chinnock, F. R., Edison Gen. Elec. Co., New York.
Cleverly, H. A., Cleverly Elec. Works, Philadelphia, Pa.
Coles, Stephen L., *Elec. Review*, New York.
Collins, L. F., *Elec. Engineer*, New York.
Collins, W. F., *Elec. Engineer*, Chicago.
Colvin, F. R., *Elec. Engineer*, New York.
Corey, R. B., Elec. Con. and Supply Co., New York.
Corriveau, A. J., Montreal.
Coster, M., Westinghouse Elec. Mfg. Co., Pittsburg.
Cowles, J. W., T.-H. Elec. Co., Boston.
Crandell, C. D., Western Electric Co., Chicago.
Crossman, T. E., Stenographer, Brooklyn.
Cullen, Wm. F., E. P. Gleason Mfg. Co., New York.
Cunz, W. R., Gas and Elec. Co., Medina, N. Y.
Cushing, F. W., Chicago.
Cutter, H. B., Cutter Elec. Mfg. Co., Philadelphia, Pa.
Cutter, Geo., Elec. Supplies, Chicago.
Davis, A. E., *Elec. Power*, New York.
Davis, D. L., Salem Elec. and P. Co., Salem, O.
Daniels, A. L., Mitchell Brant Copper Co., Erie, Pa.
Darlington, F., United Elec. Lt. and P. Co., New York.
Daverin, W. A., Elec. Engineer, Boston.
De Ronde, F. S., Standard Paint Co., New York.
Dickerson, M., *Street Railway Journal*, New York.
Dumoulin, L. S., West End Street R'y, Boston.
Eckert, W. H., Kerite Wires, New York.
Ellicott, Edw., West Elec. Co., Chicago.
Edson, Jarvis B., Edson Recording Gauge, New York.
Fairbanks, H. H., Elec. Light and Power Co., Worcester, Mass.
Famous, W. N., Penn Elec. Eng. Co., Philadelphia.
Faye, C. H., Mun. Elec. Ill. Co., Brooklyn.
Fearey, T. H., T.-H. Elec. Co., Syracuse, N. Y.
Fenn, W. A., Elec. Supplies, Buffalo, N. Y.
Fenton, H. J., Worthington Pumps, Lockport, N. Y.
Ferguson, C. G., Electric Correspondence, New York.
Ferguson James, Municipal Elec. Lt. Co., Brooklyn, N. Y.
Fessenden, R., Stanley Elec. Co., Pittsfield, Mass.
Field, C. J., Field Eng. Co., New York.
Fielder, P. G., Boston Braid Co., Boston, Mass.
Findlay, J. H., Elec. Light and Gas Co., Ogdensburg, N. Y.
Fisher, F. E., Fisher Elec. Co., Detroit.
Fisher, G. E., Commercial Elec. Co., Detroit.
Foote, Allen R., Washington, D. C.
Foster, H. A., Electric Census, New York.
Francisco, M. J., Rutland Elec. Lt. Co., Rutland, Vt.
Francisco, Master Don, Rutland, Vt.
Fremyear, T. C., Edison Gen. Elec Co., Buffalo, N. Y.
Fulton, H. J., Lockport, N. Y.
Gilbert, G. A., Saginaw Mfg. Co., Saginaw, Mich.
Goble, Chas., Lockport, N. Y.
Godfrey, J. W., N. Y. Insulated Wire Co., New York.
Gorke, H. J., Elec. Eng. and Sup. Co., Syracuse, N. Y.
Gray, Elisha, Chicago.
Gray, L. A., Chicago.
Griffith, C. C., Rochester, N. Y.
Gwynn, J., Gas Elec. Co., Steubenville, O.
Hall, A. E., Otis Elec. Pumps, New York.
Hanna, J. A., J G. Brill Co., Philadelphia.
Hare, R. S.
Hart, L. H., *Elec. World*, New York.
Hayes, C. F., Syracuse.
Heath, Dr. W. H., Buffalo, N. Y.
Heinrich, R. O., Western Elec. Inst. Co., Newark, N. J.
Hering, Carl, New York.
Hewlett, O. H., of Thos. Welds, New York.
Hill, F. T. G., Gas and Elec. Lt. Co., Waltham, Mass.
Hills, Chas., I. Perkins Lamps, Hartford.
Hine, Henry, Stanley Elec. Mfg. Co., Pittsfield, Mass.
Holmes, W. C., Newton Gas Co., Newton, Mass.
Hover, P. H., Standard Paint Co., Chicago.
Hubbard, Wm. A., Photos, N. Y.
Hume, S. W., *Power*, New York.
Hungerford, D. L., Benedict & Burnham, Waterbury, Conn.
Hunt, W. T., *Electrical Age*, New York.
Hunt, G. W., Hunt Engineering Co., New York.
Huntley, C. R., Brush Elec. Lt. Co., Buffalo.
Houghton, C. W., Ashton Valve Co., Boston.
Issertel, H. G., A. B. C. Co., New York.
James, J. N., Naval Observatory, Washington, D. C.
Johnston, W. J., *Elec. World*, New York.
Jones, A. J., Edison Elec. Ill. Co., New Brunswick, N. J.
Jones, F. P., Elec. Supplies, Buffalo.
Kaelber, J. G., Western Elec. Co., Rochester, N. Y.
Kitton, Frank, Manager W. U. T. Co., Buffalo.
Knight, J. C., Elec. Con. and Supply Co., New York.
Knudson, A. A., Knudson Cuttriss Wire Co., New York.
Kreidler, W. A., *Western Electrician*, Chicago.
LaRoche, F. A., LaRoche Elec. Works, Philadelphia.
Laurence, A. B., Shultz Belting Co., New York.
Law, M. D., Edison Co., Schenectady, N. Y.
Learned, Chas. A., J. C. Elec. Lt. Co., Jersey City, N. J.
Lee, G. M., Little Falls Elec. Lt. Co., Little Falls, N. Y.
Leonard, F. H., Jr., Electric Engineering and Supply Co., Syracuse, N. Y.
Leonard, H. Ward, H. Ward Leonard & Co., New York.
Leonard, S. S., Hill Clutch, Cleveland.
Leslie, E. A., Manhattan Elec. Lt. Co., New York.
Little, F. P., F. P. Little & Co., Buffalo, N. Y.
Lockwood, J. E., Detroit Elec. Works, Detroit, Mich.
Lovell, W. N., Dynamos, Erie.
Low, W. W., Elec. Appliance Co., Chicago.
Lyman, H. M., Canton, O.
Lynch, W. A., Cent. El. and P. Co., Canton, O.
Mackie, C. P., Elec. Secret Serv. Co., New York.
Mackie, Richard, Cincinnati.
Mainwaring, A. H., Brush Elec. Lt. Co., Philadelphia.
Manson, Geo. T., Okonite Co., New York.
Martin, John K., J. J. Murray Co., Glass, Philadelphia.
Martin, T. C., *Elec. Engineer*, New York.
Mason, J. H., Simplex Wire Co., Boston, Mass.
McBrier, James, Ball Engine Co., Erie, Pa.
McCarthy, Louis, Mica, Boston.
McCoy, D. B., New York.
McDuff, G. G., *St. R'way and Elec. News*, Chicago.
McIntire, C. H., Wire Joints, Newark, N. J.
McIntyre, J. D., Elec. Eng. and Sup. Co., Syracuse, N. Y.
McLaughlin, Wm. R.
McMann, H., Police Dept., Buffalo.
Mead, Morris W., Bureau Elec'y, Pittsburg.
Mellville, G. S., New York.
Mertz, W. H.
Metzger, E., Warren.
Minott, F. S.
Montfort, J.
Morrison, E. W., Ft. Wayne Elec. Co., Toronto.
Morse, C. M., Buf. Engrg. Co., Buffalo, N. Y.
Nicholls, Frederic, Inc. Electric Lt. Co., Toronto. Ont.
Noble, J. W., Stanley Elec. Co., Pittsfield, Mass.
Noll, Aug., N. Y. Ins. Wire Co., New York.
Nunn, P. N., Telluride, Colo.
Oakman, Henry B., Edison Gen. Elec. Co., Buffalo, N. Y.
O'Hara, J. B., *Western Electrician*, Chicago.
O'Hearn, Wm., Memphis.
Olip, B., U. P. Land Dept., Gothenburg, Neb.
Osborne, W. F., *Western Electrician*, New York.
Osgood, J. L., R. Hoffeld & Co., Buffalo.
Paiste, H. T., Switches, etc., Philadelphia.
Peck, E. F., Citizens' Ill Co., Brooklyn, N. Y.
Peck, E. H., Phœnix Glass Co., New York.
Perry, Marsden J., Narr Elec. Lt. Co., Providence, R. I.
Phelps, Geo. M., *Elec. Engineer*, New York.
Phillips, S. S., Seneca Electric R'y, Seneca Falls, N. Y.
Pierrez, J. C., Columbia Rubber Works Co., N. Y.
Platt, F. B., Elec. Supply Co., Chicago.
Pool, H. W., *St. Railway Journal*, New York.
Pope, R. W., *Elec. Power*, New York.
Porter, G. F., Sec'y N. E. L. A., New York.
Possons, N. S., Eureka Tempered Copper Co., Erie.
Post, I. M., The E. S. Greeley & Co., New York.
Power, E. L., *Industries*, Chicago.
Powers, H. N., New York.
Prentiss, J. D., Brush Elec. Co., Cleveland.
Price, C. R., Boston.
Price, C. W., *Elec. Review*, New York.
Pritchard, F. E., Brush Elec. Co., Niagara Falls.
Purdy, C. J., Supt., Canandaigua, N. Y.
Reed, E. M., Lt. H. & P. Co., Pueblo, Col.
Reis, Elias E., Reis Elec. Mfg. Co., Baltimore, Md.
Reynolds, J. F., Buffalo.
Reynolds, H. D., Postal Tel. Co., Buffalo.
Rhodes, P., Brush Elec. and P. Co., Niagara Falls.
Rhotehamel, J. H., Columbia Lamp, St. Louis, Mo.
Richards, H. T., *Elec. Review*, N. Y.
Ridlon, Frank, Wright Elec. Mfg. Co., Boston.
Riker, S. H., W. U. Tel., Syracuse, N. Y.
Roach, M. C.
Robbins, H., Elec. Supplies, Pittsburg, Pa.
Rosenstamm, S., Lewisohn Bros., N. Y.
Ross, E. L., Boston.
Royce, Fred. W., Washington, D. C.
Schieren, Chas. A., Jr., Chas. A. Shieren & Co., New York.
Schieren, C. A., C. A. Schieren & Co., New York.
Seely, J. A., Complete Elec. Construction Co., New York.
Seymour, A. P., Pass & Seymour, Syracuse.
Seymour, E. W., Westinghouse Elec. Mfg. Co., New York.
Shain, C. D., Edison Gen. Elec. Co., New York.
Sharp, E. P., Gould & Watson Co., Boston.
Shay, J. H., Munson Belting Co., Chicago.
Sheehy, R. J., Equit. Mfg. & Elec. Co., New York.
Sherman, S. S., Beacon Lamp Co., Boston.
Sherwood, R. H., Elec. Railways, New York.
Shippy, H. L., Roebling Wires, New York.
Smith, H. J., Edison Elec. Ill. Co., New York.
Smith, J. B., Boston.
Smith, T. J., The E. S. Greeley & Co., New York.
Sparling, F. H., J. A. Roebling's Sons, New York.
Spicer, W. H., Detroit.
Starr, D. A., Genl. Ag't Royal Elec. Co., Montreal.
Stanley, Wm., Jr., Stanley Elec. Mfg. Co., Pittsfield, Mass.
Stephenson, D. J., Elec. Supt., Pt. Huron, Mich.
Stetson, G. R., Boston.
Stillwell, L. B., Westinghouse Elec. Co., Pittsburg.
Sturgeon, C. J., Keystone Elec. Co., Erie, Penn.
Sullivan, M. C., New York.
Sullivan, M. J., *St. Railway Gazette*, Chicago.
Sweeten, F. D., Del. Elec & Supply Co., Wilmington, Del.
Swetland, H. M., *Power*, New York.
Taltavall, Thos. R., *Electrical Age*, New York.
Taltavall, J. B., *Electrical Age*, New York.
Taylor, S. F., New York.
Temple, W. H., *Electricity*, New York.
Terry, A. C., W. U. Tel., Buffalo.
Tillinghast, J. W., Buffalo, N. Y.
Titus, N. V., Economic Lamp Co., Boston.
Tolles, C. L., Jewell Belting Co., Hartford, Conn.
Townley, C. L., Westinghouse Elec. Co., Pittsburg.
Vallee, G. W., Vallee Bros., Philadelphia.
Van Court, B. R., Detroit Motor Co., Detroit.
Van Der Weyde, Prof. P. H., New York.
Van Nuis, C. S., Elec. Spec., New York.
Van Trump, G. R., Wilmington Elec. Co., Wilmington, Del.
Walker, W. L., Boston.
Warner, C. D., Stand. Elec. Time Co., New Haven, Ct.
Waugh, C. T., Chicago.
Weaver, A. B., Buffalo.
Webster, N. D., *Electrical Age*, New York.
Western, Benj. R., Manufacturers' Advertising Agency, New York.
Weston, W. H., Weston Elec. Co., Philadelphia.
Weston, W. H., W. H. Weston & Co, Philadelphia,
Wetzler, Jos., *Elec. Engineer*, New York.
Wheeler, S. S., Crocker-Wheeler Co., New York.
Wheels, S. M., Indiana Elec. Co., Indiana, Pa.
White, C. A., Elec.-Magneto Clock Co., Boston.
Whitney, H. C., Union Electric Co., N. Y.
Whitney, L. C., New Britain, Conn.
Whitney, W. A., Stanley Elec. Co., Pittsfield, Mass.
Whittlesey, W. A., Stanley Elec. Mfg. Co., Pittsfield, Mass.
Wiegand, H. H., Johns Hopkins University, Baltimore, Md.
Wightman, E. T., Danbury Elec. Lt. Co., Danbury, Conn.
Wilbur, G. H., Ft. Wayne Elec. Co., Philadelphia.
Wiley, G. L., Standard Cable Co., New York.
Wilkins, E. W., Partrick & Carter, Philadelphia.
Willyoung, E. A., Queen & Co., Philadelphia.
Wiman, Hon. Erastus, New York.
Wilmerding, C. H., Chic. Arc Lt. & P. Co., Chicago.
Wilson, E. P.
Wilton, H. L., Elec. Lt. Co., Detroit.
Wolfram, A. C., Elec. and Mechanical Con., St. Louis, Mo.
Wood, E. E., *Electrical Industries*, New York.
Wood, Wm. H., New York.
Young, E. P., Sewickley Elec. Co., Sewickley, Pa.

LADIES.

Armstrong, Mrs. E. W.
Baker, Jr., Mrs. C. O., Newark, N. J.
Barre, Mrs. Jos.
Ferguson, Mrs. James.
Francisco, Mrs. M. J.
Johnston, Mrs. W. J., New York.

Law, Mrs. M. D.
Leonard, Mrs. F. H.
Morse, Mrs. C. M.
Packard, Mrs. W. D.
Redman, Mrs. A. G.
Redman, Miss A. E.
Ridlon, Mrs. F.
Ross, Mrs. E. L.
Sherman, Mrs. S. S.
Shivers, Miss M. L.
Smith, Mrs. H. J.
Smith, Mrs. T. J.
Titus, Mrs. N. V.
Wheeler, Mrs. S. S.
Willyoung, Mrs. E. A.

THE TRIP TO THE FALLS.

A large party of delegates and ladies made a trip to Niagara Falls Wednesday, Feb. 24, going by the New York Central road. The special train left Buffalo at 2 P.M., and on arrival at the Falls some members of the party visited the tunnel of the Niagara Falls Power Company. This was an extremely interesting event, and the magnitude of the work was a surprise to all. Others of the party visited



IMPROMPTU BAND, ORGANIZED AT NIAGARA FALLS, FEBRUARY 24, 1892.

different parts of the Falls, many climbing up to the summit of the ice pile at the foot of the American Falls. They found that it was easier to get up than down, and in descending many took an involuntary coast down the slippery incline, and a sudden desire of the head and heels of others to exchange places caused them to perform marvellous acrobatic feats.

Lunch was served at the station of the Brush Electric Light Company, Niagara Falls, after which the station was inspected. Carriage drives around the Falls were indulged in by many, and some of the young men in the party organized themselves into a "band." They purchased all the toy horns and noisy wind instruments they could find in town, and, accompanied by others with Indian war-clubs, marched to the station on their return trip. They created such a racket that the town turned out *en masse* to see what was going on. At the station platform the "band" was photographed in all its glory.

The party got back to the city about 6:30 o'clock, all having enjoyed themselves hugely.

It was through the courtesy of the Brush Electric Light Company of Niagara Falls that this enjoyable trip was made.

THE BANQUET.

A large number of delegates attended the complimentary banquet on Thursday night, which was tendered to the members of the National Electric Light Association by the citizens of Buffalo. The banquet was held in the Board of Trade rooms and was an elegant affair, and the tables were lighted by special electrical arrangements with beautiful effect. The dinner was an elegant one, and when coffee was reached, speech-making was in order.

The following is a list of the toasts and the names of those responding to the same: "The City of Buffalo," Hon. C. F. Bishop; "The National Electric Light Association," Hon. E. A. Armstrong; "Buffalo Manufacturers," Richard K. Noye; "Municipal Lighting," C. H. Wilmerding, Chicago; "Buffalo Electricity," John G. Milburn; "The Electrical Press," T. Comerford Martin, New York; "The Buffalo Press," F. H. Hollister; "Electricity," Prof. Elihu Thomson; "Our Partners in Niagara Falls," Prof. H. A. Bovey.

Mr. C. R. Huntley, the retiring president of the Association, made some appropriate remarks, which were received with tremendous applause.

Prof. Elihu Thomson received a perfect ovation, and was especially toasted as the greatest electrician living. The scene was intensely enthusiastic and every one applauded this elegant tribute.

Throughout the evening the utmost good feeling prevailed, and the banquet was without exception one of the most enjoyable the members ever attended.

The beautiful electric lighting arrangements for the occasion was the work of F. P. Little & Co., of Buffalo, to whom much credit is due. The lights and their arrangement were very attractive and greatly admired.

THE SPECIAL TRAIN FROM NEW YORK.

A special train containing delegates to the Convention left the Grand Central Depot for Buffalo at 11 A.M., Monday, February 22. The train was composed of four drawing-room cars, a dining car and a buffet smoker. The only inappropriate feature of the special was that it was drawn by a steam-locomotive instead of one run by electricity. The last car on the train was reserved for the ladies of the party, of which there were quite a number, and the trip throughout was a most enjoyable one. The weather was pleasant almost the entire day, and the view of the Catskills, as the train sped along the Hudson, was most charming. The scenery along the Mohawk valley was also greatly admired. A stop was made at Albany, where Mr. William A. Hubbard, a photographer of New York, who accompanied the party on invitation, took a picture of the delegates and ladies on the station platform. He also took a picture of the party at Utica, where a stop was made, and at Syracuse a flash light of the interior of the ladies' car was taken.

Three musicians were aboard, with two mandolins and a guitar, and they tendered some choice music during the trip, which added largely to the enjoyment of the party, and helped largely to pass away the time. The train arrived at Buffalo at 10:45 P.M., and every one of the party expressed the opinion that it was one of the most delightful rides they had ever taken.

The success of this trip was due entirely to the efforts and enterprise of Mr. C. O. Baker, Jr., and was complete. His courteous manner and consideration for the comfort and welfare of the delegates and ladies won for him a great many new friends and greater admiration from his old ones. He is to be congratulated on the great success of his efforts.

At Albany a car containing the Boston delegates was attached to the train.

ELECTRIC PUMP EXHIBIT AT BUFFALO.

One of the most attractive exhibits at the Iroquois Hotel, Buffalo, during the Convention of the Electric Light Association, February 23, 24 and 25 last, was that of Otis Brothers & Co., the well-known makers of electric elevators, 35 Park row, New York. The exhibit occupied a most advantageous location, being immediately adjacent to the passenger elevator, in the main corridor of the hotel, and it consisted of an automatic electric pump in practical operation.

A photograph of this exhibit, taken by the aid of the light from a photo-engraving lamp, manufactured by the Electric Construction and Supply Company, of New York, is given herewith.

This electrical pump was in practical operation from 8 A.M. till midnight each day, and attracted a great deal of attention, not only among those in attendance at the Convention, but from outsiders, many buisness men and private individuals of Buffalo coming in especially to see it.

Mr. A. E. Hall, who was in attendance looking after the company's interests, states that it was a most satisfactory exhibit as far as his company is concerned; everything worked smoothly, and the noiseless operation of the pump, and its perfection, opened the eyes of many who had read about it but had never seen it in actual operation.

The pump exhibited was a No. 3 of the Otis Company's regular make. It was operated by a Crocker-Wheeler 1½ H. P. electric motor, and had a pumping capacity of 650 gallons an hour. It was entirely automatic in its operation, and as soon as the water got down to a certain level, the current was turned on and pumping resumed until the level of the water in the tank reached a given point, when the current was shut off and the flow of water stopped.

The operation of the motor was controlled by a new Crocker-Wheeler automatic switch, which turned on the full current in six seconds, the switch, of course, being operated through proper mechanism actuated by the water at different levels.

The current used for the operation of the motor was of 110 volts, the same as is used in lighting the hotel.

DEATHS.

We regret to learn of the death, on February 17, in Boston, of Mr. W. P. Mullen, Vice-President of the Shultz Belting Company, of St. Louis. Mr. Mullen was well known in the electrical fraternity, and his many friends will be pained to learn of his death.

We are also pained to learn of the recent death of Mr. E. T. Lynch, Jr., the well-known electrical expert, of 120 Broadway, New York.



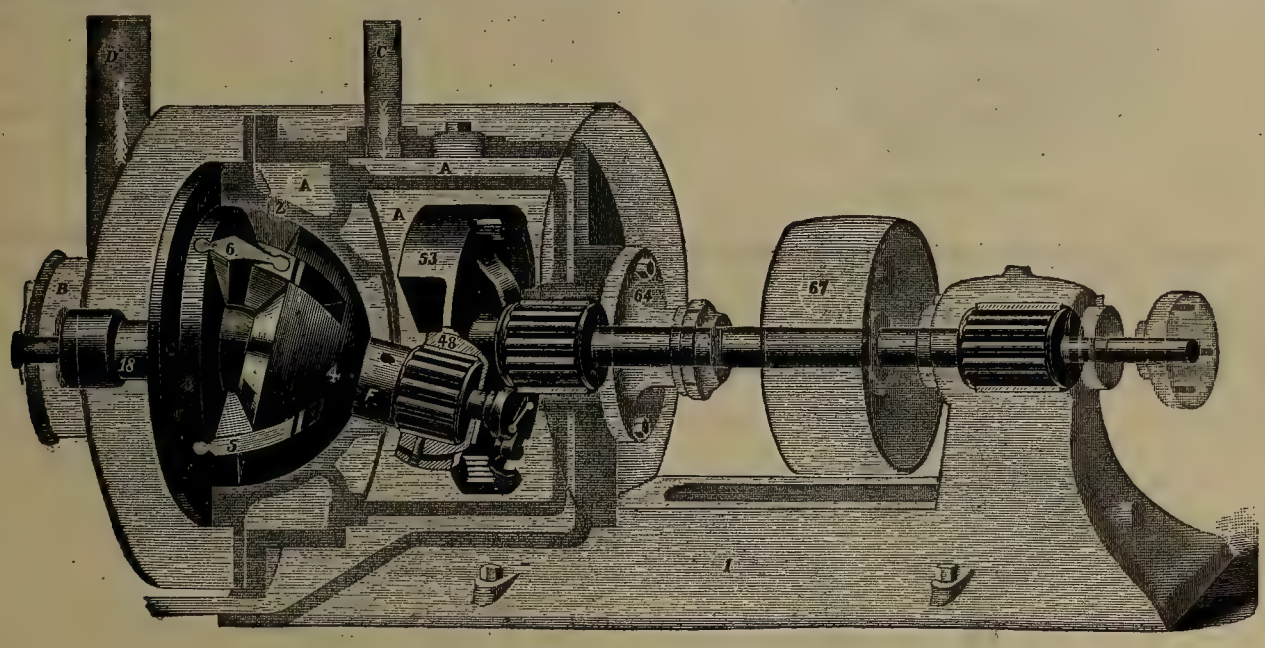
EXHIBIT OF OTIS ELECTRIC PUMP, BUFFALO, N. Y.

The Canadian Magazine of Science and Patent Office Record, of Montreal, Can., has recently suspended publication.

The Hygeia Hotel, Old Point Comfort, is just installing a 60 H. P. Ball Engine, being the third furnished this hotel by the Ball Engine Co., Erie, Pa.

NEW HIGH-SPEED ENGINE.*

In this busy age of ours, when the one thought is the "mighty dollar," the saving of time means the saving of money, and anything new in the inventive line which will produce better and more economical results than systems in vogue at the time is always reasonably certain to meet with a welcome reception. The use and application of steam, such a potent factor in the conduction of a great number of industrial pursuits, is ever an interesting topic, and especially so when the subject deals with new and improved machinery by the use of which a greater economy will be assured. Our illustrations and description, then, of this new high-speed engine, for which speed, simplicity and economy are claimed as cardinal principles, will, we are sure, be well received by our readers.



AMERICAN HIGH SPEED ENGINE. [INTERIOR VIEW.]

The application of steam in generating power is revolutionized in this engine, and the inventor, feeling confident of the impossibility of securing higher speed by pursuing the old methods, determined to solve the problem by working on entirely new lines, and concluded to devise a machine as if he had never seen a steam-engine as heretofore constructed. He was thoroughly posted on the laws governing the action of steam and the principles involved in its application for the generation of power, and started his work in this original direction with the gratifying result of producing the high-speed engine we now illustrate. While not a rotary engine the motion of its parts is such that there are no dead centres. Steam is taken and exhausted four times at each revolution.

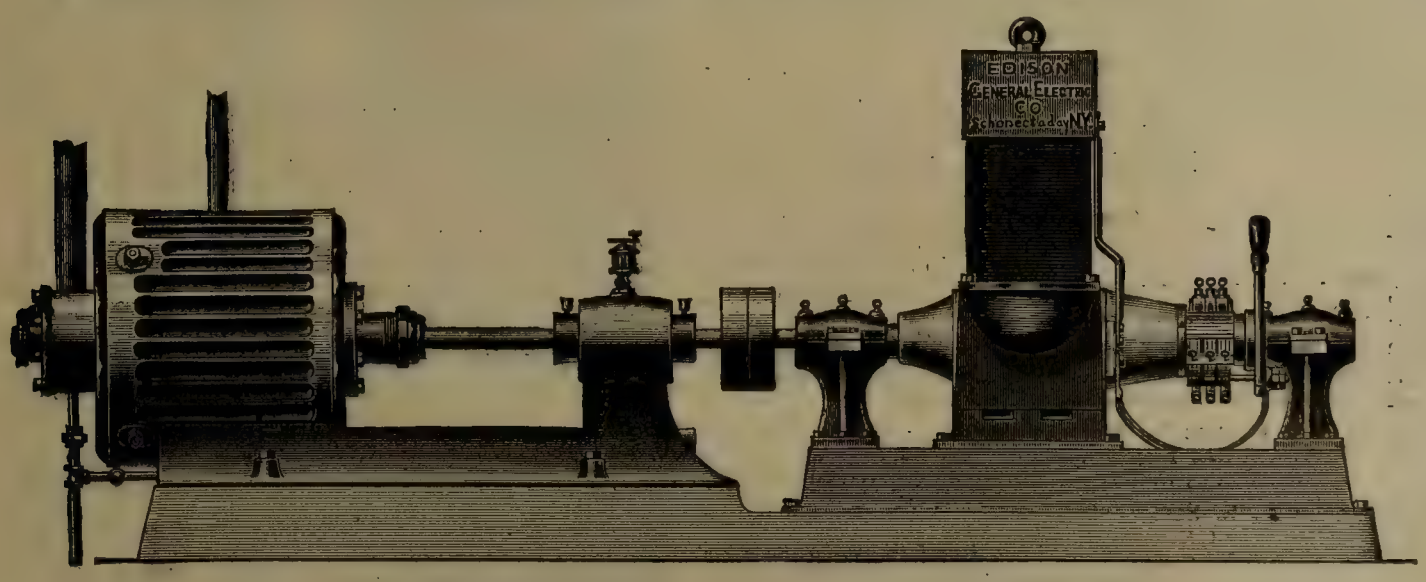
It is claimed that for speed, simplicity and economy this engine excels, and it is also claimed to possess a number of advantages over other engines, whether slow, or so-called "high-speed." It has an automatically variable cut-off and a constant admission and exhaust of steam, lacking which economy cannot be attained. In other forms of engines this cannot be had without to much complication for rapid motion. It is so arranged that it can be governed to run at any desired speed up to 1,000 or more revolutions per minute, and it can be coupled directly to dynamos, circular saws, fans, etc., is accurately balanced, light and compactly built, can be placed anywhere so as to be coupled directly (without belting) to main-shaft when so desired. With the agency of a simple, sensitive, prompt and reliable automatic governor, its speed can be perfectly governed. As direct coupling is made through the use of this engine, considerable saving is made in the cost of belts, extra shafts, counter-shafts with their pulleys and bearings, as well as the slip friction and consequent loss of power which their use involves, and, therefore, a saving of floor-space.

In construction it is quite simple, requiring no skilled engineer to manage it. There are eight principal moving parts, an automatic governor being directly connected with a cut-off valve, thereby rendering unnecessary the use of shifting eccentrics, eccentric straps, valve-rods and rock-arms, therefore accomplishing all that can be done in a more direct way without such multiplicity of parts and necessary maintenance and care. With the exception of one bearing, all moving parts are lubricated with steam, saving many oil-cups and all danger from heating.

*The American Engine Co., Bound Brook, N. J.

EDISON COMPANY'S NEW PITTSBURG OFFICE.

The Edison General Electric Company has leased a spacious building on the corner of Wood and Diamond streets, Pittsburg, which it now occupies as a branch office and supply depot of the Eastern District. The offices have been most elaborately fitted up and finished, and the store-rooms are being supplied with a complete stock of all kinds of railway and lighting supplies and fixtures. A stock of 25,000 electric lamps of various candle-powers and voltages will be kept on hand, and local dealers or individual consumers can be supplied with any quantity immediately on receipt of orders. This branch is in the charge of Mr. I. H. Silverman.



American High Speed Engine as Coupled Directly to an Edison Dynamo.

ILLUMINATION AT BROOKLYN'S FOOD EXHIBIT.

The matter of illumination was well attended to by the managers of the Food Exhibition recently held at the Brooklyn Rink. Arrangements were made with the Edison Electric Illuminating Company, and about 500 16 C. P. incandescent lamps were used. Colored lamps were also made use of in the display of exhibits at the various booths, with very pretty and pleasing effect. One, specially notable, was that of C. F. Perry, 360 Pearl street, Brooklyn. A myriad of colored lamps and shades being arranged as a canopy over the booth. In it is was exhibited one of his new electric motor cyclone coffee mills, which he claims will grind from 200 to 500 pounds of coffee with 10 cents' worth of "electricity," whereas, on the other hand, it would cost twenty times as much to run a machine by hand.

The American Cereals Co. also had a unique exhibit, consisting of a revolving globe mounted on a shaft. On top of the globe is the figure of a Quaker, the company's trade-mark, incandescent lights being used to show the globe off with great effect.

SEARCH-LIGHTS AND PHOTO-ENGRAVING LAMPS.

At Buffalo during the Electric Light Convention the powerful beams of a search-light, placed in a window of one of the upper stories of the Iroquois, attracted a great deal of attention each evening. The light was one of those manufactured by the Electic Construction and Supply Company, 18 Cortlandt street, New York, an illustration of which we give herewith.

This light is simple in construction, durable and efficient, is portable and easily manipulated, and can be attached to any continuous-current circuit of low potential. The lamp works automatically, holding the focus and requiring no adjustment after once being set.

Another part of the exhibit of this company consisted of a photo-engraving lamp, of which we also give an illustration.



SEARCH LIGHT.



PHOTO-ENGRAVING LAMP.

This latter lamp is extremely portable, and by the aid of the one on exhibition we were enabled to take photographs of certain exhibits at the hotel, which we could not otherwise have obtained. This lamp gives a powerful light, such as is needed in photo-engraving work. It is equally adapted for stereopticon work, photography or special space lighting

where focusing and concentration of light is desired. The power of the light can be made from 2,000 candle-power up as high as desired. It has a regular feed and equal distribution to effect uniform exposures. The lamp is simple in construction and can be easily handled, and is absolutely free from danger to the operator. It is designed for low-tension circuits, and burns with remarkable steadiness.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE ELECTRICAL ENGINEERS.

At the regular monthly meeting of the Council of the American Institute of Electrical Engineers, held February 16, it was voted that the General Meeting of the Institute for 1892 be held in Chicago. This meeting has heretofore been held the third week in May, but the exact date of the Chicago meeting has not yet been fixed upon.

WORLD'S ELECTRICAL CONGRESS.

We are in receipt of the following communication from H. S. Carhart, University of Michigan, Ann Arbor, Mich., Secretary of the World's Electrical Congress Committee:

EDITOR ELECTRICAL AGE:

Messrs. C. C. Bonney, President of the World's Congress Auxiliary, O. Chanute, Chairman of the Engineering Congress Committee, and Elisha Gray, Chairman of the Electrical Congress Committee, have arranged that the section of the Engineering Congress, relating to electrical engineering, shall be merged into the World's Electrical Congress.

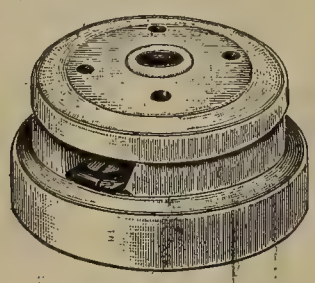
Due notice of this agreement from the office of the World's Congress Auxiliary will follow the recently distributed circular relating to the Engineering Congress.

H. S. CARHART,
Secretary World's Electrical Congress Committee.

EDISON CEILING CUT-OUTS.

The growth of practical electrical application, and its adaptation to popular use, has created an immense demand for cheap appliances which are required to be, at the same time, thoroughly efficient in their functions.

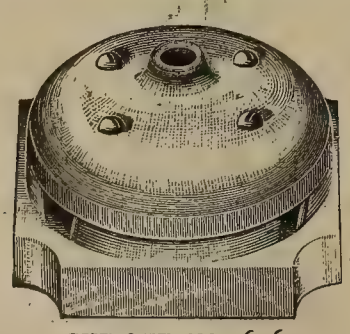
Recognizing the possibility of the increase in demand, the Edison General Electric Company invented and patented some years ago a ceiling cut-out embodying most of the fundamental principles underlying all cut-outs devised for a similar purpose. Recently the old form of single-pole pendant cut-out was superseded by a double-pole cut-out of a



CUT-OUT NO. 123.

novel shape, especially devised for cleat work, and possessing additional recommendations and advantages.

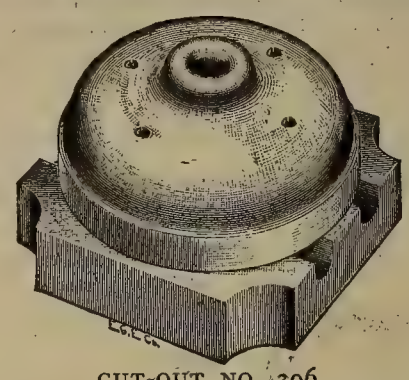
In the manufacture of this, the Edison Company, fully cognizant of the important factor of cheapness, succeeded in so reducing the cost by the adoption of new principles of manufacture that it could be sold as cheaply as the cheapest ceiling cut-out in the market, without depreciation of quality. This was followed shortly afterward by two new double-pole cut-outs—one for moulded work, the other for concealed work. These are of special design and of superior workmanship to that mentioned above, their interior construction, however,



CUT-OUT NO. 696.

being similar. Two safety fuses protect the appliance. The cut-outs are made of the best hard, white, non-absorbative porcelain.

The two last-named cut-outs lend themselves with peculiar facility to decoration; and when decorated, form a valuable adjunct to the available stock of the present-day interior decorator. The Edison Company will shortly be ready to supply decorated ceiling cut-outs to suit any or all requirements. The establishment of a porcelain factory under their immediate supervision in their own works at Schenectady has enabled them to bring these cut-outs to that high state



CUT-OUT NO. 396.

of perfection already attained by manufacturers of the most advanced porcelain for electrical purposes in England, where the development of porcelain for electrical uses has heretofore been greatest.

The use of ceiling pendant cut-outs has hitherto



TUBE EXTENSION FOR SWINGING LIGHT.

been confined to lights hung from the cut-out by a flexible twin conductor. The flattened shape of the No. 123 cut-out shown in figure 1 permits of its use with a swinging light hung from it by a length of metal tubing. To effect this end, the cover of the appliance is provided with a universal joint, to which is attached the tube. The light can be swung to a considerable distance from its normal point of rest, returning thereto much more quickly than is the case with the flexible cord pendant. The many advantages for store lighting and similar work presented by this arrangement are obvious.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Feb. 27, 1892.

H. E. WEBB, of the Solar Carbon and Manufacturing Co., Pittsburg, Pa., was in town recently.

The East River Electric Light Company, of this city, has received permission to change its name to the Thomson-Houston Electric Company of New York.

MR. GEORGE L. WRIGHT, the former president of the River and Rail Electric Light Co., now known as the Union Electric Co., 45 Broadway, died in this city on February 26.

MR. C. E. STUMP, vice-president and business manager of the Street Railway Publishing Co., this city, has recovered from his recent sickness in Chicago. His many friends will be glad to hear this news.

THE PREMIER ELECTRIC CO., Brooklyn, N. Y., manufacturer of motors, batteries, specalties and electrical novelties, expects to be in its new factory, 17 to 19 Whipple street, by the middle of March, with greatly improved facilities for executing all orders promptly.

J. P. FRINK, 551 Pearl street, this city, is the manufacturer of reflectors for electric lights, which have given entire satisfaction in large assembly rooms, halls and churches where they are extensively used. Through the agency of these reflectors a brilliant illumination is diffused.

HINE & ROBERTSON, 45 Cortlandt street, New York, must have something remarkably good in their "Straight-Line" Indicator. Ever since it was first brought out their orders have exceeded the output of the factory, and it is only now they report that they can promise reasonably prompt delivery.

THE ALEXANDER CHAMBERLAIN COMPANY, 126 Liberty street, this city, electrical engineers and contractors for all kinds of electrical work, has, owing to rapid increase in its business, been obliged to secure larger quarters, and is now located in two large handsome offices on the second floor of the same building.

THE MANHATTAN ELECTRICAL SUPPLY CO., 36 Cortlandt st., has issued a circular for the information of the electrical trade and public generally, stating that it is selling the Mesco Dry Battery with a guarantee to protect its customers in the sale and use from any infringement suit which may be brought against them.

WE are informed that suit has been brought by the Builder's Insulating Tube Company, of Lynn, Mass., and the Indurated Fibre Industries Company, against the Interior Conduit and Insulation Company, of New York, Mr. E. H. Johnson, president, for infringement of patents that cover the making of pipes, or paper tubing, to carry electric wires. The plaintiffs in this action announce that they will also bring suits against users of the pipe in question.

THE KNUDSON CUTTRISS WIRE CO., Limited, has been organized under the laws of the State of New York. The company is owner of patents granted to A. A. Knudson and Chas. Cuttriss for a new insulated fibre wire which is claimed to be superior to other wires. Information regarding rights to manufacture under the patents controlled by the company may be obtained from the president, Mr. John F. Zebley, room 37–38 Drexel Building, this city.

M. T. DAVIDSON, located at 43–53 Keap street, Brooklyn, N. Y., makes the Davidson Steam Pump which is extensively used for boiler-feed purposes in the Edison and other electric lighting stations throughout the United States. The "Davidson" is a tip-top good pump for such purposes, being very simple, efficient and durable. It is perfectly noiseless in operation, and has many other good features which are fully explained in a new catalogue issued by the manufacturer.

THE C. W. HUNT CO., of New York, comes before the electrical fraternity as a valuable aid in one of the most important departments of an electric light or power station, viz.: that of economically handling and distributing the coal supply by original devices for unloading either from railway or boat, and its distribution by a system of industrial railways. We are satisfied that correspondence with the C. W. Hunt Co., 45 Broadway, New York, would prove of great advantage.

THE TYPEWRITERS' EXCHANGE, 10 Barclay street, this city, of which Mr. George A. Hill is manager, is the largest house in the world dealing in typewriters of all makes. The special feature of the Exchange lies in the fact of its selling machines at one-half the manufacturers' prices. It also rents them at $5 per month, besides selling on the instalment plan. Its average monthly sales exceeds 150 machines, as well as 100 or so more scattered throughout the country on the rental system.

THE FISHKILL LANDING MACHINE COMPANY, the enterprising engine builders of Fishkill-on-the-Hudson, N. Y., are making their "Fishkill-Corliss" Horizontal Engine in several sizes, for central station electric lighting and power plants. The company has designed an engine especially for this class of work, and its marked popularity is very gratifying to it. The adoption of Citie's patented releasing valve-gear for operating the steam valves, instead of the the old-time "crab-claw" and liberating hook formerly used, is a noticeable improvement in the "Fishkill-Corliss" engine, also the noiseless dash-pots. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Engineering Co., N. Y.	1,000,000	100 00	60 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 25
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J.	25,000	100 00	120 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush ElectricLight Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Commercial Cable Co	7,716,000	100 00	150 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.	35,430,000	100 00	113 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*101
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	81 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	98 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	44 50
Excelsior Electric Co. 6s, N. Y.	300,000		par

Fargo Gas & Elec. Co. 6s, Dak...	100,000		*92
Fidelity Trust Receipts.....	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*98
Fort Wayne Elec. Co.....	4,000,000	25 00	13 25
Franklin Electric Co., N. Y.....	5,000,000	100 00	†83 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky.....	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co.....	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	51 00
Guthrie Elec. Lt. Co., Ok., 7s.....	15,000		*92
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co.....	250,000	100 00	20 00
Hickory Electric Co., N. C.....	12,000	100 00	109 00
Hoboken Land & Imp. 5s.....	1,000,000		*105
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., N. Y., 6s..	30,000	100 00	*90
Hunt Engineering Co., N. Y.....	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.....	50,000		*95
Kansas Elec. Co. 6s, Mo.....	20,000		*96
Laclede Gas Co.....	7,500,000	100 00	20 50
Laclede Gas pref.....	2,500,000	100 00	64 00
Laclede Gas 5s.....	10,000,000		*82
Law Telephone.....	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s.....	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light.....	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa..	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph.....	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y..	3,500,000	100 00	100 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver..	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s..	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	110 00
Nat'l Aut. Fire Alarm, L. I.....	150,000	100 00	100 00
Nat'l Lead Trust.....	9,000,000	100 00	19 75
New England Butt Co.....	100,000	1,000 00	1,000 00
New England Phonograph Co.....	12,500	100 00	†20 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s..	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co.....	20,000	100 00	20 00
Newark L. & P.....	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio..	50,000		*95
North American Railway Co.....	39,767,200	100 00	16 00
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph.....	10,000,000	100 00	37 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light.....	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.....	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.....	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light.....	50,000	100 00	55 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston.....	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich..	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co.....	16,000	100 00	†80 00
Swan Incandescent.....	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y..	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.....	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y..	100,000	100 00	105 00
The Ongley Electric Co., N. Y....	250,000	100 00	85 00
The Railway Impt. Co., N. Y.....	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500 000	100 00	80
Thomson-Houston Electric Co....	6,000,000	25 00	59 00
Thomson-Houston pref.....	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston.....	500,000		*100
T.-H. E. L. Co., Yonkers, 6s.....	100,000		*99
T.-H. L. H. &P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y....	50,000	100 00	100 00
United Elec. Light and Power....	3,000,000	100 00	40 00
United Elec. Traction 6s.....			*20
United Elec. Traction Co.....	1,370,000	100 00	
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100.000	100 00	
Vine Street Motor Co. 6s, Colo..	100,000		*95
Western Union.....	86,188,852	100 00	87 75
Westinghouse Electric Co.....	7,000.000	50 00	14 75
Westinghouse Elec. Co. pref. 7s..	3,000,000	50 00	50 00
West End L., Boston.....	13,550,000		18 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The following circular was issued on the 24th of February, which, to those who hold shares in either company and are satisfied with the consolidation scheme, will clear away the clouds, opening up a new and, I trust, prosperous era in the business of the great parent industries.

NEW YORK, Feb. 24, 1892.

To the Stockholders of the Edison General Electric Co. and Thomson-Houston Electric Co.:

In pursuance of the terms of the fifth article of the Stockholders' Agreement, dated Feb. 9, 1892, you are hereby notified to deposit your stock on the terms and for the purposes of the agreement with the New York Guaranty and Indemnity Company, No. 59 Cedar st., New York, or the Old Colony Trust Company, Ames Building, Boston, Mass., on or before March 7 next.

Either company will issue temporary negotiable receipts therefor.

J. PIERPONT MORGAN,
D. O. MILLS,
H. MCK. TWOMBLY,
FREDERICK L. AMES,
T. JEFFERSON COOLIDGE.
HENRY L. HIGGINSON.
} *Committee.*

Before this is completed no doubt the various companies lighting the city of New York will be under one management, although the corporate names and securities will continue as at present. Philadelphia is reported as being in the same boat, and if the Huckleberry Railroad bill, as passed by the Assembly, receives the Governor's signature, the whole country adjacent to New York north and east of the Harlem river will be also the property of a single corporation known as the Union Railroad Co. In the same direction of unifying the interests, so far as municipal territory is concerned, comes the information that through the house of Seligman & Co., Broad-st., and Exchange place, a syndicate has purchased the surface railroads of Cleveland, O., consisting of 114 miles, well equipped, for $9,000,000. These negotiations have reached a point where Congress should take some notice and voice its opinion in the shape of a general act applicable to all the States and between the States. There must be a beginning as a foundation to build upon, and these $10,000,000 consolidations are so frequent they are becoming monotonous.

WESTERN NOTES.

VOGHAN BROS., of Newcastle, Pa., will shortly be incorporated for the manufacture of street cars, etc. Capital stock, $50,000.

IT is reported that a controlling interest in the National Electric Manufacturing Company, of Eau Claire, Wisconsin, has been purchased by Messrs. C. A. Daigh and Morgan Brooks, of St. Paul, Minn. These gentlemen also control the Electrical Engineering and Supply Company of that city. Mr. Brooks is to be made general manager of the St. Paul concern, and Mr. Daigh has been elected vice-president of the Eau Claire Company, of whose affairs he will assume active management.

MR. AMOS E. TOWNSEND, of Pittsburg, Pa., claims the distinction of building the second electric street railway in this country. He has been a builder of street railways for the past 26 years. The following are some of the roads he has built: Second Ave. Electric Ry., Sharpsburg Electric Ry., Pittsburg and Birmingham Electric Ry., Beaver Falls Electric Ry., Braddock Electric Ry., Newcastle Electric Ry., Washington Electric Ry., Uniontown Electric Ry., etc., etc. Corporations in need of an experienced builder of street railways should note the above facts.

THE GODFREY & CLARK PAPER CO., Pittsburg, Pa., is manufacturing an extra fine quality of paper tape which is being very extensively used in wrapping wire for insulating purposes. The tape is made from pure manilla rope, a fibre specially selected for the purpose. In the course of manufacturing this tape it is sized sufficiently hard to render it absolutely waterproof, but does not prevent its great pliability, which is an important feature. The most essential features of this tape are its lightness in weight, tenacity and pliability. It is put up in bolts and cut into ribbons or strips from one-half inch and upwards in width, and is made in two colors, red and gray. It is much cheaper than any other kind of insulation, and, Messrs. G. & C. claim, just as good. They are having a great demand for it at present.

N. D. W.

FROM OUR LIMA CORRESPONDENT.

PITTSBURG, PA., 1892.

The following parties have purchased the Lima, O., Street Railway: Mr. Amos E. Townsend, street-railway contractor, Pittsburg; Wm. M. Brown, contractor, Newcastle, Pa.; W. W. Hazzard, of Cleveland, O., and W. R. Kimball, of Cincinnati, O. The new company intends to expend $75,000 to $100,000 in reconstruction and re-equipping with the Thomson-Houston system in place of the Vandepoele apparatus. The new company will increase the number of cars from 10 to 15. The deal was consummated last week.

ANNUAL SPRING SALES.

It is certainly novel to hear of "bargain days" as applied to the electrical trade, yet still the term is aptly used in connection with the prices at which Messrs. Queen & Co., of Philadelphia, are selling their old stock. Among other things they are selling Ayrton and Perry spring ammeter and voltmeters, of which they have a good many on hand, and they not being so salable as formerly, at very low figures. Their reasons for so doing, as explained in the circular issued by them, is to be attributed to the fact that they have recently engaged extensively in the manufacture of ammeters and voltmeters for all purposes, and find that for exact work they are in a position to produce instruments of greater accuracy, and for stationary use, of equal accuracy at a cost less than the Ayrton and Perry type. In order to dispose of them as rapidly as possible they have decided to sell them at 50 % less than last year's price. A rare opportunity is therefore presented to secure a good ammeter or voltmeter for experimental or every-day use at a very low figure. Full information regarding the sale of these instruments can be obtained from circular No. 275, which may be had upon application to the firm.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

February 16.

469,041. Electric-Arc Lamp. Robert S. Dobbie, Jersey City, N. J. Filed Oct. 23, 1890.

In combination with the other operating parts of an arc lamp, a feed-disc, a brake therefor, spring-toggles for operating the brake, a solenoid included between the terminals of the lamp, an armature therefor attached to the toggles for retracting the brake, a second shunt winding on solenoid open-circuited at contacts, toggles for closing the contacts and actuated by the solenoid against the action of a spring, and the starting magnet, presenting salient poles to the faces of the feed-disc.

469,048. Suspending Device for Electric Lamps. James J. Renehan, New Britain, Conn. Filed Jan. 30, 1888. Renewed Jan. 27, 1890.

In an electric-lamp-supporting device, the combination of the post, arm projecting therefrom, a pulley at the outer end of the arm and a similar pulley at the inner or post end of the arm, an endless band around pulleys, a shoe fixed to band and carrying the lamp-suspending device, a saddle at the outer end of the arm, upon which shoe may rest, and means for imparting rotation to pulley.

469,050. Electric Search Light. Nelson Weeks, Jr., Long Island City, N. Y. Filed June 4, 1891.

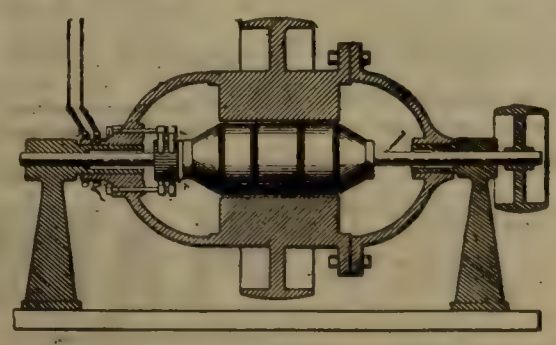
The combination of a case or drum, a lens mounted therein, and an arc light and its frame supported by drum with the carbon pencils parallel with the axis of the lens.

Issued February 16 and 23, 1892.

469,080. Armature for Dynamo-Electric Machines. Marcel Deprez, Paris, France. Filed Dec. 7, 1885.

In an armature for a dynamo-electric machine, the combination, with a segmental-ring core, of a series of segmental bobbins of refractory insulating material fitting upon the core and an armature coil upon each bobbin.

469,085. Telephone-Transmitter. Elwood A. Grissinger and Theodore Grissinger, Mechanicsburg, Pa. Filed Sept. 16, 1891.



469,193.—DYNAMO ELECTRIC MACHINE OR MOTOR.

In a telephone-transmitter, a diaphragm consisting of a film of suitable material enclosed by a substantially homogeneous strongly-coherent body of carbon.

469,093. Electric-Arc Lamp. Houghton Sawyer, San Francisco, Cal. Filed Feb. 24, 1891.

In an electric-arc lamp, a magazine for containing upper and lower carbons, a pair of carbon-holders, and means for feeding the carbons from magazine into pair of carbon-holders respectively and successively as required.

469,129. Storage Battery. Chaimsonovitz P. Elieson, London, England, assignor of one-half to Frederic Alfred Pellas, Oggobio, Italy. Filed June 4, 1891.

An electrical accumulator or storage battery, each electrode of which is built up of a series of juxtaposed corrugated and perforated metal tubes united together by a contact-piece, the corrugation of each of the several tubes composing such electrode being at an angle to those of its next adjacent tube or tubes.

469,135. Electric Curling-Iron. Alexander F. Godefroy, St. Louis, Mo. Filed June 26, 1891.

469,181. Electric Letter-Box. Charles A. Pinkham, Wollaston, Mass. Filed July 3, 1891.

The combination, with the electric circuit and the alarm or indicator included therein, of a letter-box or other receptacle provided with a circuit-closer operated by the introduction of a letter or other matter within the box to actuate the alarm or indicator, a branch circuit having a push-button or key located at a distant point, and a circuit closer for connecting branch circuit with the main circuit, branch-circuit closer being actuated by the introduction of a letter or other matter within the box, whereby the presence of such matter can be at any time ascertained by operating push-button or key

PATENTS—Continued.

469,193. Dynamo-Electric Machine or Motor. Henry M. Byllesby, St. Paul, Minn. Filed June 8, 1891.

The combination of concentric oppositely-rotatable armature and field-magnets, power transmitting devices actuated both by armature and field-magnets, commutator-brushes carried by field-magnets, and insulated contacts carried by field-magnets, electrically connected, respectively, with brushes and also with the line-wires.

469,203. Mechanical Telephone. William H. Eastman, Concord, N. H., assignor, by mesne assignments, to the Pulsion Telephone Company, same place. Filed May 7, 1888.

In a mechanical telephone, the combination of the diaphragm, the conducting-wire, and a spring mounted on and supported by wire behind the diaphragm, the outer end thereof being free to vibrate.

469,208. Electrical Conduit. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed May 13, 1891.

A system of interior or house conduits consisting of one or more pairs of tubes or pipes running from a central point of distribution to one or more points of consumption.

469,220. Electric Cut-Out. Van A. Thomas, Providence, R. I. Filed May 15, 1891.

In an electric cut-out, the combination, with a casing having hooded openings and non-conducting base with central stud, of an oppositely-notched insulating-disc loosely mounted on stud, the separated contact-plates on the upper and lower faces of disc, the binding-posts with lateral extensions, upper and lower contact-plates secured to extensions to frictionally engage the contact-plates on the disc, and an operating-lever mounted on the stud and secured to the insulating-disc.

February 23.

469,241. Moulding for Electric Wires. Walter Gritten and Arthur Parmley, London, England. Filed April 27, 1891.

In an insulating device, a casing, beading or moulding made of thin strips of fibrous non-combustible non-conducting material held together by a suitable non-combustible non-conducting adherent and having longitudinal grooves therein for the reception of the electric wires.

469,248. Electric Conductor for Metallic Circuits. Silas W. Holman, Newton, Mass. Filed Oct. 10, 1891.

A metallic-circuit electric conductor in which the out and return wires of each circuit constitute a pair and are arranged spirally in tubular form, leaving an air-space within, the two wires of each pair being located diametrically opposite to one another throughout the length of such tube and provided with supporting material to hold them in place.

469,257. Speed-Regulator for Dynamos or Motors. Luther H. Leber, Pittsburg, Pa., assignor to David J. Richardson, same place. Filed May 11, 1891.

An automatic electrically-controlled speed-regulator for dynamos and motors, consisting of a governor having its centre rod insulated for a portion of its length, a main-line wire having connection with a suitable battery and having contact, respectively, with the governor-rod at a point thereof below the insulated portion and with a binding-post on the motor, a continuous wire connected, respectively, with a binding-post on the motor and with a ring or disc carried by the lower portion of the governor-arms, and gearing connecting the motor-shaft and the governor-rod.

BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48 inch double belts and six 25-inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., Street Railway Company, two 24-inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway, of Wheeling, W. Va.

EMPIRE STATE EXPRESS.

The Christmas number of *Harper's Weekly* contains a full-page cut of the "Empire State Express" of the New York Central & Hudson River Railroad. This is the fastest train in the world. The cut was made from a photograph taken by A. P. Yates, of Syracuse, while the train was running sixty miles an hour. It shows distinctly the locomotive, No. 862, and four coaches. It is a perfect picture of the train. Some idea of how rapidly a photographer's camera works may be gained from the fact that a train running at the rate of sixty miles an hour moves eighty feet in a second, and the shutter of the camera has to be opened and closed in the eightieth part of a second, in order that the picture be not blurred on the plate. That is quick work; but photography has reached that degree of perfection that it can be done. "The Empire State Express" leaves New York daily at 9 A.M., and makes the run from New York to Buffalo, 440 miles, in 504 minutes, the actual running time being 52⅓ miles an hour. It is a pleasure to ride in such a train.

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THE ELECTRICAL AGE.

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SIEMENS & HALSKE.

It is reported that the firm of Siemens & Halske, of Berlin, Germany, has made arrangements to establish a plant in Chicago at an ultimate cost of from $3,000,000 to $5,000,000. It is hinted that the Edison-Thomson-Houston combination will find a formidable competitor in the Siemens & Halske enterprise.

THE DOUBLE-CARBON LAMP-CASE.

The Brush Electric Light Company on March 1 scored an important victory in court. In its suit against the United States Electric Lighting Company, asking for an injunction restraining the latter company from using the double-carbon lamp, which was patented by Charles Brush, September 2, 1879, the court granted a perpetual injunction, and ordered that testimony be taken of the amount due the Brush Company for infringement of the patent.

MR. TESLA IN ENGLAND.

Mr. Nikola Tesla has recently visited England and demonstrated to an audience of English scientists and others the possibility of producing electric light without the use of wires and the carbon filament. The audience was amazed at the result, and a London paper printed an article in reference to the lecture, which is calculated to fill the souls of stockholders of the Swan United Company with alarm and dismay. The article intimates that the filament lamp, with its delicate fragility, may be "entirely ousted by the much more durable, simple and inexpensive contrivance"—referring to Tesla's method—and that the capital of the Swan United Company may be swept away at one stroke.

DEVELOPMENT OF WATER-WHEELS.

The great improvements made in water-power wheels for power purposes is very aptly shown in an illustration which accompanies an article on water-wheels, on another page.

Those who have travelled in European countries and the far East have no doubt seen water-wheels of huge dimensions slowly revolving under the influence of streams of water of varying volume, and those of a practical turn of mind have noticed that these affairs are crude in the extreme, and very wasteful of the water-power. Under these conditions it requires a very large wheel to generate a small amount of power. The water-wheel has in late years, however, undergone a great change and refinement, and the interesting feature about the illustration in question is the comparative sizes of the large wheel and the modern wheel of equal power. The latter appears like a pigmy alongside its ancestor.

EFFICIENCY OF TRANSFORMERS.

Some valuable data was added to our knowledge concerning transformers, by Mr. L. B. Stillwell at the recent convention of the National Electric Light Association in Buffalo. That gentleman read a paper, entitled "The Relation of Size and Efficiency in Transformers," in which he gives some valuable tables, showing the efficiency of transformers of various sizes under the condition of load and no load. These tables go to prove that greater efficiency is obtained in using a single transformer when it is desired to supply any number of lamps up to 100, than in using two or more of less capacity. In regard to the design of transformers, Mr. Stillwell states that that one is the best which has the lowest leakage of magnetizing current; that regulates most closely; that is lightest and most easily handled; and that will carry its full load indefinitely with the least increase of temperature—all of these qualities should be combined as far as possible in the best transformer.

We give an abstract of this paper on another page, which, no doubt, will be read with great interest.

PRESERVATION OF POLES.

The portion of electric-wire poles which is placed in the ground is apt to soon decay unless it is treated in some manner calculated to arrest the destructive processes. This fact has been well known for years, and has led to the adoption of various methods of treating the poles before they are set in place. Charring, tarring and creosoting the wood are commonly practised methods, and any one prolongs the life of the pole considerably; but Mr. E. F. Peck, of Brooklyn, who has had great experience in this line and who read a paper on this and kindred subjects before the National Electric Light Association, at Buffalo, last month, has arrived at the conclusion that no method is successful unless it is applied to the entire pole.

The application of pitch or tar to the butt, he says, hastens decay, because it confines the sap, which ferments, and the creosoting process is objectionable on account of the unpleasant odor, as well as the fact that the creosote does not penetrate the wood to a sufficient depth. He refers to the Haskins process of treating poles, which he thinks is highly successful in its results.

The paper was an extremely interesting one, and we give elsewhere in this issue an abstract of the same. Mr. Peck's conclusions are based on practical experience, and are worth careful consideration.

STEAM ENGINES FOR ELECTRIC LIGHTING.

An extremely interesting paper read before the Electric Light Convention at Buffalo, was that of Mr. D. Ashworth on "The Allied Powers," an abstract of which we print on another page in this issue. Mr. Ashworth therein reviews the development of the steam engine to meet the requirements of electric lighting.

As one stands by and observes the operation of the modern steam engine in its unvarying motion and its great power, the mind is naturally filled with thoughts of the vast amount of labor, time and skill represented by such a mechanical giant. The thought of the countless problems that have been solved and the thousands of difficulties that have been met and overcome in the development of such a machine is bewildering to the finite mind, but the result is a grand monument to the efforts of American students, scientists and mechanics. As perfect as steam engines are, however, there remains room for improvement. An engine running continuously, as is required in electric lighting, must be durable, and in this direction Mr. Ashworth states there is much to be done in the way of betterment. The tendency to multiplicity of parts or movements in valve gear, is deplorable, he says. Complications eventually end in interruptions and break downs that frequently entail expenses of alarming proportions and culminate occasionally in an entire abandonment of the plant. Such disasters, of course, are ruinous, and Mr. Ashworth has pointed out the way in which efforts should be directed, with a view to their avoidance.

There is no doubt that American ingenuity will solve this problem, as it has done in the case of all others, and experience combined with scientific thought will certainly triumph.

ELECTRIC POWER IN MINING.

The utilization of sources of power remote from its point of application has, during the past two years, received considerable attention from electricians in this and other countries; and repeated experiments have demonstrated the practicability of utilizing power, by the adoption of electrical methods, which would otherwise be wasted, and of its utilization to such advantage that projects may be, and have been, carried out which, without the application of electricity, would have been impossible. This has been particularly the case in the mining industry. Lodes of metal are frequently found at great altitudes, where, unless some cheap power can be applied at the required spot, they can never repay working. It is not so long ago that a project to generate power for mining purposes at the foot of a mountain and utilize it economically midway or at the summit, would have been scoffed at as visionary; but this feat has been accomplished and with complete success.

Probably the best example of this, at the present time, is the large plant which has been installed by the Edison General Electric Co. at the Virginius group of mines near Ouray, Colorado. It is one of the largest, if not the largest, purely mining plant in the world. Every difficulty likely to be met with in work of this nature was encountered in the installation. The pipe line is laid along the side of a rocky cañon; the wires from the power-house to the mine are strung partly through dense timber, where they are exposed to damage from falling trees, and partly above timber line, over rocks and snow-banks, where the poles and wires are liable to be carried away by snow-slides, and where lightning storms are frequent and violent. The line is nearly four miles long, the

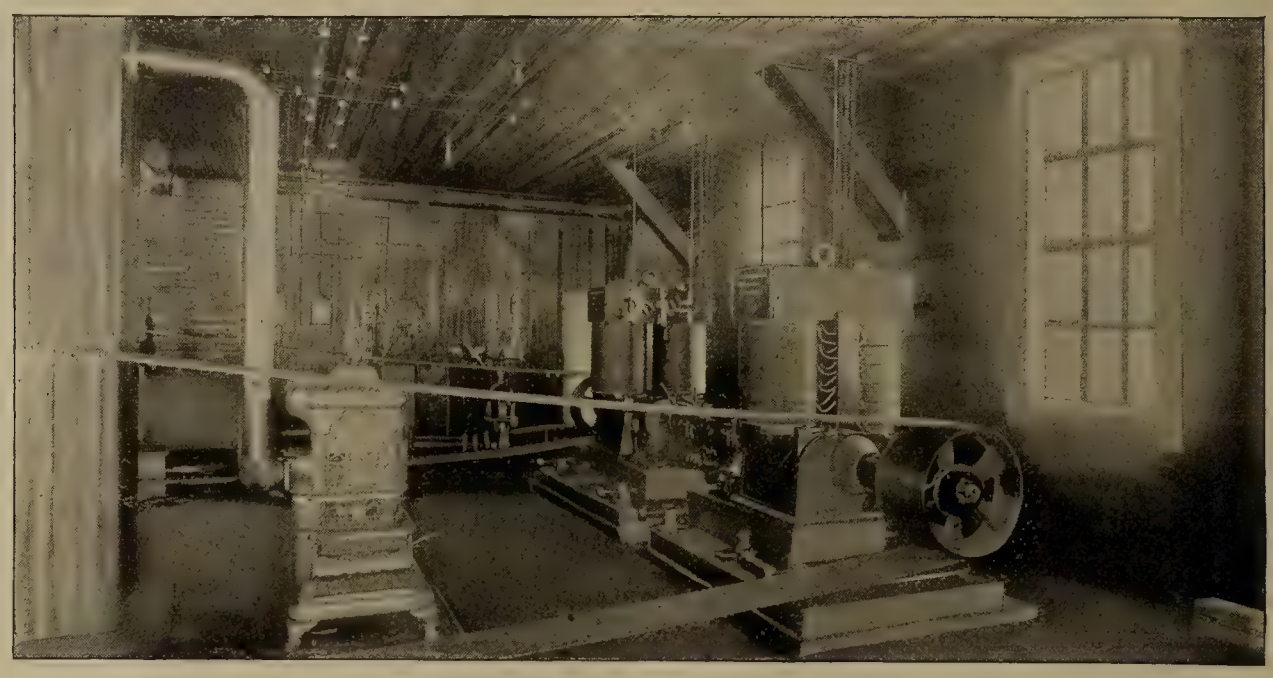


LINE OVER SNOW PLATEAU, ALTITUDE 12,500 FEET.

voltage of the current eight hundred volts, and the mine is wet. The relative advantages of the ground return and complete metallic circuit are illustrated, and switches are so arranged that either may be employed, the metallic circuit being used at present. The plant includes a variety of machinery, comprising two pumps, one hoist, one blower and two motors running mills; indeed, almost everything except locomotives and drills, and these will probably be added shortly. Lastly, the enormous saving that can be effected in many places by the utilization and transmission of water-power by means of electricity is strikingly manifested. Coal at the mines costs $18 per ton, and before the installation of this plant was made the cost of the power amounted to nearly $40,000 per annum. This sum is saved by the adoption of electric power. An instance is also afforded of unprofitable mines being rendered profitable by the use of cheaper power, for while some of the mines in this group are rich enough in metal to repay working under the most adverse conditions there are others of lower grade which would have been shut down in case the electric plant had proved a failure, but which, with the plant, will now yield a satisfactory profit.

The Virginius and neighboring mines, owned by the Caroline Mining Company, are situated near the summit of Mt. Sneffles, in the region of perpetual snow at an altitude of 12,700 feet above the sea and about 5,000 feet higher than timber line. They are reached by a wagon road, open in the summer, but impassable in the winter, when the only route to the mines is by a difficult trail.

The water-power utilized for the plant is in Red Cañon Creek, nearly four miles from the mines. It consists of a small dam, an iron pipe line, extending along the side of the cañon a distance of about 4,000 feet, giving an effective head of 485 feet, and two Pelton wheels, one 5 feet, the other 6 feet in diameter, capable of developing under that head 500 H. P. and 720 H. P. respectively, or a total of 1,220 H. P., the two wheels being connected to separate shafts, so that either wheel may run the entire station. The



POWER-HOUSE—VIRGINIUS MINES, OURAY, COL., ALTITUDE 9,000 FEET.

little over 19,000 feet. The electric machinery operated at the mines consists at present of two pumps, 60 H. P. and 25 H. P. respectively, one hoist (25 H. P.), 2 Edison motors, each of 60 H. P., running



LINE THROUGH THE TIMBER.

concentrators and stamping mills and a 15 H. P. blower. The large pump which was erected when the plant was first installed raises 150 gallons of water 700 feet per minute, and is of the Knowles duplex type. An Edison standard motor is geared to it by a double worm, one right-hand and one left-hand, working into two spur-gears that mesh into each other and operate the pump, the object of the two worms being to neutralize the longitudinal thrust. The smaller pump, which was installed a few months ago, is somewhat similar, the motor, however, being mounted over the pump, with its armature vertical, the weight of the armature counteracting the thrust of the single worm employed. Both pumps have been working steadily and smoothly for several months, and have satisfactorily filled requirements.

The hoist consists of an Edison motor of standard type, but of street-car winding and controlling switch, geared to the drum through the medium of a friction clutch. By means of the controlling switch and clutch the hoist is under more perfect control than a steam-hoist.

The motors for the mills and blowers are of the standard type, and present no exceptional features.

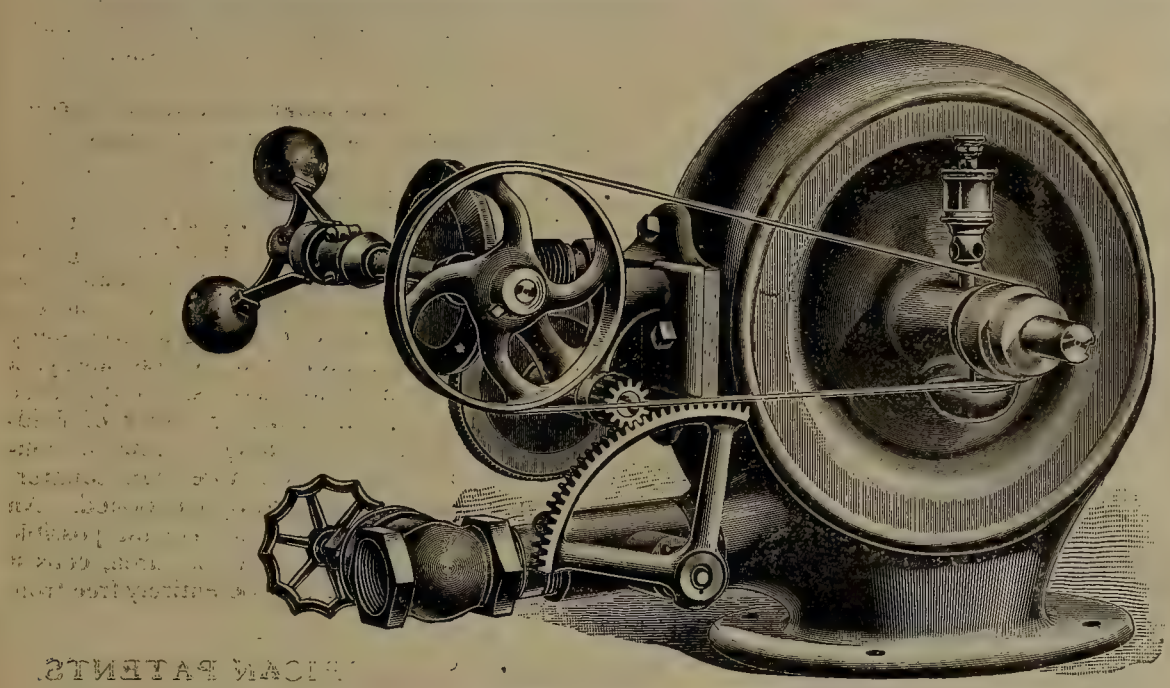
The most serious troubles have been caused by lightning, electric storms in that section of the country being frequent and very violent. This has formed the subject-matter of particular study, and special lightning-arresters have been devised that give excellent protection. Since their adoption little or no trouble has been experienced from this source.

MR. TESLA IN LONDON.

On February 3 last, Mr. Nikola Tesla gave a lecture before the Royal Institution in London, and gave some demonstrations of electric lighting with alternating currents of very high frequency.

The *Investors' Guardian* of London, February 13 last, contains the following observations on the lecture which are interesting: "The lecture, with its accompanying demonstrations, given by Nikola Tesla, the young Montenegrin, at the Royal Institution on Wednesday of last week, undoubtedly marks a notable era in the progress of electrical development. It may be truly said that the wonders of his marvelous manifestations amazed an audience which included the majority of the skilled experts of the Kingdom. By his ingenious contrivances he was able to produce a current alternating so may millions per second as to pass the wit of man to conceive. This marvellous current 'of all these million mole-

cules per jiffy' he passed through his body 'at a potential which might, or might not be a hundred thousand volts,' and he is none the worse for it. That the current actually does pass through his body, although only one hand touches the instrument, was abundantly proved from the fact that the glass tube held aloft in the free air by the other hand glowed in the dark room like a sword of fire. And this is the point to which it is our duty to call the attention of investors. It is known that the principal value of the Swan United Electric Light Company consists in their possession of the best patent for making carbon filaments, and using them in vacuum bulbs for incandescent lighting. It is also a matter of common experience that these filaments are fragile and of extremely uncertain duration, and that when destroyed, as they may be in 1 hour or 1,000 hours, the expense of a new lamp must be defrayed.

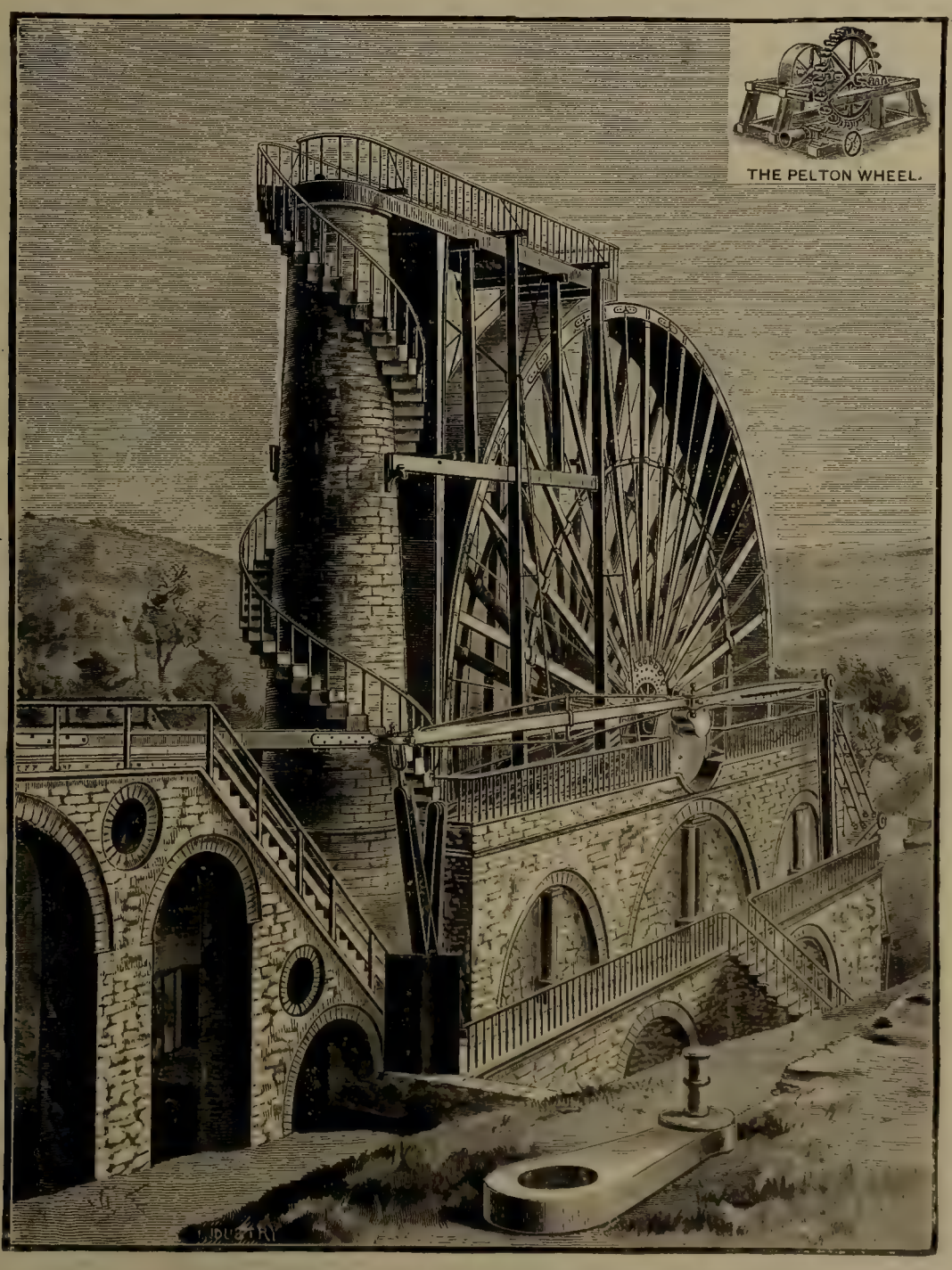


PELTON WATER MOTOR, NO. 2.

"Mr. Tesla has now shown that a most beautiful and powerful light can be produced under perfectly novel conditions from a simple tube or bulb of glass, and it seems to us that investors must ask themselves the question whether the filament lamp, with its delicate fragility, is not likely to be entirely ousted by the much more durable, simple and inexpensive contrivance now made known to us. If this should be the case, we do not hesitate to say that the present capital value of the Swan United Company, £375,000, would be swept away at a stroke."

WATER-WHEELS.*

Of the accompanying illustrations, the large cut in our illustration represents an over-shot or gravity wheel, constructed about 40 years ago, at Laxey, on the Isle of Man, a small island in the Irish Sea, off the west coast of England. The diameter of the wheel is 72 feet, and it develops 150 horse-power, which is transmitted a distance of several hundred feet to a lead mine, where it is employed in operating a system of pumps, the function of which is to raise 250 gallons of water per minute to an elevation of 1,200 feet. An underground conduit is used in bringing the water, which comes from some distance, to the wheel, where it is forced up the masonry tower by pressure, and flows over the top into buckets.

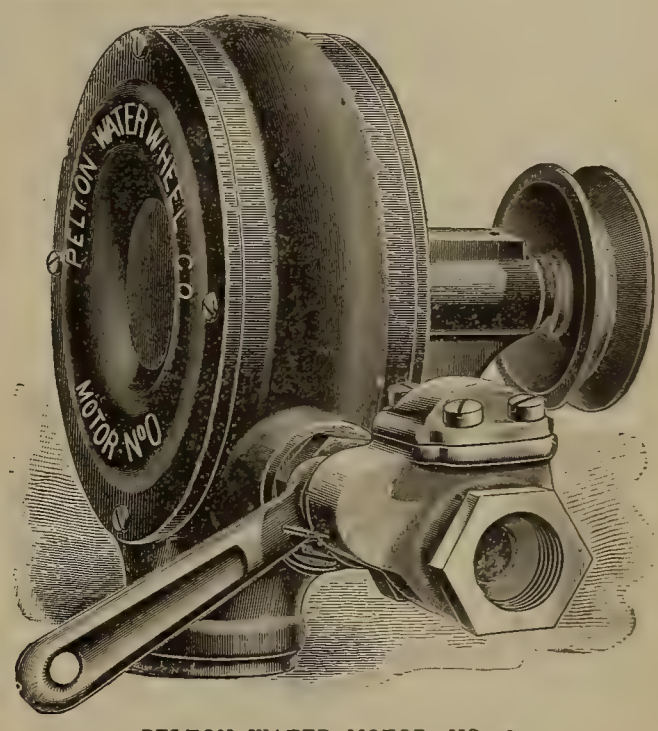


OVER-SHOT WATER WHEEL, LAXEY, ISLE OF MAN, AND PELTON WHEEL OF SAME POWER.

* The Pelton Water-Wheel Co., New York and San Francisco.

The small illustration in the upper right-hand corner shows a Pelton wheel of the same capacity (under similar condition of head and water supply) being drawn to scale, and by comparison the rapid strides which have been made in hydraulic engineering since that time are manifestly apparent. This illustration also gives evidence of the superiority of the modern method as demonstrated by the Pelton system of power.

The estimated efficiency of the Laxey wheel—taking resistance into account—is about 65 % of the theoretical power, while on the other hand, it is claimed that the Pelton wheel will develop 20 % more,



PELTON WATER MOTOR, NO. 0.

and as to dimensions, it is but a mere toy when compared with the other.

Of the remaining illustrations, one represents the smallest size of a Pelton water-motor, listed as No. 0, and is intended for operating sewing-machines, dental apparatus, etc.; the other shows a No. 2 Pelton motor with governor attached, for the purpose of controlling the wheel when running under varying loads.

THE ALLIED POWERS.*

BY D. ASHWORTH.

As the step from the conditions of the steam-engine with its slide valve to that of the automatic was radical and brought about by the imperative demands of closer regulation for the manufacture of textile fabrics, and



D. ASHWORTH.

economy of fuel from a commercial point of view, so was the evolution of the steam-engine to meet the requirements of the introduction of electricity in all its applications, especially that of lighting.

We now come to the period where the merging of the Allied Powers was imperatively demanded. As at the time of James Watt there were great trials and tribulations, accompanied by a host of disappointments, so in the electrical application. The world at large will never know of the sore trials, failures and disappointments that attended these conditions. The divine poet has said, "As it was in the beginning, it is now, and ever shall be," so will the inventive genius of man rise to the occasion again with a thoroughness and determination.

Again, the world over, did our scientists and ingenious mechanics apply themselves to meet this new and exacting requirement of the steam-engine for electric purposes. We now reach a point that may be worthy of attention—at all events, may lead to an idea. How often does the popular mind conceive the idea that the age of steam power is on the decline, and confidently predict that the time is not far distant when electric power will be the sole agency employed? Try to bear in mind, if you please, that since the advent of electric lights and motors the refinements of the steam-engine in every respect to meet the requirements have more than surpassed those of the half century preceding.

It may be said, without exaggeration, that during

* Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., February 23, 1892.

this period the finest intellects have been taxed to their utmost in research of principles to meet the exacting demands of the electrical requirements. Observe, if you please, the magnificent workmanship, far surpassing anything of the kind produced before; indeed, so far has this refinement been extended that special tools were created to produce the perfection desired. Does not this all point to the closer and inseparable union of the two powers, instead of that separation born of the heated imagination?

In this development of the steam-engine for this special purpose this great and constantly increasing field has resulted in the bringing forth of a vast number of competitors, each having, or at least claiming to have, some special factor of superiority, all converging to the two important points, regulation and economy, and last (though not always placed last), first cost. Right here is where the most of the troubles between the two powers originate, in that over-zealous desire to capture the contract by a guarantee upon the first two points, so that in the very depths of their silent thoughts they feel that they are straining a point just to barely overlap some one else. A moment's reflection, it would seem, would convince them that the day of reckoning may come, but this is the process of his reasoning: "These parties will never require this; it will never be tested. I will take my chances;" and oh! what a sea of trouble that taking involves; the innumerable disappointmenrs and delays, attended finally with bitter contentions and, perhaps, a long train of litigation. Frequently this taking of chances, by reason of minimum duty devolving upon it at the time of starting, allows it to pass in safety, but eventually the day of reckoning comes. Reputable houses, I believe, make every effort to abstain from this, but it is the over-zealous agent that is generally the factor who enters into this prevailing trouble.

There are two points which, I think, if acted upon by both parties, would do much to eliminate, if not remove it entirely, viz., on the part of the seller, to be careful to promise only that which he is positive can be accomplished with fair conditions and with ease, and upon the part of the purchaser, to reject at once that which upon investigation seems to promise too much. In case your knowledge is limited, employ an expert to sift the matter thoroughly. So clearly is the importance of this matter becoming understood that, in cases of importance, this course is becoming the rule, and is considered first-class practice. Notwithstanding these existing sources of irritation, it is gratifying to know that they are generally the attendants of unhealthy competition, and, with an increase of knowledge by those directly interested, will, in a measure, disappear.

Another feature, prolific of great annoyance and engendering friction at every point between the powers, is the often misplaced confidence of the authorities in placing officers in charge who may, perhaps, be thorough in all that pertains to the electric affairs, yet at the same time utterly lacking in the elements that go to make up the correct requisites for the steam department. Under such conditions, how often do we find upon the threshold of operations a multitude of troubles and almost every point bristling with disappointments and irritations. The writer has in mind a number of such cases, all of which could have been avoided by a more thorough knowledge of the steam requirements.

In the matter of steam or fuel economy, a general survey of the field in this direction reveals results of a marvellous character. Looking back to the period antedating the advent of the electric power, the majority of cases were well content with a result of four or five pounds of coal per horse-power per hour. With the advance in the adoption of the compound system, one and a half and two pounds are attained in practice.

An inspection of one of our first-class plants, fully equipped and properly maintained, cannot fail to impress the appreciative mind with the grand results of the efforts of American students, scientists and mechanics. As you look upon these muscles of brass and sinews of steel as they reciprocate to and fro, and listen to the soft whirr of the dynamo, does it not at times suggest to you the vast army of unknown ones that have burned the midnight lamp over the countless problems that have been solved to bring about such an harmonious whole? And more impressive is the fact that still the never-ceasing cycle of time continues with the same mastering passion to do more, to do better, ever reaching out for hitherto unseen forces and powers.

As has already been stated, the results in regulation and economy in engine practice to-day would seem to fill the round of desires or expectations at least. There yet remains much to be done in the direction of design with a view to durability, embracing within itself those qualities which, in a machine of continuous operation, would reduce the wear and tear to a minimum or scarcely appreciable amount. The tendency to a multiplicity of parts or movements in valve gear is to be deplored. This evil undoubtedly has been born with the effort of straining after exceedingly fine points, regardless of the mediums introduced for the accomplishment of the object in view. This complication never fails eventually to make itself known by its prolific fruits, in exasperating breakdowns and interruptions, entailing with the same a train of expenses that frequently assume alarming proportions and culminate occasionally in an entire abandonment of the plant.

In the matter of economy in the adoption of early points of cut-off and rates of expansion, it has been conceded that the positions of pure theorists, governed by the laws of thermodynamics, when brought into the actual school of practice and measured by the searching light of commercial conditions, were at variance. A halt upon this important point was the result, and now these theories are rapidly being modified and brought into close relations with accurate and first-class practice by this over-reaching, as it were.

BIOGRAPHICAL SKETCHES.

C. G. SMITH.

Many years ago there was established, upon the site now occupied by Lord & Taylor's dry-goods store, Grand street, New York City, a small lamp and oil-stove store by the founder of the great lamp house of "Smith of New York."

In the year 1842 "Smith of New York" hung out his sign at the above place, and by fair dealing, indomitable will and perseverance has made his name famous among the users of lamps for street-railway purposes throughout the universe. From Grand



C. G. SMITH.

street, New York, Mr. Smith, owing to want of room and the rapidly increasing business, removed his manufactory to 42 and 44 Fulton street, Brooklyn, N. Y., and in the year 1869, owing to increasing business, he was again obliged to seek larger quarters, and moved into the five-story building since occupied by him, at Nos. 350 and 352 Pearl street, New York City, where over eighty men are constantly employed.

One could travel the world over, and it is safe to say that upon every street-car line could be found a sample of the work of "Smith of New York."

Among others of the recently equipped foreign railways is that of the Electric Street Railway Company, of Leeds, England.

It may be interesting to mention here that "Smith of New York" was the first manufacturer of lamps to introduce a centre lamp in street cars. Upon the death of Mr. Willard H. Smith, the founder of the house of "Smith of New York," which occurred December 5, 1882, his widow, Mrs. Josephine D. Smith, and his son, Charles G. Smith, assumed control of the business, the active management devolving upon the subject of the above sketch, who was born in the year 1861, and after receiving a common-school education entered the employ of his father. When, having mastered the essential points in the trade, he travelled extensively some eight years, throughout the United States and Canada.

Mr. Charles G. Smith is an active, energetic young business man, and is personally known by every street-railway man throughout the country. He has devised and patented some very novel and useful inventions in the car-lamp line. We could enumerate hundreds of large electric, cable and horse-car lines which have recently sent to "Smith of New York" large orders for lamps. Suffice it to say, that quite recently the West End Street Railway Company, of Boston, Mass., placed an order with this firm for two hundred and fifty head-lights.

This house manufactures more lamps for street-railway purposes than all other manufacturers combined, and is constantly producing some new and novel feature in this line.

The Edison General Electric Company is installing an electric-light plant in the Indiana Hospital for the Insane, Indianapolis, Ind., which, when completed, will be one of the largest of its kind that has ever been put into a public institution. More than 3,300 incandescent lights will be used.

The two stations of the Chicago Edison Illuminating Company have a combined capacity of 53,600 incandescent lamps. Large additions to the plants are to be made during the present year.

FILED-MAGNETS WITH CONSEQUENT POLES.

Many dynamo-electric machines are constructed on the consequent-pole principle. If we take an iron ring without a break, with projections as pole-pieces, it will be practical, by means of proper winding of the wire on the field-cores, to concentrate the magnetic poles at the two opposite points, known as the pole-pieces.

The ring really, then, consists of two electro-magnets, with their like poles together. This arrangement gives rise to what has been termed consequent poles. An electro-magnet, with consequent poles, was first applied to dynamos by Gramme, who embodied this construction in his constant-current machine as early as 1870.

Consequent-pole field-maghets were very commonly used in dynamos until the investigations of Hopkinson and others revealed the fact that this construction generally involved considerable avoidable loss of energy. As commonly carried out, the design embraces a considerable length of magnetic circuit, as it includes—in the Gramme dynamo—the end-frames of the machine. In addition to the extension of the circuit this form of magnet commonly involves a considerable number of joints—always a weakening feature in field-magnets. Experience proves that although this combined form of field-magnet presents many advantages from a constructive point of view, they are more than counterbalanced by the drawbacks already mentioned. An ideal field-magnet would have the shortest possible circuit, the greatest possible sectional area, consist of the softest possible iron, and be entirely free from joints.

ELMORE'S AMERICAN PATENTS.

Elmore's American and Canadian Patent Copper Depositing Company (Limited), with headquarters in London, is now offering all of its Priority shares, 65,000 in number, for subscription at par. The Priority shares are entitled to priority in respect to both income and capital, and are entitled, after making provision for a reserve fund, to a cumulative preferential dividend of 30 per cent. per annum and half the remaining divisible profits. The Deferred shares are entitled to the remaining half profits.

This company has been formed to acquire the patents and all improvements thereon for the United States of America and for the Dominion of Canada, relating to the valuable discovery made by Messrs. F. E. Elmore and A. S. Elmore, for manufacturing metal articles, and more particularly copper articles direct from rough copper plates, with power to the Messrs. Elmore to use the process for the extraction of crude metals from the ore.

The invention supersedes the processes of rolling, forging, drawing, etc., and the present costly and laborious methods of manufacturing copper articles, such as tubes, vats, cylinders, pans, rollers for printing and paper-making, etc., rams, cartridge case shells, sheets, wire and tape for electrical and other purposes, and many more articles.

By the invention of the Messrs. Elmore, copper is electrically deposited upon a revolving mandrel or mould, upon the face of which a burnisher is caused to move automatically for the purpose of condensing the copper particles as they are deposited, thus not only rendering the material dense, silky, fibrous and cohesive, possessing strength, ductility and uniformity otherwise unobtainable, but at the same time producing articles automatically during the process of refining the copper, and at a low cost hitherto unknown.

The advantages, as stated by the experts, of the process as applicable to copper, may be summed up as follows:

1. That in the making of tubes and similar articles by this process, all drawing down and brazing is entirely done away with.

2. That there is practically no limit to the diameter of seamless pipes and other articles that can be produced, whilst by present processes these are strictly limited as to size, owing to the great expense of production.

3. That many copper articles, especially large tubes, vats, cylinders, etc., can be produced direct from rough copper far more cheaply than by any other process.

4. That the electrical conductivity of the annealed copper has a conducting power of 4½ per cent. above that of the best guaranteed commercial copper.

5. That the copper articles produced by the process have been proved to have absolute uniformity of density, thickness, tensile strength and true circular section.

6. That the copper can be varied in tensile strength and ductility according to requirements.

It is not the intention of this company to work the

process itself, further than by the erection in New York of a plant of sufficient size to demonstrate on a working scale the merits and simplicity of the invention, the extraordinary low cost of manufacture, and the enormous advantage to users of the articles when so made, by reason of their high and uniform quality. As soon as this plant has been erected, it is the intention either to dispose of licenses for the various States for a fixed sum, in addition to a royalty in the shape of a portion of the profits made by such licenses, or to dispose of the entire patents for the United States to a powerful group of American capitalists, for a large sum in cash and a proportion of the share capital of all companies formed by them to work the separate States.

The well-known metal firm, Messrs. Jere Abbott & Company, of Boston and New York, have, in view of the important character of the industry, accepted the commercial agency for the United States.

CORRESPONDENCE.

PRIMARY BATTERIES.

EDITOR ELECTRICAL AGE: In your issue of the 27th instant there appears over the initials "D. N. K." a letter on the subject of primary batteries, containing a series of statements of such a unique character that we beg permission for a portion of your valuable space in which to draw attention to them. In this connection it would be much more satisfactory did we know with whom we have entered upon discussion. There is something wraith-like and shadowy about a set of bare initials which renders it difficult, if not impossible, to engage in interested argument, and our present task would be hopeless were it not that our practised eye has enabled us to identify the author, at least to the extent of sex. Many of your less reflective readers may quite excusably have attributed the communication to some ambitious youth just entering upon a career of usefulness and impelled by enthusiasm to attack an unfamiliar subject, yet restrained by virgin modesty from revealing his identity. But not so with us. The confiding belief in deductions derived from insufficient and incomplete premises; the swiftness and fearlessness with which conclusions are reached instantly to become convictions, and the golden hope which radiates from the concluding portions of the letter—all these betray an instinct which is the attribute alone of woman, and thus is the identity of "D. N. K." in part revealed. Before proceeding to discuss her communication, permit us to express the hope that her personality may not always remain a mystery.

In the letter under reply, particular reference is made to "the copper oxide battery invented by Lalande and Chaperon," which, in its original form, as introduced by these gentlemen, was but little known outside scientific circles on account of its cumbersome and costly method of construction, but which, as improved and rendered commercial by Mr. Thos. A. Edison, has achieved such a wide and enviable reputation under the name of the Edison-Lalande Battery.

The first of "D. N. K.'s" indiscretions to which we invite attention, is the following: "The E. M. F. [of the Edison-Lalande cell] is so low that cells must be multiplied largely in order to obtain the required voltage. Its voltage is only two-thirds of the Daniell cell, or .66 volts as given by Thomson. This low voltage is a fatal defect for closed-circuit work, it requiring from six to ten cells to operate a common sewing-machine."

To be accurate, it requires six cells. This statement might be disposed of by asking "D. N. K." to favor us with the name of any other primary battery which can be employed practically for operating sewing-machines, either common or uncommon; but as she invites a more technical answer, we cheerfully provide it, and doubtless she has an experienced friend who will explain it for her benefit.

The value, electrically, of any battery for this class of work is represented by $\frac{E^2}{R}$—that is to say, by the figures derived by dividing the square of its electromotive force by the resistance of the cell. In illustration of this principle the following tabulation will prove instructive:

CELL.	E. M. F.	RESISTANCE OHMS.	VALUE AS ABOVE.
Leclanche	1.5	2.	1.125
Daniell	1.1	1.	1.121
Fuller	2.	2.	2.
Edison-Lalande Motor-Cell	.7	.03	16.3

Now the above shows, by a method which "D. N. K.'s" experienced friend, if he be interested in her welfare, will not permit her to dispute, that, while it is true of the Edison-Lalande cell that "its voltage is only two-thirds of the Daniell cell," its relative value for the work we are discussing is as 16 is to 1, and to the same relative extent has "D. N. K." departed from the truth in asserting that "this low voltage is a fatal defect." The Leclanche is never employed in this class of work. The Fuller is a fair representative of the various forms of electropoin cells whose use has been attempted, none of which has ever proved successful owing to defects which are inseparable from cells of which porous cups are a feature.

To proceed. We quote "D. N. K." again. "It is also misleading to many to state the capacity of the cell by *ampère hours*, instead of *watt hours*—the impression is made that the cell has double its actual capacity when compared with cells of high E. M. F."

While it doubtless is true that this impression might be made upon the mind of "D. N. K." it could not leave its imprint upon the mind of any person to whom either expression conveys the slightest ray of intelligent meaning.

Edison-Lalande cells are made in seven different sizes, viz.: 15, 40, 50, 150, 300, 600 and 900 ampère hours, each one of which is an absolute standard of capacity, whose rating is guaranteed by the manufacturers. It is not alone the only primary battery in the market so standardized, rated and guaranteed, but is the only battery known which admits of standardization and commercial rating by capacity. Why? "D. N. K." has hit it, though she doesn't know it. We will quote her own words in answering this question: "Their chief value being that no waste is suffered, while the circuit is open—which is important." It *is* important. It is vitally important. It is so important that the rating of any cell without it is a meaningless, useless ceremony that is indulged in only by people who wish deliberately to convey a false impression.

As to "D. N. K.'s" statements concerning the trouble of recharging Edison-Lalande cells; the destructive nature of caustic potash; their excessive cost and her allegation that "they are now only recommended for open-circuit work where small current is sufficient;" one of the principal features which has contributed to the success of this battery is the perfection attained in its construction. Renewals are effected with an ease and facility hitherto unknown in recharging primary cells.

The caustic potash which is supplied in sticks, that it is absolutely unnecessary to bring in contact with the person, is far less objectionable than the destructive, dangerous and fumid acids that are used in other cells; and during the past two months the sales of Edison-Lalande batteries from the factory amount to about thirty per cent. of the total business for the year 1891, which is a fair indication that costs are satisfactory to the purchasing public.

At the present time there are about 40,000 Edison-Lalande cells in general use, a large number of which are doubtless employed exclusively for open-circuit work; but the great majority of these are feeding closed circuits. The cells used in connection with sewing-machine motors are also employed for heating cautery knives that require a delivery of twenty ampères of current to bring them up to the required temperature, a fact of which "D. N. K." could not have been aware when she stated that they are only recommended "where small current is sufficient."

"D. N. K.'s" remarks concerning diaphragms or porous cups are not less interesting than her comments on the Edison-Lalande Battery. As, for instance, the following:

"The general teaching upon the subject is that in porous-cell batteries for strong current it is only a question of time when the depolarizing solution will get through and consume the zinc if the circuit be left open any length of time, while numerous trials have demonstrated the contrary."

It is a fact which should be intelligible to even the dullest comprehension that a diaphragm impervious to liquid will offer great resistance to the passage of a current of electricity.

From such a cell only a very small delivery of current can be obtained, and it is entirely worthless for work on external circuits of low resistance, such as motors, as the greater portion of its energy is wasted in overcoming the resistance of its diaphragm; while on the other hand, if cups be made sufficiently porous to absorb moisture, a freer passage is afforded for the current, and the degree of useful energy which can be obtained from the cell is increased. But then comes the trouble stated by "D. N. K."—"the depolarizing solution will get through the porous cell, attack and consume the zinc if the circuit is left open any length of time"—a trouble which is inevitable in all porous-cup cells.

As for numerous trials having demonstrated the contrary, the reference to these is vague and uncertain and lends color to the supposition that they must have been made in the privacy of "D. N. K.'s" boudoir, if they ever were made at all.

And now follows the most characteristic part of "D. N. K.'s" communication, where, with truly womanly impulsiveness, she "holds herself bound to sustain" all that she has said, and lavishes praise upon the child of her imagination like a mother on her first-born.

What man could, with so light a heart, assume such grave responsibilities?

"I may safely affirm that the following has been achieved," says "D. N. K.," and then follows a list of flattering attributes that read like the merit-cards which are given by insinuating school-marms at commencement to the emancipated scholar whose gladness is equalled only by his surprise in finding that he has been "very proficient" in every study. And indeed this resemblance is perhaps more than accidental. "D. N. K." may have taught school. In fact, the more we think of it the more convinced we become that this is so. She has probably carried upon her graceful shoulders the cares and responsibilities of some rural institute of learning, and incidentally "kept company" with the village bell-hanger, from whom she has absorbed her store of electrical knowledge. Far better would it be if "D. N. K." would return to her one-time home and marry the bell-hanger; but if she must remain where scenes are more exciting; if her affection for old associations has been eclipsed by an insatiable ambition which finds temporary relief only by having printed the products of her effusive pen, we commend to her the columns of an afternoon journal that is now discussing a subject which "D. N. K." is doubtless highly qualified to speak upon, viz.: "Should husbands pay a salary to their wives?"

A. O. TATE,
General Manager Edison Manufacturing Company.
NEW YORK, February 29, 1892.

THANKS FOR COURTESIES SHOWN.

EDITOR ELECTRICAL AGE:

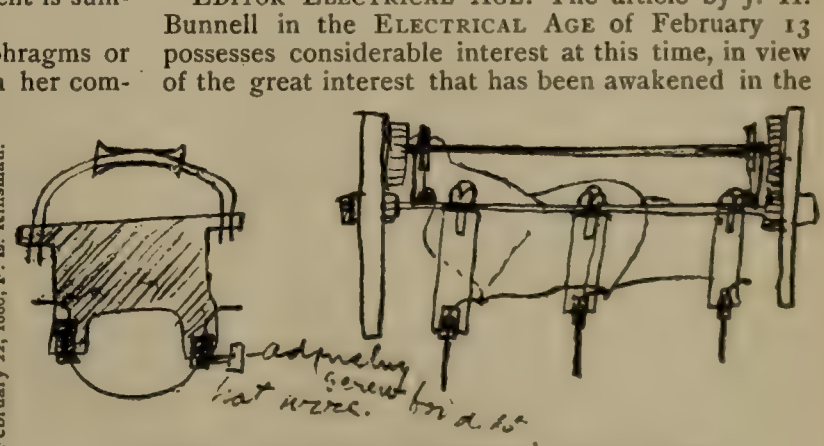
On behalf of the National Electric Light Association I desire to tender thanks through the electrical press to the following-named gentlemen for the very efficient services rendered and the numerous courtesies extended to our delegates during the recent Convention in Buffalo:

Mr. M. C. Roach, Gen. Eastern Pass. Agt. N. Y. C. & H. R. R. R., New York City.
Mr. Edson J. Weeks, Gen. Agt. Pass. Dept., Buffalo, N. Y.
Mr. H. H. Parry, City Ticket Agt., Buffalo, N. Y.
Mr. J. C. Yager, Div. Supt. Wagner Palace Car Co., New York.

Yours very truly,
C. O. BAKER JR.,
Master of Transportation.
NEW YORK, March 1, 1892.

ICE-CUTTING BY ELECTRICITY.

EDITOR ELECTRICAL AGE: The article by J. H. Bunnell in the ELECTRICAL AGE of February 13 possesses considerable interest at this time, in view of the great interest that has been awakened in the subject of ice-cutting by my article in the ELECTRICAL AGE of January 16, 1892.



ORIGINAL DRAWING OF KINSMAN'S ICE CUTTER.

The idea of melting ice by electricity is not new (to me at least), and we show you a design of an apparatus invented by me for that purpose. The great objection to its use is the cooling effect of the ice upon the wire or rod. This arrangement is shown working by hand or upon a carriage propelled by a motor.

It is not necessary to describe the portable plant feature, used in connection therewith.

I write you this to show your readers what has been done. This method is one which I have proved by actual experiment to be open to very serious objections. Had this not been the case, I should have used the apparatus in preference to designing the one illustrated in your issue of January 16, last.

F. E. KINSMAN.

THE RELATION OF SIZE AND EFFICIENCY IN TRANSFORMERS.*

BY L. B. STILLWELL.

The designer of a transformer has presented to him alternative paths. He may easily design with reference to a very small loss of energy and relatively high efficiency at light loads, if he is willing to sacrifice regulation. He may design a transformer of little weight and large output, if he is content to work at a very high temperature, which may perhaps endanger the



L. B. STILLWELL.

lasting qualities of his insulation. The best transformer is not necessarily that which has the lowest leakage or magnetizing current; nor that which regulates most closely; nor that which is lightest and most easily handled; nor yet that which will carry its full load indefinitely with the least increase of temperature, but it is that transformer which best combines as much of each of these desirable properties as is practicable. In comparing various types, therefore, it is necessary to begin with a realizing sense of the fact that the same laws govern all types as to design and performance, and that, under the general laws of physics which have to do with this class of work, extraordinary excellence in one respect is necessarily obtained at the price of sacrificing excellence with respect to other properties equally important.

Let us take, as a starting point, a very small transformer; for example, one of five lights capacity, the primary terminals of which are connected to an alternating-current circuit of 1,000 volts potential. We will suppose that the lamps which are connected to the secondary circuit are all turned off. Under these conditions a small current, called magnetizing current, or leakage, flows in the primary coil. This current magnetizes the iron and, as a result, we have in the primary what is called a counter-electromotive force. Every transformer, small as well as large, which is connected to this dynamo circuit, must develop a counter-electromotive force approximately equal to that delivered to it from the dynamo. This counter-electromotive force depends upon the alternating magnetization of a certain amount of iron, and the magnetization of this iron means the expenditure of energy. The amount of iron required and the expenditure of energy necessary will naturally be less in a transformer of small capacity than in one of large capacity, but there must be some iron magnetized and some energy expended in holding back the electromotive force of the dynamo. It is safe to say that a commercial transformer, by which I mean a transformer that can be manufactured at a cost that will make it a commercial or salable article, cannot be so designed as to have a loss of less than 20 watts, due to the magnetization of the iron. A transformer twice as large—that is, of 10 lights capacity—is called upon to do precisely the same work and no more in developing counter-electromotive force to oppose that of the dynamo and may quite as easily be designed to work with an iron loss of 25 watts. If the rated capacity of the five-light transformer is 250 watts and of the 10-light transformer 500 watts, the loss in the former will be eight per cent. and in the latter five per cent. A 20-light transformer may as easily be designed to work with an iron loss of 30 watts, and a 40-light transformer with an iron loss of 45 watts; the percentage of loss in these cases being, respectively, three per cent. and 2.25 per cent.

One 10-light substituted for two five-light transformers will reduce the amount of energy lost in magnetizing the iron from eight per cent. to five per cent., a saving of three per cent. One 40-light substituted for two 20-light transformers will reduce iron loss from three per cent. to 2.5 per cent., a saving of one-half of one per cent. About the same percentage of saving can be effected by again doubling the size, and 100-light transformers can be furnished in which the iron loss does not exceed 1.7 per cent. Beyond this figure it is easily seen that improvement is difficult and even were it possible, by employing a very large transformer, say, one of 500 lights capacity, to reduce iron loss to one per cent., the improvement in efficiency resulting from the substitution of one of this size for five of the 100-light size would be but a fraction of one per cent., and, in view of the necessarily greater weight and the obvious objections to putting a large number of eggs in one basket, the advisability of such substitution would be doubtful.

Thus far we have considered only the loss in iron when no current flows in the secondary circuit, and it will be sufficiently accurate for our purpose to assume that this iron loss remains constant under varying loads of the transformer. The loss of energy due to the resistance of the copper when no current flows in the secondary is negligible, since the magnetizing current in the primary is very small, but this loss increases as the load on the transformer is increased, and the increase varies as the square of the current flowing—that is to say, the copper loss is four times as great when two ampères flow in the secondary circuit as when one ampère flows in that circuit. In the transformer without load we have a certain loss of energy designated iron loss, while in the transformer fully loaded we have this same iron loss plus the maximum copper loss. For intermediate loads we have approximately the same iron loss with varying copper losses dependent upon the amount of the load.

The loss due to the resistance of copper is generally about two per cent. This does not vary materially with a variation in size of the transformer, certain considerations having to do with regulation being largely accountable for this fact. If we assume that the loss in copper at full load for every size is two per cent., and that the iron loss is constant, irrespective of the load, the following table will, with sufficient accuracy, indicate iron and copper losses and efficiencies at full load. The table does not represent actual measurements of selected transformers, but is intended to fairly represent the proportionality of losses in transformers of various sizes. Actual tests will show results as good as or even better than the figures given in the table.

Capacity in 16 C. P. Lamps.	Loss in Iron.	Loss in Copper.	Efficiency at full load.
5	8 per cent.	2 per cent.	90 per cent.
10	5 "	2 "	93 "
20	3 "	2 "	95 "
30	2.5 "	2 "	95.5 "
40	2.3 "	2 "	95.7 "
60	2.1 "	2 "	95.9 "
80	1.9 "	2 "	96.1 "
100	1.7 "	2 "	96.3 "
300	1.5 "	2 "	96.5 "

It will be seen that for sizes of less than 20 lights capacity the falling off in efficiency as we go down the scale of sizes is very rapid, while, on the other hand, the gain in efficiency of transformers larger than that of 20 lights capacity is much less marked. The exact significance of the table will, perhaps, be better shown by putting it in another form. Let us compare the losses at no load and at full load in 1,200 lights capacity of converters of each of the several sizes, and let us express the loss in each case in terms of the number of 16-candle-power lamps, which the energy so lost would be sufficient to supply. We then have the following:

Transformers used.		Loss at no load.	Loss at full load.
240	5 Light Capacity.	96 Lamps.	120 Lamps.
120	10 "	60 "	80 "
60	20 "	36 "	60 "
40	30 "	30 "	54 "
30	40 "	27 6/10 "	51 6/10 "
20	60 "	25 2/10 "	49 2/10 "
15	80 "	22 8/10 "	46 8/10 "
12	100 "	20 4/10 "	44 4/10 "
4	300 "	18 "	42 "

These figures plainly show that to supply any number of lamps up to 100 it is desirable, on the score of efficiency, to use a single transformer of the required size rather than two or more of less capacity.

For sizes of a capacity above 100 lights the improvement in efficiency is necessarily little, and although the argument on the score of efficiency is still in favor of the use of the large sizes, that argument is by no means as strong as it was before we passed the 100-light limit.

This properly finishes the discussion on the relation of size and efficiency in transformers as they are to be purchased in the market to-day, but there are certain other considerations very closely connected with the subject which will naturally influence a central-station manager. I have left myself no space for a discussion of these points, but they are, for the most part, of a very obvious character, and it will be sufficient to simply mention them.

In favor of the use of large sizes is the very practical argument of reduced cost per lamp capacity. In giving proper weight to this consideration the purchaser should assure himself that the manufacturer has not effected a reduction in cost at the price of an excessively high-limiting temperature, which may endanger the lasting qualities of the insulation.

Transformers of 300 or 500 lights capacity are naturally large and difficult to handle; or if they are not very large it will be well to again note the temperature.

An investment in a 500-light transformer is large as compared with an investment in one of 100 lights capacity, and the chances of accident, such as may be caused by lightning, are quite as great in the case of the former as in the case of the latter.

It is extremely improbable that a static discharge from the line caused by lightning will damage more than one of a group of five transformers which may be connected together in multiple arc, while a discharge which may break down the insulation of one of these will be quite as likely to damage a 500-light transformer.

*Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., February 23, 1892.

LEGAL.

DECISION IN FAVOR OF THE BRUSH LAMP.

A decree was handed down in the United States Circuit Court on March 1 by Judge Shipman in the suit of the Brush Electric Light Company against the United States Electric Lighting Company for an injunction restraining the latter company from using the double-carbon lamp. The Judge finds the lamp in question was patented by Charles Brush on September 2, 1879; a perpetual injunction against the United States Company was therefore granted by him, and it was ordered that testimony be taken of amount due the Brush Company for infringements on its patents. An order was also issued by Judge Shipman compelling the agents and directors of the United States Company to give testimony as to their profits during the years that the Brush lamp was used by them.

OVERHEAD CONSTRUCTION.*

BY E. F. PECK.

While on the subject of poles, I wish to call attention to what I consider an erroneous method of treating poles to preserve them which is practised by many companies. Pitch or tar is applied to the butt, thus confining the sap, which ferments and hastens decay.

There are many different ways of treating poles,



E. F. PECK.

but I know of no method which is successful unless applied to the entire pole. The well-known creosoting process is objectionable on account of the dirt and the unpleasant odor connected with it, as well as the fact that the creosote does not penetrate to a sufficient depth. The same objections apply to the Burnettizing and Kyanizing processes.

My attention has been recently called to the Haskins process, which seems to be highly successful. This process consists in the placing of timber in an air-tight retort and subjecting it to the heavy pressure of superheated air, which permeates the whole section, thereby accomplishing the same result as a charring process, without losing any of the chemical properties of the wood.

In regard to the character of wood to be used for poles, the choice is limited in the vicinity of New York, those obtainable being chestnut, Norway pine, Princess pine, cedar, yellow pine, spruce and white pine. The Princess and Norway pine, although not as durable as chestnut, are the most desirable for the heavier poles, on account of their straightness and size. For lighter work, I prefer hewn or sawed chestnut poles to all others, and they are still obtainable in lengths up to 40 feet. Cedar poles are excellent as far as life is concerned, but too crooked and knotty to be useful for first-class work. My experience with yellow pine, spruce and white pine has been very discouraging, the life of each being short and uncertain.

The next step in the way of improvement which suggested itself was a better method of hanging commercial lamps. It has always been a source of surprise to me that more attention has not been paid by lighting companies to this important matter. The small additional expense necessary to ornament these fixtures certainly ought to warrant an improvement.

Last in the line of improvements came the wiring. It was only a question of rubber-covered wires *versus* weather-proof. We compromised the matter by using the best grade of rubber-covered wire for all leads from the switchboard to the main poles, and on all lines crossing under telephone and telegraph or uninsulated wires. For the balance of the reconstruction the best grade of weather-proof wire was used. It will be noticed that I have used the term "best grade" for both classes of wire. This term is a little ambiguous, as I am reminded each day by our friend, the wire salesman, who claims that his brand of wire is the best, and that all other kinds are not in it. So it remains for the purchaser to judge for himself as to the respective merits of the different brands in the market.

On some of the loops to buildings, where two or more circuits were necessary, we have used, with great success, duplex cables, thus doing away with a complicated and unsightly network of wires and fixtures. All wires are run on deep-groove double-petticoat insulators, the use of rubber hooks and porcelain knobs being avoided. It would be difficult to formulate rules for this branch of construction, it being simply a question of judgment and experience. However, a few suggestions may not be amiss. Great care should be used in the stringing of wire, for the insulation of a whole circuit may be ruined by the carelessness of linemen in handling. Joints should be soldered on all electric-light work when possible. I have found that wrapping a joint with tin foil and then covering with a good rubber tape, makes an excellent substitute for soldering, and is easily applied. Keep wires on the same relative pins to the end of the line, thus avoiding confusion, and making it an easy task to locate trouble.

Diagrams of principal poles, showing location of

*Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., February 25, 1892.

circuits, should be kept in every central station, for they are often the means of preventing serious trouble. Do not leave loops up that are out of service, expecting to pick them up again, as they may become a menace to your live wires. If more attention were paid to overhead construction by the electric lighting companies—substantial, neatly painted poles being used, with well-insulated wires kept taut and thoroughly inspected—the everlasting hue and cry against the "deadly" electric light wires would soon change to one of commendation and praise.

NEW INCORPORATIONS.

The Carbon Incandescent Gas Tip Company (incorporated in W. Va.), New York City, N. Y., was incorporated February 18, with a capital stock of $500,000, to manufacture fixtures of every kind for gas and electricity. Incorporators: I. Samuels, Benjamin E. Devoe, Wendel Samuels, all of New York, N. Y.

The Hubinger & Pool Company, New Haven, Conn., was incorporated February 15, with a capital stock of $50,000, to manufacture and deal in dynamos, motors and electrical apparatus, etc. Incorporators: J. E. Hubinger, N. W. Hubinger, New Haven, Conn.

The Diamond Incandescent Lamp Company, Denver, Col., was incorporated February 17, with a capital stock of $50,000. Incorporators: Samuel S. Campbell, John W. Flintham, Moses L. Stern, W. H. Brevoort.

The Oak Terrace Cold Storage Company, Jacksonville, Fla., was incorporated February 16, with a capital stock of $25,000; among other things it will generate electricity for light and power purposes. Incorporators: T. H. Butler, J. M. Foggerty, W. T. Chapin.

The Curtis Electric Company (incorporated in W. Va.), Brooklyn, N. Y., was incorporated February 20, with a capital stock of $500,000. Incorporators: Byron A. Beal, W. W. Pratt, F. B. Hooper, all of Brooklyn, N. Y.

Canton Water Works and Electric Light Company, New Orleans, La., was incorporated February 19, with a capital stock of $50,000. Incorporators: Irwin Jamison, L. E. Cenas, Relant C. Perkins, New Orleans, La.

The Hollister Light and Power Company, Hollister, Cal., was incorporated February 17, with a capital stock of $25,000. Incorporators: Thomas Donovan, E. A. Crepin, Hollister, Cal.; F. E. Kenney, William Palentag, A. Towne, Thomas McMahon, G. S. Nash, all of San Francisco, Cal.

Merchants' Lighting Company of Santa Rosa, Cal., was incorporated February 17, with a capital stock of $50,000, to operate an electric light and gas plant and distribute light and power. Incorporators: J. H. Bruch, M. H. Dignan, William E. Stahl, I. A. Proctor T. P. Keegan, J. H. Rinhorn, C. A. Wright, Santa Rosa, Cal.

The Roseburg Electric Light Company, Roseburg, Ore., was incorporated February 16, with a capital stock of $20,000. Incorporators: J. E. Hurd, O. Boon, L. L. Hurd, all of Roseburg, Ore.

The Marseilles Electric Light and Power Company, Marseilles, Ill., was incorporated February 22, with a capital stock of $25,000. Incorporators: Clarence Griggs, C. L. Stinson, J. M. Grantham.

The Connellsville Electric Railway Co., of Connellsville, Pa., has been incorporated with a capital stock of $100,000. Incorporators: H. C. Huston, Worth Kilpatrick, John L. Gans, all of Connellsville, Pa.

The Pen Argyl Electric Light and Power Co., Pen Argyl, Pa., has been incorporated with a capital stock of $10,000. Incorporators: John S. Jackson, C. J. Fitzgerald and Henry E. Stephens.

The Somerset Electric Light, Heat and Power Company, Somerset, Pa., has been incorporated with a capital stock of $12,000. Incorporators: G. B. Hough, A. W. Knepper, J. A. Berkey, all of Somerset, Pa.

The Apollo Electric Light, Heat and Power Company, Apollo, Pa., has been incorporated with a capital stock of $20,000. Incorporators: George G. McMurtry, Allegheny, Pa.; Wallace P. Bache, Pittsburg, Pa., and James S. Whitworth, Apollo, Pa.

The Clinton County Electric Light, Heat and Power Company, Lock Haven, Pa., has been incorporated with a capital stock of $25,000. Incorporators: Charles M. Blanchard, Charles M. O'Connor and E. B. Shoemaker.

The Constantine Electric Company, Constantine, Mich., was incorporated February 8, with a capital stock of $6,000. Incorporators: Levi Hull, Franklin Wells, John J. Proudfit, all of Constantine, Mich.

The Washington Street Railway Company, Washington, Ind., was incorporated February 12, with a capital stock of $50,000. Incorporators: Joseph Wilson, Oscar Kahn, Robert N. Van Dorn, Samuel H. Taylor, William Marmaduke.

The Madera Electric Light, Transportation and Power Company, Madera, Cal., was incorporated February 11, with a capital stock of $100,000. Incorporators; Return Roberts, W. C. Maze, T. A. Ripperdan, Madera, Cal.; A. F. Johns, William Jenningson, San Francisco, Cal.

The Alessandro Valley Land Company, Alessandro, Cal., was incorporated February 10, with a capital stock of $1,000,000. Among other things it will operate electrical works. Incorporators: Paul C. Skiff, New Haven, Conn.; John A. Preston, Walter A. Main, A. E. Sterling, E. W. Sterling, E. W. Wilmot, E. G. Judson, Redlands, Cal.; George H. Talbot, Norton, Mass.

The Central Electric Light and Power Company, Chicago, Ill., was incorporated February 13, with a capital stock of $500,000. Incorporators: A. T. McDonald, W. H. Harding, W. J. Buckley.

The Lower Chichester Electric Light, Heat and Power Company Lower Chichester, Pa., was incorporated February 9. Incorporators: John H. Kerwin, Linwood, Pa.; Thomas H. Berry, Chester, Pa.; H. F. Walter, Media, Pa.

The Milton Electric Light and Power Company, Milton, Pa., was incorporated February 8, with a capital stock of $40,000. Incorporators: Ed. D. Mullen, Frank Rhue, Philadelphia, Pa.; Levi E. Snow, Milton, Pa.

The Lincoln Street Railway Company (Consolidated Lincoln Street Railway Co. and Rapid Transit Co.), Lincoln, Neb., was incorporated February 10, with a capital stock of $2,300,000. Incorporators: T. W. Little, C. C. Upham, C. F. Ernest, all of Lincoln, Neb.

The Everett Gold Mining and Milling Company, Tacoma, Wash., was incorporated February 8, with a capital stock of $1,000,000. Among other things it will operate electric-light works. Incorporators: Henry Hewett, Jr., John F. Plummer, Tacoma, Wash.; J. F. Wardner, Fairhaven; F. W. Dunn, L. W. Getchell, Seattle, Wash.

The Dayton Auxiliary Fire Alarm Company, Dayton, O., was incorporated February 12, with a capital stock of $30,000, to install and operate auxiliary fire-alarm devices and operate and deal in other electrical supplies and appliances. Incorporators: John F. Ohmer, John P. Breen, A. B. Ridgway, A. L. Bauman and Harry F. Nolan.

The Robinson Motor and Battery Company, Portland, Me., was incorporated February 10, with a capital stock of $500,000. Incorporators: Matthew H. Robinson, Orlando A. Foster, both of Boston, Mass.; Webster C. Langmaid, Watertown, Mass.

Universal Printing Telegraph and Signal Company, New York, N. Y., was incorporated February 4, with a capital stock of $100,000. Incorporators: John H. Bradford, D. H. Bates, New York, N. Y.; C. Fellowes, Morristown, N. J.

The Mitchell Electric Company, St. Paul, Minn., was incorporated February 11, with a capital stock of $15,000. Incorporators: H. M. Byllesby, H. C. Levis, W. Bromhall, B. T. Meek, Jr., W. P. Johnson, C. K. Stearns, S. P. Wells, Jr., all of St. Paul, Minn.

The Ogden Electric Power Company (incorporated in W. Va.), New York City, N. Y., was incorporated February 8, with a capital stock of $500,000. Incorporators: W. S. Morrow, Westfield, N. J.; J. W. Snedeker, Bloomfield, N. J., and J. A. Kitten.

The Central Gas Light and Water Company, San Francisco, Cal., was incorporated February 6, with a capital stock of $300,000. Among other things it will operate electric-light lamps. Incorporators: Charles O. Buckland, Lodi, Cal.; W. J. Phillips, T. B. Key, San Francisco, Cal.; S. T. Dodson, Sr., S. T. Dodson, Jr., Oakland, Cal.

The Eldora Electric Light Company, Eldora, Ia., was incorporated February 9, with a capital stock of $15,000. Incorporators: W. S. Porter, C. E. Albrook, J. H. Smith, C. E. Greef, J. F. Hardin, J. D. Newcomer, E. K. Brown, all of Eldora, Ia.

The Electro-Automatic Appliance Company, Hartford, Conn., was incorporated February 5, with a capital stock of $20,000. Incorporators: M. W. Terrill, Middlefield, Conn.; H. T. Sperry and J. A. Spalding, both of Hartford, Conn.

The Ryan & McDonald Construction Company (incorporated in W. Va.), Baltimore, Md., was incorporated February 8, with a capital stock of $600,000, to construct railroads to be operated by steam, electricity and other power; will also construct telegraphs, etc. Incorporators: C. J. Ryan, New York, N. Y.; J. B. McDonald, P. W. Briggs, Baltimore, Md.

MUNICIPAL FRANCHISES FOR QUASI-PUBLIC CORPORATIONS.*

BY ALLEN R. FOOTE.

Men group themselves into municipalities for the purpose of securing industrial, commercial, educational and social advantages. The particular advantage enjoyed in the most marked degree determines the controlling character of the municipality. The advantages principally sought have been, and are, industrial and commercial. These considerations led to the founding of municipalities wherever natu-



ALLEN R. FOOTE.

ral water-powers, waterways and harbors could be found. When a municipality has been founded where some advantages can be obtained, not possessing all, the inevitable tendency is to seek to secure by artificial means the advantages in which it is deficient. Man's first industrial need is the use of mechanical power that he controls. To supply this want it is absolutely necessary that natural forces be utilized. This necessity has led to the development of engineering science in planning constructions for the utilization of the energy of falling water, steam and electricity. The economic value of these forces is determined by the conditions under which they are produced, transmitted, subdivided and used. The red man was uneducated in the use of mechanical power. He had no municipalities.

The production, transmission, subdivision and cost of mechanical power determines the number of persons who can use such power *with a profit.* The number of persons such users of power are able to employ with a profit determines the number who can enjoy *the rate of wages* the utilization of mechanical power enables such employers to pay. Cost of power is the determining factor. The lower this cost the better the opportunity for making a profit. The more certain a profit becomes the greater will be the number of persons employed. The larger the number of persons employed the smaller will be the number of the unemployed. The smaller the number of unemployed the better will be the wages of the employed, and the smaller the tax on the employed for the support of the unemployed the greater will be *the profit of labor.* The greater the profit of labor the greater is the prosperity of individuals, municipalities, states and nations. While every person has a vital interest in the settlement of questions affecting industrial prosperity properly to secure the greatest economic advantage, those most interested are the wage-workers and the unemployed.

The municipal needs with which we may now deal are the production, transmission and subdivision for use, of a supply of good water, gas and electricity for the production of light, heat, and power, the electrical transmission of intelligence and the transportation of persons and property.

Properly to supply these needs, it is necessary to create quasi-public corporations, and grant to them franchises giving them the right to construct, maintain and operate the necessary works, and to construct, maintain and operate through the streets and alleys the necessary street and service connections to enable the service to be supplied to every building in the municipality. The importance of the organization and facilities granted to such corporations will be quickly appreciated if any citizen will ask himself what the industrial, commercial and social advantage to his municipality would be if it were true that all these services were there rendered at a less cost to the user than in any other municipality in the world. No one will have to think long or closely on the subject to become overwhelmed with his conception of the vast magnitude of the value of such advantages. How properly to secure such advantages is a question requiring clear perception, broad views and an entire absence of prejudice, or interest that tend to sway the compass needle by so much as a hair's breadth from the true point of direction, and a calm, unyielding judgment. Men so dishonest as to be willing to divert by force of legal enactment a portion of the profits of industry from those who incurred to those who have not incurred a risk in their production; men so incapable of a correct judgment as to denounce rent, interest and profits as robbery;

*Abstract of paper read before the National Electric Light Association, Buffalo, N. Y., February 25, 1892.

men so prejudiced against monopolies that they regard them with fear and hatred; men so full of sympathy with the sufferings of the poor that they are blind to the cause of their sufferings, are not safe guides for public opinion.

The correct settlement of this question will render a great service to industry, the prosperity of wage-workers and the betterment of society. Since the ignorant cannot become the equal of the intelligent, except by becoming intelligent, or the poor cannot become the equal of the wealthy except by becoming wealthy, the surest means they can use to assist them in securing these objects is to co-operate with the intelligent and wealthy in organizing corporations for the supply of quasi-public services and the conduct of private industries. It is by means of such corporations that labor can receive the most intelligent direction, obtain the use of the most efficient tools and realize the highest degree of profit.

By corporate services the conditions of life have been improved *for every person.* While they are not as good and as cheap as they might be, the economic advantages secured by them enable every person to enjoy more comfort, greater freedom, a higher degree of intelligence, and to acquire more wealth than was ever before possible. These services are not a tax upon the people. They are assisting every person to make a profit for himself.

A supply of water is a perpetual municipal need. The best interests of its users demand that the supply shall be abundant, wholesome, and that it shall be furnished at the lowest possible price.

A means of producing light, heat and power for public and private use, distributed from a central station, is a perpetual municipal need. The best interests of its users demand that such means shall be abundant, wholesome, reliable and safe, and that it shall be furnished at the lowest possible price.

A means for the electrical transmission of intelligence is a perpetual municipal need. The best interests of its users demand that such means shall be quick, accurate, reliable and safe, and that it shall be furnished at the lowest possible price.

A means of inter-municipal transportation for persons and property is a perpetual municipal need. The best interests of its users demand that such means shall be rapid, reliable and safe, and that it shall be furnished at the lowest possible price.

That these requirements may be be properly satisfied, true economic conditions demand:

First, that a corporation organized to supply a perpetual municipal need shall have the exclusive right to perform the service perpetually.

Second, that the service shall always be supplied by the best methods known to science that are made commercially available by the best practices known to the art.

Third, that all accounts shall be honestly and correctly kept, and economic thrift be insisted upon in every department, and that charges be so fixed from time to time, by a competent and disinterested tribunal, as to yield a revenue sufficient to pay all fixed charges, expenses of administration, operation and maintenance, and a reasonable per cent. dividend annually upon the investment.

A comparison of these economic conditions with the conditions fixed by the law on this subject in all States will quickly show how blindly the blind have been led in efforts to secure the greatest good for the users of the services supplied by municipal franchise corporations. Had laws governing the organization, management and control of municipal franchise corporations been enacted in accordance with the requirements of true economic conditions, instead of in compliance with the dictates of an unintelligent self-interest or prejudice, how great the change in their wording and meaning would be! There would have been no reference to a particular source, force or instrument, such as gas, telegraphs, telephones, electricity or horses. *The character of the need to be supplied, not the character of the method of supplying it, would have determined the designation of the work to be done.* The sovereign law of labor and property would have protected the right to work. The immutable law of nature that brings man into physical life and excuses him from it—but not until another has been supplied to take his place—would have been recognized by making a perpetual provision for perpetual needs. The municipality, into which men come, out of which men go, like the eternal life of Time, lives on and shall forever live as long as man remains. Co-existent with the life of the municipality are its needs, and so should be the life of the municipal franchise corporations organized to supply them.

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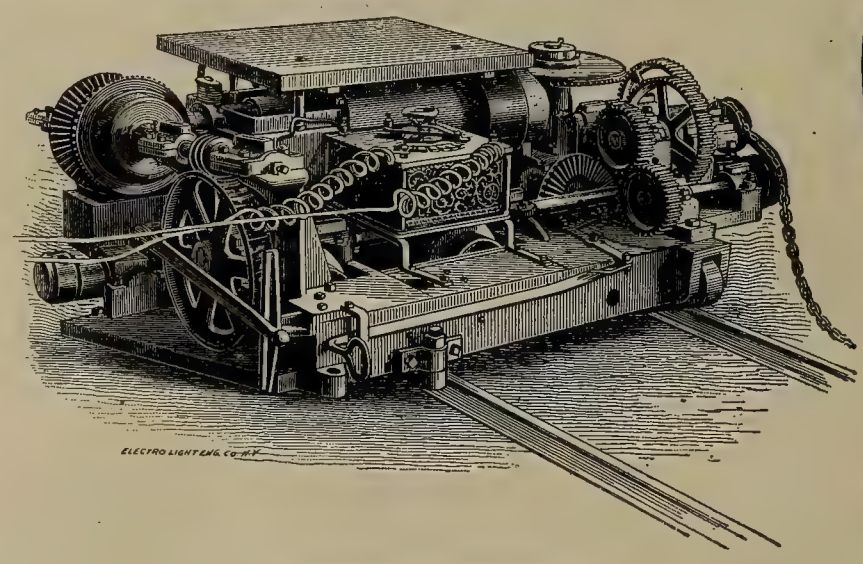
The services rendered by municipal franchise corporations are assistants to industry, promoters of comfort and inducers of prosperity. Any unnatural restriction placed on them is as fatal to the welfare of society as an unnatural obstruction to the inhaling of air or taking of food is to the health of the physical body. Any tax levied upon them is as fatal to the best interests of industry as the extraction of blood is to the physical strength. Obstructions and taxes laid upon quasi-public services are like rust upon a plough or a hole in a grain sack. They narrow the depth of the soil turned and lessen the quantity of seed to be sown. As the value of the harvest is greater than the seed, so is the value of the cheapened service greater than a tax that enhances its cost.

A perfect franchise is the exact equivalent to a perfect title to real estate. It conforms fully with the conditions that give economic value to all property. It is in accord with ethical and economic laws that proclaim and establish the dignity and freedom of labor. It conveys and guarantees unrestricted, exclusive and perpetual possession, subject to such use and control as shall best serve the public welfare.

A condition of vital importance to wage-workers, in the discussion of a question of this kind, that cannot be urged upon their attention with too much force, is the fact that every time an industry is removed by legislative enactment from the list of self-producing industries and placed in the list of non-profit-producing industries operated under government ownership, an avenue to industrial independence is closed. Profit-producing industries are avenues to industrial independence and economic freedom for all who are engaged in them. For the wage-workers, more than any others, the self-interest of the individual, and moral interest of society, the group interest of the municipality, state and nation, demands that *all avenues to industrial independence and economic freedom shall be kept open.*

ELECTRIC COAL-CUTTER.

The accompanying cut illustrates a coal-cutter of the under-cutting type driven by a 15 H. P. C. & C. Electric Motor of special design. This is in operation in the Mead Run Mine in Pennsylvania. The motor placed in position on the machine is covered by a heavy board which serves to protect it from possible injury from any heavy object falling upon it. The starting-box is also placed on the machine in a convenient position, as can be seen from the illustration. The armature-shaft carries a bevelled pinion at each end, and by a mechanical device this can be made to operate the endless chain to which the coal-cutting knives are attached and which revolves about the arm, and also to operate the feed-chain, which is made fast at one end, so that the machine can be moved forward at any desired speed or allowed to remain stationary if the hardness of the coal so requires. The potential of the electric motor being low, 220 volts, there is no danger to be feared from coming in contact with the wires.



ELECTRIC COAL-CUTTER.

Two men operate the cutter—one regulating the speed of the gears and the other attending to the moving of the machine.

The Thomson-Houston Electric Co. has found this machine so successful in mines where an under-cutting machine can be used to advantage, that it has made an arrangement for its adoption, and it is expected that several mining machinery manufacturers will do the same.

THE TROLLEY IN BROOKLYN.

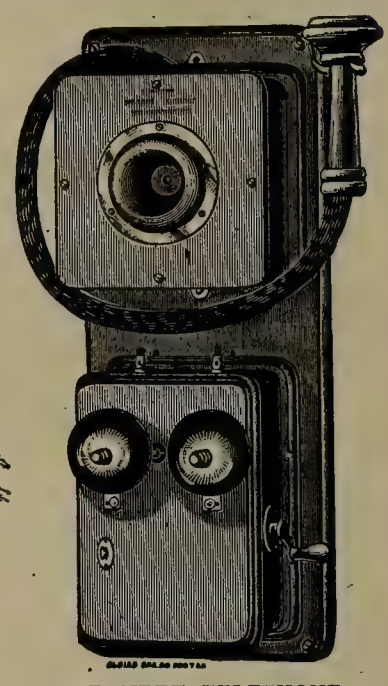
Mr. Daniel F. Lewis, president of the Brooklyn City Railroad Company, who has just returned from a tour of inspection in the principal cities, says that of all the systems he saw during his travels none came up to the trolley. Mr. Lewis and Mr. Bliss, a director of the company, who accompanied him, visited the works of the Westinghouse Electric Co., Pittsburg; Short Electric Railway Co., Cleveland, O.; Edison General Electric, Schenectady, N. Y., and those of the Thomson-Houston Co., Lynn, Mass.

An order for 1,200 motors, the cost of which will amount to about $1,500,000, has been placed with the latter company, and is the largest order for equipment of electric railway service ever received by the Thomson-Houston Co.

TELEPHONE SYSTEM.*

Our illustration shows a telephone of the Bennett Telephone System, which, it is said, will give better service than the Bell Telephone within distances not exceeding 5,000 or 6,000 feet. It is the only telephone with the "Bell Electric" using receiver and transmitter combined.

A valuable feature of the system is that connection can be made with the several floors of a store, factory or warehouse from the office. A button is pushed indicating the number of the floor, and conversation can be carried on without disturbing other stations. The different floors besides being connected with the office are made inter-communicating. The value of such a system is apparent.



BENNETT TELEPHONE.

LUBRICATING OILS.

The question of lubricating oils is an important one to all managers of electric generating stations, and there exists considerable difference of opinion as to which oil gives the best satisfaction in practical use. Naturally most makers of oils claim that their own is superior to any others, and there is unquestionably some ground for these claims, as many of the oils are of superior merit.

During the Convention of the National Electric Light Association in Buffalo last month, Mr. F. A. Lane, of Cleveland, Ohio, made a few remarks at one of the meetings on the subject of lubricating oils, which were of interest. He said that most people were under the impression that it was necessary to use lubricating oils of high viscosity and low gravity in order to get good lubrication on heavy or high-speed machinery. He said that after extended experiments it had been found that a light oil, light in gravity and low in viscosity, was the oil that would give the best satisfaction in the lubrication of both high-speed and heavy machinery. In the case of machinery running at very high speed an increase of oil will increase the temperature; and unless oil enough to absorb the heat is used, so that the oil will run away, taking the heat with it, the heat cannot be reduced by a large amount of oil. Mr. Lane recommended an oil of about 32° gravity and 140° viscosity. He instanced the Calumet and Hecla mines, where lard oil was used up to two years ago, but now a mineral oil is used. Objection was sometimes raised to oils because they produced a gummy substance; but this is usually a scale-making material, which comes from the walls of the cylinder. As a rule, any oil that will produce a gummy substance is a good oil.

The Hartford Insulating Company, Hartford, Conn., was incorporated February 4, with a capital stock of $75,000. Incorporators: G. Wells Root, Erastus S. Root and F. E. Fowler, all of Hartford, Conn.

The Dalles Electric Telephone and Power Company, The Dalles, Ore., was incorporated February 4, with a capital stock of $40,000. Incorporators: G. V. Bolton, H. C. Wilson, George C. Blakeley, George Ruch, all of The Dalles, Ore.

* National Telephone Mfg. Co., Boston.

GERMANIA UNIVERSAL SHADE-HOLDER.

A shade-holder so made that it can be used on varying sizes of lamp-sockets has long been a necessity, and many efforts have been made to meet the demand, but up to the present time none has been offered which would fill all the requirements.

The principal sockets on the market are the Edi-

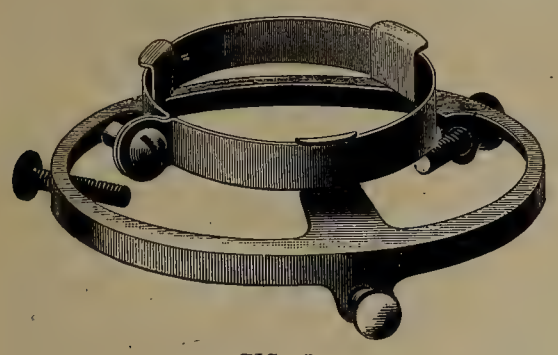


FIG. 1.

son, Thomson-Houston and Westinghouse, and of these the socket-shell diameters are of two sizes. The Thomson-Houston and the Westinghouse are of the same size, and the Edison is larger, so that two different-sized clamping devices or rings are necessary to adapt a shade-holder to them.

The Germania Electric Co., of Boston, has solved the problem, and has produced a device called the Germania Universal Shade-Holder.

Figure 1 shows this shade-holder as used on the Thomson-Houston and Westinghouse sockets, which, as will be seen, involves the ordinary method pursued of attaching any shade-holder. Figures 2 and 3 show the method of applying it to the Edison sock-



FIG. 2.

et, which is done by unscrewing the rubber ring, inserting the prongs into the brass shell and replacing the rubber ring.

The claims for this shade-holder are that it fits all standard sizes of sockets, is simple, strong and artistic, and has no weak points and no joints to work loose.

CHANGES IN EDISON "DISTRICTS."

On February 1, the territory known as the "Southern District" of the Edison General Electric Company was divided between the "Eastern" and "Cen-

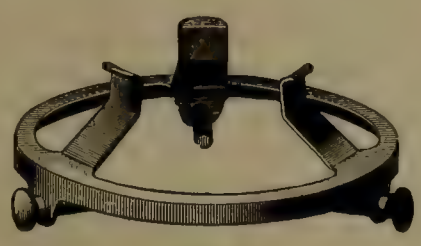


FIG. 3.

tral Districts." North Carolina, South Carolina, Georgia, Florida and Alabama have been included in the jurisdiction of the "Eastern District," and Tennessee, Arkansas, Mississippi, Louisiana, Texas and Indian Territory have been included in the "Central District." That portion of Connecticut which lies east of the Connecticut river has been included in the "New England District."

A NEW CEILING PENDANT CUT-OUT.

Another new form of ceiling cut-out has recently been added to the long list of special and improved devices now upon the market. The block illustrated herewith is a development of a design by Mr. J. Van Vleck, Electrician for the Edison Electric Illuminating Co., of New York, for whose special requirements it was originally made.

Mr. Van Vleck has succeeded in embodying in one block of small dimensions all the desirable features that such an appliance should possess.

The cut-out is adapted to both exposed and surface work; in the latter case the wires are brought directly through the base to the binding-posts, and do not appear on the outside of the cut-out. It has a square base, and consequently is especially adapted to moulding work.

The interlocking contacts are substantially made, and of such a character as to permit of no loose connections or the liabilty of the same working loose. Double-pole safety-catches are concealed in the cover, permitting easy renewal without disturbing the base of the block, and the room for making connections is not cramped.

Possessing no external binding-posts or metal parts, the block has found favor and received the indorsement of the Fire Underwriters.

The block is known as the V. V. Ceiling Cut-Out, and a close inspection or trial will readily demonstrate that the claim of the manufacturer, the Interior Conduit and Insulation Company, of New York, that it is the neatest and best, is well founded. It is sure to meet with the approval of those who demand the best.

THE DELANY CROWFOOT ZINC.

The E. S. Greeley & Company have become the sole licensees for the manufacture and sale of the new zinc shown in the cut, the invention of Mr. P. B. Delany. The zinc itself is just like the ordinary "Crowfoot" zinc in common use, but Mr. Delany has added a very simple and effective means for removal of the stalactite formations of spongy copper which form on the under side and hang down into the copper solution, thus setting up local action and causing great waste of zinc and bluestone.

The device scarcely needs description. A glance at the cut will show a wire sweep through the central toe of the zinc. The wire is bent on horizontal plane with the zinc, so that by touching the eye-end projecting above the solution the sweep is free to move in either direction so as to thoroughly sweep or brush the entire bottom of the zinc from centre to circumference, thereby sending all the spongy coating to the bottom of the jar. Heretofore this operation has been attended with so much difficulty that it was either imperfectly done or neglected altogether.

Besides the great saving effected in zinc and copper the resistance and efficiency of all the cells of a battery will be uniform, as the laziest or most careless attendant will not fail to give the sweep an occasional twist.

As we understand that the nature of the device is such as to add little or nothing to the cost of the zinc, we see no reason why the Delany form of "Crowfoot" zinc should not become the standard.

CARDEW VOLTMETERS.

Since acquiring the American patents which control the Cardew Voltmeter, Queen & Co. have made extensive preparations to manufacture this celebrated instrument. Special tools have been procured so that the mechanical parts may be constructed in the best manner possible, and in the new Queen laboratory every facility is afforded for exact calibration. The Cardew has an enviable name as a standard voltmeter, for it possesses qualities not to be found in any other instrument. It is dead beat, direct reading for both alternating and continuous currents, contains no permanent magnets nor parts liable to change, can be left constantly in circuit, and the indications are correct within one per cent. under all circumstances. These qualifications render the Cardew the best station voltmeter on the market, and the only satisfactory potential indicator for marine installations.

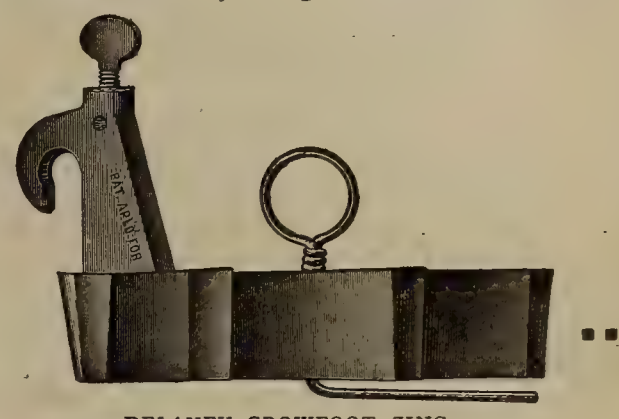
Queen & Co. inform us that they are making these instruments in large numbers to supply the increasing demand.

The Quinsigamond Electric Power and Light Company, Worcester, Mass., was incorporated February 2, with a capital stock of $10,000. Incorporators: Horace H. Bigelow, Irving E. Bigelow, Eben F. Thompson.

FAN-MOTOR.

As the time for the disappearance of cold weather approaches thoughts of the succeeding warm weather, and how we shall best keep cool, begin to fill our minds. Here electricity comes to our aid, as it does to supply many more of our wants.

There is no better way of keeping cool during hot weather than by using an electric fan-motor.



DELANEY CROWFOOT ZINC.

These machines keep the air in constant motion, and this enables us to keep cool to a reasonable degree.

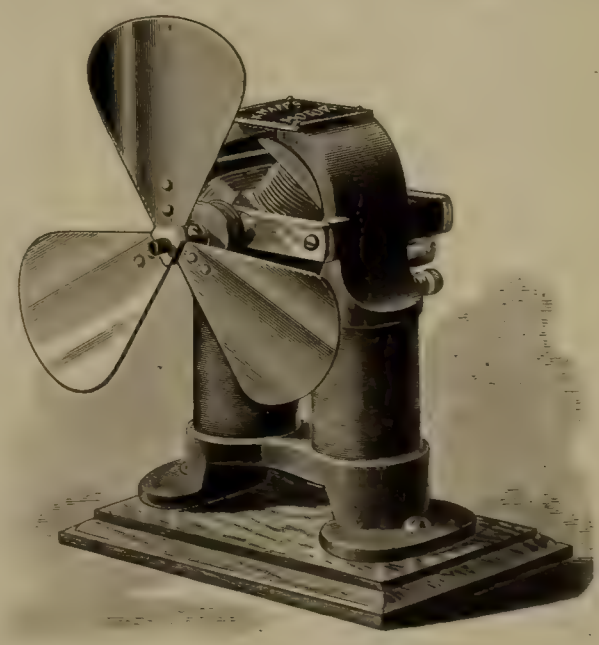
In the past two or three years several fan-motors have been put upon the market, but the one illustrated herewith is so extremely simple and efficient that there would seem to be no reasonable excuse for a person or a family sweltering during the hot weather when one of these machines can be obtained for so low a price.

The motor illustrated herewith is made by the



CEILING PENDANT CUT-OUT.

Knapp Electric and Novelty Co., 34 Warren street, New York. It is but six inches high, and weighs only four lbs., so that it requires little space, and can be easily carried about and placed in any desired location. This motor is mounted on a mahogany base, and is very well finished. The binding-posts are attached to the iron work of the motor, so that the machine can be fastened to a table or desk, or any other desired place. It is made with as much care as any of the high-priced motors, and is finely finished in enamel with brass trimmings. Com-



KNAPP FAN MOTOR.

pared with other motors, at the same cost, it outranks them all in power and workmanship. It will operate a fan from six to ten inches in diameter, and will also run toys and light machinery. It will run on one or more cells of battery, according to the amount of work required of it, and it is, besides, self-starting. A six-inch fan comes with each motor, free of charge.

INSTITUTE OF ELECTRICAL ENGINEERS.

The 65th meeting of the American Institute of Electrical Engineers will be held at the headquarters of the Institute, No. 12 West 31st st., New York, Tuesday evening, March 15, at 8 o'clock. A paper will be read by Mr. Alexander Wurts, of Pittsburg, on "Lightning Arresters."

WESTERN NOTES.

The St. Paul and Minneapolis Street Railway Company has ordered 90 noiseless motors from the Short Electric Railway Company, Cleveland, O., and has received 5 new large Westinghouse triple-condensing engines.

F. P. Little & Co., 141 East Seneca street, Buffalo, N. Y., have just closed a contract with the Western Transit Company, for lighting its city elevators "A" and "B." The contract includes a 7 x 12 "Rice" Engine, manufactured by the John T. Noye Mfg. Co.; one E. I. Cylindrical Type "Thomson-Houston" Dynamo, and the necessary wiring and equipment for 300 16 C.P. incandescent lights, and 4 arc lights to be run on the same circuit. They will also erect a brick building, 10 x 25 x 13, in which to put the plant.

N. D. W.

NEW YORK NOTES.

First Floor, World Building,
Office of the Electrical Age,
New York, March 5, 1892.

Mr. W. R. Mason, president of the Electric Merchandise Company, Chicago, was in town last week.

The Old Reliable "Eureka" Packing is still forging ahead, from what Hine & Robertson, 45 Cortlandt street, this city, tell us. Its growth has been marvellous, and it is being used for both steam and water ends of engines and pumps in all parts of the civilized globe. The sales have increased from 1,000 lbs. to 7 to 8 tons monthly.

Apropos of the Buffalo Convention, it should be noted that the Buffalo Street Railway Company, consolidated lines, has just ordered three 24-inch Underwood cotton-leather belts for its power station. These are in addition to the four cotton-leather belts of the same make and size now at this station. These and other Underwood belts running in Buffalo were inspected and found to be doing exceedingly well. The Iroquois and Broezel Hotels are equipped with them, and guests of these houses who were attending the Convention were shown the practical working value of Underwood belting. The Buffalo belts were purchased through the Engineering Equipment Company, who has full control of the Underwood trade in New York State from its offices, 143 Liberty street, this city. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,825,000	100 00	62 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Engineering Co., N. Y.	1,000,000	100 00	60 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	†20 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	209 25
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	30 00
Commercial Cable Co	7,716,000	100 00	155 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	112 50
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*101
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	81 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	99 00
Edison General Receipts		98 75	
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	46 00
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	†83 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	51 00
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	105 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hunt Engineering Co., N. Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	20 00
Laclede Gas pref	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	102 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	39,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	19 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P Co. 6s, Ohio	50,000		*95
North American Railway Co	39,767,200	100 00	16 25
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty, E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500,000	100 00	80
Thomson-Houston Electric Co	6,000,000	25 00	59 00
Thomson-Houston pref	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston	500,000		*100
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Western Union	86,188,852	100 00	88 50
Westinghouse Electric Co	7,000,000	50 00	15 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		19 25

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The success which the industrial corporations are meeting among speculators and investors, both in town and country, is shown very plainly by such corporations as the Claflin Co., Thurber-Whyland Co., and last, but not least, Journeay-Burnham Co. In each of these the employés and customers were depended upon to subscribe for sufficient interests to assure the ultimate placing of the entire capital with the public, and the increase of business resulting from the reciprocity forms the basis on which the transient dealer expects to secure, first, his dividend, and next, a profit on the sale of the shares in which he took chances for his money. British capital was first in the field for this opportunity; but as it costs from $15,000 to $25,000 to distribute shares in any respectable enterprise among the English investors, they could only attempt to float an undertaking, the magnitude of which was equal to that expense and a profit for services beside, commensurate with the risk. The Joint Stock Act of 1862 opened up a field for the concentration of capital in corporations of this description which the promoter seized with avidity and scoured the universe in quest of promising ingredients containing the materials which, moulded into a compact body, could be made to recoup themselves and satisfy the investing public with a few dividends and the possibility of continuance. The public soon became educated, and studying the prospectuses demanded more of the component parts of the business or property, forcing the vendors from one industry to another, and from one country to another. With the exception of mines, baling ties and stock ranches, until very lately they found little in this country to answer the purpose. The breweries started the ball, and to-day the woods are full of agents, backed by competent and capable promoters with ability, ready to negotiate for any industry which they can be convinced will take with their clients after being whipped into shape. Railroads were incorporated here and the bonds sold abroad; now the company is incorporated in England or on the Continent with only a sufficient American holding to comply with the statutory laws in case any real estate is concerned. While we are abundantly able to supply the home demand, it is surprising how very few industrial enterprises exist in this country which fill the requisites and can be made to show income sufficient to satisfy the manipulators. Nothing less than twelve per cent. per annum will be looked at. Only a few days ago I was applied to for an option on a dozen or more street tramways to be placed in one Scotch company and which should pay not less than fifteen per cent., as the principals would not waste their time on anything under that. The tendency is to keep such investments in this country, whether on the scale of $250,000 or up in the millions. The current year should bring to the front a few financiers capable, each in different channels, of honestly preparing and exploiting industrial enterprises on a sufficiently co-operative plan to be acceptable to all, and whose names should be a guarantee to the investors that there was a moral probability of the business proving successful. We want a few men such as Sir Henry Tyler, Sir Edward Watkin, or firms such as Ashurst, Morris & Crisp, to promote industrial enterprises. They will not lead where the widow and orphan may not follow, nor permit any flippant dallying with the securities by the directors. Their broad, liberal views of all financial development permit of no speculation. Commercial laws and rules are followed, and the inevitable only is the result.

All the financial world and the readers of the Electrical Age, either as investors or students, are interested in the results attained on account of the extraordinary clever negotiating of the affairs of Baring Brothers & Co., Limited, under the guidance of probably the most skilful financiers of the day. At the general yearly meeting of the company, held a few days ago in London, with Mr. Francis Baring presiding, the shareholders present cheered to the echo a report and statement which I believe to be absolutely impossible in any kindred situation or condition in the United States.

The chairman, in presenting the report, said the directors hoped the results shown in the balance-sheet would be satisfactory to the shareholders, considering that 1891 had not been a year of generally active business. The profits were made up almost entirely of commissions on acceptances and regular banking. Above all it must be remembered that the company did not get fully to work before April, so that the profits were the result, not of a full year, but of only nine or ten months. These results were the best proof he could give that the company had retained almost the whole of the mercantile and the main part of the banking business of the old firm. The apparent reduction in the current accounts at credit since June was a mere accident, due to the fact that £200,000 which should have arrived in December came to hand on the 1st of January, and that the figures for June included an exceptional deposit of nearly £500,000 to meet a special payment due early in July. In their proposals for dealing with the net profits by distributing half as dividend and placing the other half to reserve, the directors had followed the ideas which the late Mr. Chas. Baring had in his mind in the early days of the company and the principles suggested by some of their largest shareholders. The object in placing so much to reserve was not to cover bad business. All doubtful debts for the year had already been provided for, and for that purpose, he was glad to say, a small amount had sufficed; but under the rather peculiar circumstances of the company it seemed to them important that a substantial reserve should be formed as soon as possible—a reserve standing at a good round figure, which could not be overlooked. The directors hoped, therefore, that the shareholders would be content with the moderate dividend proposed for 1891, and trusted that the business might show a steady increase in following years.

Mr. Bertram Currie moved, and Mr. Daniell seconded, a resolution, and it was resolved to adopt the report, to declare a dividend at the rate of 5 per cent., and to place £50,000 to reserve. This having been carried, Mr. Henry Cazenove proposed, and Mr. Hope Morley seconded, the election of Mr. Thomas Baring as a director, which was carried unanimously.

Ten years hence the wreckage will have been assorted; practically all of value will be utilized and the rubbish cremated or honestly stamped "N. G." With the balance, the men at the helm are capable and undoubtedly will steer the ship safely into port.

LIGHTING PLANT IN A BROOKLYN THEATRE.

H. Ward Leonard & Co., of this city, have just installed a plant of two thousand lights in the new Columbia Theatre, Brooklyn, which was opened March 7. The work was done under the supervision of M. J. Demuth, who is district superintendent, assisted by Wm. B. Martin. Grimshaw white core wire was used throughout. The switchboard is immediately behind the stage, and will be in charge of Mr. E. W. Latham, who has been selected from Mr. Leonard's force as electrician of the house. In the centre of the switchboard is an Ajax switch, which makes connections with the Edison central station by two different routes. The architects were Parfit Bros., of Brooklyn. Two thousand electric lights hidden or sunk somewhat below the surface of the walls, illuminate the building; some are hung in clusters along the balconies, their light illuminating the metallic ornamentation with beautiful effect. The large proscenium arch is completely surrounded with lights, also hidden from view, thus producing a subdued light. The heating is done by hot air, forced into a plenum chamber beneath the auditorium, through small holes beneath every other chair in the orchestra floor, with a register provided with damper for regulating the heat. Before the beginning of a performance it is proposed to force a large volume of hot air to the front of the auditorium to offset the force of the draught of cold air which invariably comes from the stage when the curtain goes up.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

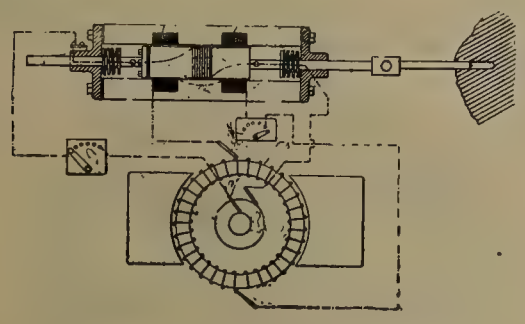
Issued February 23 and March 1, 1892.

Issued February 23.

469,266. Electrical Burglar-Alarm for Windows. Friend C. Page, Creston, Iowa. Filed June 16, 1891.

469,273. Electric-Telegraph Apparatus. Joseph Robinson, London, England. Filed Jan. 21, 1891.

In an electric-telegraph transmitter, a train of wheels operated by a first-motion wheel following by a spring-tension a transmitter-handle, in combination with a controlling-flier constructed with vanes pivoted near the axis of the flier, a spiral spring on the axis, and a notched collar in the heels of vanes folding them normally toward the axis, but permitting them to extend radially outward against the spring reaction under the centrifugal force developed by the speed of the flier.



469,441.—ELECTRO-MAGNETIC RECIPROCATING ENGINE.

469,281. Dynamo-Electric Machine. Johannes Sohlman, Frederikshamn, Finland, Russia. Filed Sept. 18, 1891.

The combination, with the two stationary annular armatures provided with induction coils, of a central shaft and the two groups of field-magnet poles carried by the shaft and adapted to be revolved within the two armatures, the pairs of armatures and groups having an equal number of poles and the position of the corresponding elements of the pairs being adjustable relative to each other.

469,283. ElectricHose-Coupling. Joseph B. Strauss. Cincinnati, Ohio. Filed Sept. 14, 1891.

The combination, in an electric hose-coupling, of the engine-outlet, having an extension secured in line therewith and carrying the insulating devices, an annular flange projecting outwardly from extension and surrounded by a pair of non-conducting packings, a sleeve, screw-threaded at one end and provided at its opposite end with an annular cap that bears against the packing, a non-conducting cylinder secured between extension and sleeve for the purpose of insulating them, a wire for conducting the electric current away from extension, and another wire for leading the current into sleeve.

469,347. Electric-Arc Lamp. William D. Graves, Cleveland, Ohio. Filed Nov. 9, 1891.

In an arc lamp, the combination, with the upper-carbon holder, of a magnet in a shunt-circuit, a lever fulcrumed to a frame or post and carrying the armature-bar, having acorn projections, springs connected to lever, lever pivoted to post and having an open-hinged ring gripping the carbon-holder, rod attached to lever and connecting it with lever, and a rod also connecting it with head by a screw.

469,361. Electric Elevator. Robert Watson, Brooklyn, N. Y. Filed Oct. 3, 1891.

The combination, with an electric motor and a load connected to be moved thereby, of a governor arranged to increase or decrease the speed of the motor as the load is decreased or increased, respectively, governor being automatically controlled by load.

469,362. Electric-Arc Lamp. Frederick R. Boardman, Manor Park, England. Filed Jan. 27, 1891.

In incandescent arc lamps, the combination of a circular three-way refractory block, a metallic case or box therefor, two carbon electrodes seated in the block, a tubular case for each electrode, insulated from the aforesaid box, and means for pressing the electrodes against the refractory block.

469,376. Fire-Alarm System. Harvey Redding, Everett, assignor to the Redding Electric Company, Boston, Mass. Filed May 15, 1891.

In a fire-alarm system, the combination, with the alarm-circuit, including a series of gongs, switches, a circuit breaking and closing wheel, a train to rotate wheel, and an electro-magnet to release and arrest train, of a branch or loop connected with the circuit and having a circuit closing and breaking device, the latter including a movable rod or slide, which when in one position breaks the continuity of branch, leaving the system operative in the usual way, and when in another position closes the circuit and limits the movement of the wheel, whereby the gong may be tested by closing and breaking the circuit without giving the usual alarm.

469,408. Automatic Electric Gas-Lighting Burner. Rufus C. Nourse and Thomas W. Lane, Boston, Mass., assignors to the Electric Gas-Lighting Company, Portland, Me. Filed Dec. 29, 1890.

The secondary-circuit breaker for electric gas-lighting burners, composed of the block, having the insulators, the socket, binding-screw, plunger, spiral spring, screw, holding spring, which in turn holds the plunger, and a co-operating contact.

469,424. Electrical High and Low Water Alarm. Alcinus C. McConnel, Allegheny, Pa. Filed Dec. 2, 1890.

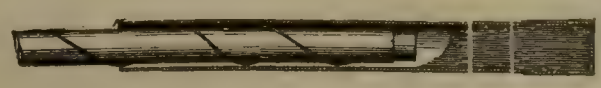
In a steam-generator, the combination of a float, a rock-shaft operated by the rise or fall thereof, an electric-circuit closer moving with the rock-shaft, to which it is secured, and when deflected from a vertical position adapted to communicate with both poles of a battery, an electric signal operated on a closed circuit, and a cylindrical insulator sliding on the circuit-closer adapted to be interposed between the points of contact.

469,441. Electro-Magnetic Reciprocating Engine. Merle J. Wightman, Scranton, Pa. Filed Feb. 5, 1891.

In an electro-magnetic reciprocating engine, an iron cylinder and an iron core fitting the bore of cylinder, in combination with electric coils in grooves or recesses in the interior of the cylinder and the exterior of the core, respectively.

469,469. Tube for Electric Conductors. Edwin T. Greenfield, New York, N. Y. Assignor to the Interior Conduit and Insulation Company, same place. Filed March 21, 1891.

The described method of insulating concentric tubing, consisting in partially filling the outer tube with insulating material in liquid form, then inserting the inner tube, thereby causing the insulating material to fill the space between the two, and finally causing or allowing the insulating material to harden or set, whereby the tubes are firmly united together.



469,469.—TUBE FOR ELECTRIC CONDUCTORS.

469,470. Conduit for Electric Conductors. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Aug. 14, 1891.

A pair of non-conducting tubes having their ends united together by a non-conducting cement and surrounded by a non-conducting ring embedded in a metal sleeve, the ends of the sleeve and the metal portions of the tubes being united together by corrugations or indentations.

469,471. Electro-Magnetic Stop-Motion for Steam-Engines. William W. Hailstone, Long Island City, N. Y. Filed June 2, 1891.

The combination, with an engine-cylinder, valves for the admission of the motive force thereto, valve-operating mechanism, and cams for disengaging the valve-operating mechanism from the valves at predetermined intervals, of a lever for controlling the position of the cams, a lever-operating rod for operating lever independently of the governor, and an electric circuit, including an electro-magnet for actuating the lever, operating to throw the cams into position to prevent connection between the valve-operating mechanism and valves.

469,474. Telephone-Support, Hammond V. Hayes, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed June 22, 1891.



469,522.—ELECTRIC CABLE.

The combination of an adjustable telephone-supporting arm pivoted at its fixed end to a stationary bracket, a spring coiled around the pivot and exerting a constant elevating force on arm, and a clamping-nut for regulating the force of spring.

469,475. Electric Cable. Hammond V. Hayes, Cambridge, and John S. Stone, Boston, assignors to the American Bell Telephone Company, Boston, Mass. Filed Oct. 12, 1891.

A cable-section of a double-line circuit, composed of two associated members representing, respectively, the sides of circuit, each member consisting of two independent parallel conductors separated from one another by a layer of insulating material of high specific inductive capacity and being insulated as a whole from its associated member by non-conducting material of low specific inductive capacity.

469,481. Electrical Atomizer. Colin Lightbody, Brooklyn, N. Y. Filed April 10, 1891.

In combination, an atomizer, an air-pump connected with the atomizer, an electric motor connected with the air-pump, a movable seat for a water-closet, and an electric circuit under the control of the movable seat to energize the motor and thereby operate the air-pump and cause the atomizer to eject fluid.

469,482. Incandescent Lamp. Frederic H. Manchester, Providence, R. I. Filed Nov. 4, 1891.

The combination, with the insulating-plate having the central perforated stud and the headed contact-tube secured therein, the contact ring or plate, secured to the surface of insulating-plate by the ears passing through the perforation and wires secured to contacts, of the shell having the contracted step and the lip adapted to be bent over the shoulder of the insulating-plate to secure plate in place.

469,483. Incandescent Lamp. Frederic H. Manchester, Providence, R. I. Filed Nov. 4, 1891.

In an incandescent lamp, the combination, with the base, having the corrugations and lip, of the porcelain insulating-plate secured within lip and having a side perforation and a central perforated boss, a metal cap covering boss and secured in place by the flanged tube, extending through perforation, and wires adapted to connect shell and cap with the lamp-filament.

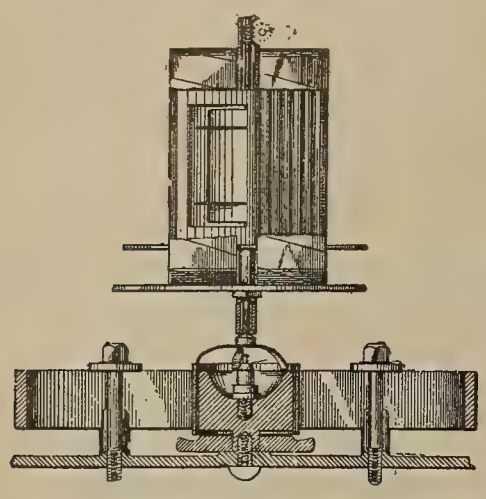
469,515. Electric Machine. Michael von Dolivo-Dobrowolsky, Berlin, Germany, assignor to the Allgemeine Elektricitats-Gesellschaft, same place. Filed Aug. 3, 1891.

In the armature of an electric generator, the combination

of an iron core, three or more coils or sets of coils, surrounding the core and connected together to form a closed circuit or circuits, other coils or sets of coils, being alike in number to that of the coils or sets of coils, and also surrounding the core and severally connected at one end to equidistant points of the closed circuit or circuits, and line-wires connected to the other ends of tbe coils.

469,522. Electric Cable. Hammond V. Hayes, Cambridge, Mass. Filed Aug. 16, 1889.

A metallic electric circuit in which the direct and return wires are combined spirally with insulating material in such



469,800.—ELECTRIC METER.

manner that the thickness of the insulating material from the common axis of the spirals to the inner surfaces of the wires, which are separated by substantially the diameter of the spirals, is greater than its thickness on the exterior surfaces.

469,649. Signal Device for Telephone Pay-Stations. William Gray, Hartford, Conn., assignor of one-half to Charles Soby, same place. Filed April 16, 1890.

In combination with the sound receiving and transmitting part of a telephone apparatus, a coin channel and guide and a signal-sounding device having a part located in the path of movement of the falling coin.

469,650. Signal Device for Telephone Pay-Stations. William Gray, Hartford, Conn., assignor of one-half to Charles Soby, same place. Filed Dec. 15, 1890.

In combination, in a telephone pay-station the automatic-sounding device and the transmitter located within the signal-box.

469,656. Electric-Lighting System. James F. McElroy, Albany, N. Y. Filed June 4, 1891.

The combination, with a dynamo-electric generator operated by motion of the train, of a potential switch in the circuit of dynamo, switch being operated by the magnetic pull of revolving armature on the field-magnets mechanically transmitted to switch.

Issued March 1.

469,672. Electro-Magnet. Andrus D. Ayres, Kalamazoo, Mich. Filed May 23, 1891.

469,706. Telephony. William C. Lockwood, New York, N. Y. Filed Sept. 29, 1891.

469,712. Device for Controlling Electric Motors. Albert L. Parcelle, Boston, Mass. Filed March 14, 1891.

The combination, of a main electric circuit, a double-acting contact-finger therein, duplex contact-plates, one on each side of the central position of finger, in a branch circuit including the field-coils of an electric motor, and a duplex rheostat, one on each side of the central position of finger, in another branch circuit including the armature of motor, whereby a movement of the contact-finger in either direction from its inactive position throws a full current through the field and a gradually-increasing one through the armature in the same direction.

469,723. Underground Electric Conduit. Edward P. Robbins, Cincinnati, Ohio. Filed Feb. 24, 1890.

469,725. Dynamo-Electric Machine. Elmer A. Sperry, Chicago, Ill. Filed Jan. 10, 1890.

469,730. Journal-Box. William O. Wakefield, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 12, 1890.

469,745. Non-Intervening Fire-Alarm-Telegraph Box. Frank F. Loomis, Akron, O. Filed Aug. 31, 1891.

469,782. Telephone-Transmitter. Joseph C. Goulding, Cardiff, assignor to Woodhouse & Rawson United, Limited, London, England. Filed June 12, 1891. Patented in England, July 12, 1889, No. 11,215.

469,792. Electrically-Heated Smoothing-Iron. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed May 27, 1891.

469,796. Galvanic Electric Plaster. John W. Shults, Wichita, Kan. Filed May 16, 1891.

469,797. Galvanic Electric Plaster. John W. Shults, Wichita, Kan. Filed June 29, 1891.

469,800. Electric Meter. James J. Wood, Fort Wayne, Ind. Filed Oct. 27, 1891.

In an electric meter, the combination, with an electromotor driven by the current to be measured, of a magnetic retarder therefor consisting of a conducting-cylinder revolving in inductive proximity to magnetic poles approaching it exteriorly.

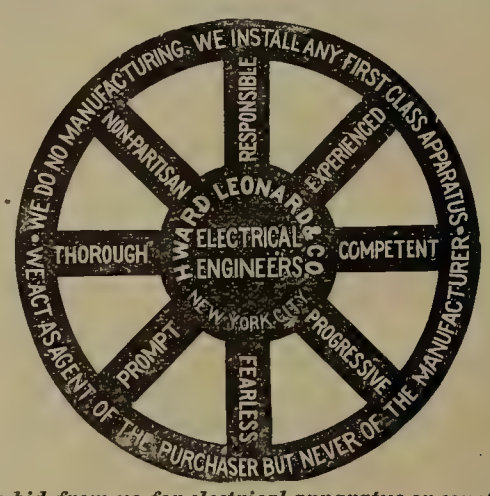
BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48-inch double belts and six 25-inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., Street Railway Company, two 24-inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway, of Wheeling, W. Va.

EMPIRE STATE EXPRESS.

The Christmas number of *Harper's Weekly* contains a full-page cut of the "Empire State Express" of the New York Central & Hudson River Railroad. This is the fastest train in the world. The cut was made from a photograph taken by A. P. Yates, of Syracuse, while the train was running sixty miles an hour. It shows distinctly the locomotive, No. 862, and four coaches. It is a perfect picture of the train. Some idea of how rapidly a photographer's camera works may be gained from the fact that a train running at the rate of sixty miles an hour moves eighty feet in a second, and the shutter of the camera has to be opened and closed in the eightieth part of a second, in order that the picture be not blurred on the plate. That is quick work; but photography has reached that degree of perfection that it can be done. "The Empire State Express" leaves New York daily at 9 A.M., and makes the run from New York to Buffalo, 440 miles, in 504 minutes, the actual running time being 52⅓ miles an hour. It is a pleasure to ride in such a train.

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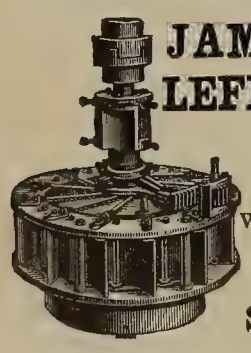
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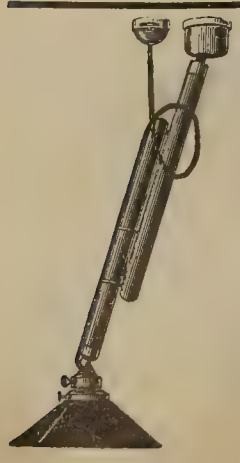
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THE CONSOLIDATION SEALED.

The trade and the public in general will await with interest further developments in the Edison-Thomson-Houston combination. The actual consolidation has been effected, as announced by the committee having the arrangements in charge, and the next step will be the announcement of the new company's future plan of operations. The adjustment of the two interests will necessarily involve considerable changing about of the officials, and we trust all will be satisfied with the result.

RACING BY ELECTRIC LIGHT.

An attempt is to be made in St. Louis to conduct horse-racing at night by the aid of electric light. It is believed that sufficient illumination can thus be obtained to enable the judges to distinguish colors and jockeys.

All there can be claimed for such an enterprise is novelty. It is doubtful, indeed, if patrons of horse-racing will appreciate the innovation sufficiently to make it pay the investors.

IMPROVEMENTS IN TELEGRAPH APPARATUS.

Those of our readers who are concerned in telegraphic matters will find considerable interest in the article by Mr. J. H. Bunnell, which will be found on another page.

In telegraphic apparatus, as well as in all other pieces of mechanism, the multiplication of parts is objectionable for the reason that it impairs the reliability of the apparatus. In the operation of most telegraph "repeaters," extra local batteries are required, and these are liable to run down and otherwise give trouble at the wrong moment. The Milliken repeater is an excellent combination of instruments, but requires extra local batteries for its operation. This fact, however, does not detract the least bit from the value of the instrument, as it gives very satisfactory results so long as the batteries are taken care of, but if we can do away with the extra locals altogether we simply remove one of the weak parts of the system, and render the apparatus more reliable.

By an ingenious method of making the wire connections Mr. Bunnell does this very thing, without at all impairing the efficiency of the repeater. A diagram accompanies the article, showing how this is accomplished.

SNOW AND ELECTRIC RAILROADS.

Many persons think that a snow-storm is a serious drawback to the operation of an electric railroad. They argue that the snow gets packed on the track and prevents the necessary and all-important contact between the wheels and the rails, thus breaking the continuity of the electric circuit and preventing the generation of the motive-power. This is all true, assuming that the snow is allowed to remain on the tracks, but all well-regulated roads do not give snow much of a chance to lie on the rails long. A snow-plough soon comes along and cleans the rails, and the result is that the electric cars run under circumstances that would ordinarily cause much trouble, if not an entire suspension of traffic, on horse-car lines.

We publish on another page an interesting article touching the experience with snow on the electric road in Ottawa, Canada. They do not appear to mind a heavy snow-fall there; everything goes along as usual after the snow-plough has passed over the line, and they dispose of the snow in a manner that is worthy of imitation in the cities on this side of the border.

GAS FOR THE EXECUTION OF CRIMINALS.

Gas—illuminating gas—has been suggested as an effective agent for the execution of criminals, as a substitute for the electric method. The plan put forward is to enclose the criminal in a properly constructed case, turn on the gas and let him die a gaseous death. This method should become popular; indeed, it is already popular, as many unfortunate beings take this course to end their earthly existence.

From all that can be learned, death by the inhalation of gas is a painless one, and our reformers in the legislature, who are trying to find out which is the most humane method of depriving a human being of life, should consider this fact.

No one ever heard of a person committing suicide by taking an electric shock, but suicides by gas are very common. The use of gas as a means of execution would, therefore, have a considerable portion of public sentiment back of it.

Another argument in favor of gas is its cheapness as compared with electricity. We do not know just how many feet of gas is required to take a life away from this mundane sphere, but at $1.50 a thousand or thereabouts it would be nothing compared with the cost of getting the machinery of an electrical plant into operation. The latter requires the services of a trained force, while to operate the former method the power and intelligence of a child are sufficient.

ELECTRICITY AS THE CAUSE OF FIRES.

Regarding the report of fires and injuries caused by electric currents during the year 1890, read at the recent convention in Buffalo of the National Electric Light Association, *The Chronicle*, an insurance journal of this city, states that Mr. Foote's figures show that the proportion of fires caused by electricity is larger than was suspected. It states, furthermore, that all experienced fire underwriters believe electric fires are increasing in frequency.

The truth of the assertion that such fires are increasing in number will be doubted by many who are in a position to know the real facts. No one denies that fires do result from improper wiring and inferior workmanship, but with improved appliances and the employment of more intelligent workmen such casualties are being steadily reduced in number. It is not good logic to assert that an effect can increase while the cause is being constantly decreased, yet this is practically what the "experienced fire underwriters" say when they claim that electric fires are increasing in frequency. "As a cause of fire," *The Chronicle* continues, "electricity will bear watching—in fact it should receive the closest attention." Quite correct; but no electrician claims that an electric-light plant, entire, or in any of its parts, is intended to be operated without care and watchfulness. When, however, such a plant is properly installed there is no more danger from fire than there is in the use of any other illuminant. If we use an inferior grade of oil we may expect our lamps to explode, and if our gas-pipes leak our houses may be blown to pieces. So it is with electric lighting; if the work is not done properly, and we do not use the best materials and appliances available, we must naturally expect trouble sometimes.

If a mouse gets hold of a match and a fire results, and the mouse is not caught in the act, the fire will, in nine cases out of ten, be charged by the underwriters to electricity, and so long as electricity is required to shoulder such responsibilities, just so long will the alleged high percentage of electric fires be maintained.

ELECTRIC PROPULSION FOR BOATS.

Mr. Gustave Trouvé had very often been forcibly impressed by the manifestly vast difference between the speed of locomotives and ships, so much so that he was led to experiment on the subject of maritime navigation, the result of which he has made known in the presentation of a paper at a recent session of the French Academy of Sciences.

Although the engines of a ship are infinitely more powerful than a locomotive, the speed attained by the former is less than half that acquired by the latter. Mr. Trouvé has attributed the cause for this

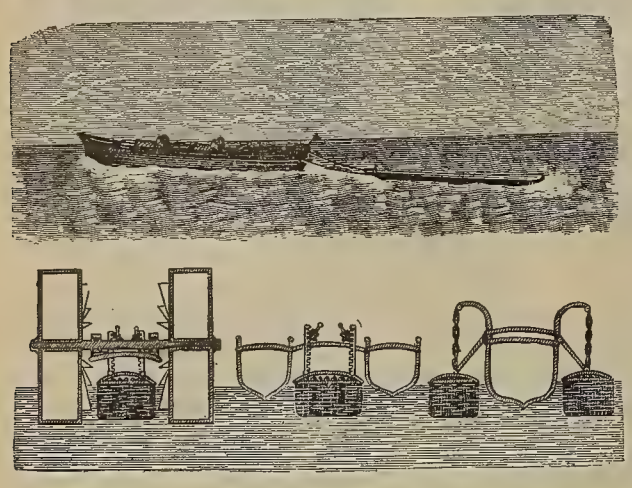


FIG. 1.

inferiority in speed to the great resistance offered by the water, and in his experiments he endeavored to diminish the resistance by transforming the submerged floating portion, with the result that in 1885 he designed the apparatus, a front and back view of which is shown in Fig. 1.

A light boat is carried by a sort of tricycle, whose large wheels have a submerged volume sufficient to maintain, of themselves alone, the entire system upon the surface of the water. These wheels are hollow, and the circumference alone enters the water. The two large forward wheels are set in motion through the intermedium of an electric motor placed upon the boat. The third wheel is movable at the stern and serves as a rudder. All three are provided with paddles, after the fashion of mill-wheels.

A short time afterward Mr. Trouvé renewed his experiments upon a larger scale, with a sea-water battery, and his new experiments showed him that the water of the ocean furnished a much higher potential than did the artificial saline solution, the electromotive force of a single element sensibly reaching one volt.

In the application of this system on a large scale, a battery float is placed astern of the vessel (Fig. 2), and the elements, united in a battery, being submerged, the current is led to the motor on the vessel through the aid of two cables containing the conductors. At least five or six volts are thus obtained without any trouble. The floating battery possesses a great advantage over steam, in that it can be immediately exchanged in a port of supplies. Floating batteries already prepared may await the ships in a dry place. Mr. Trouvé remarks that the energy discharged can but increase with the speed, since the hydrogen of the electrolyte is driven away by the current of water that is created between the elements, and induced currents have hardly the time to form. There is, then, in short, no polarization, and this redoubling of energy is comparable to that which we observe in a battery when the liquid is agitated.

Mr. Trouvé asserts, in conclusion, that his new system of maritime navigation with sea-water battery is based upon solid data verified by the experiments that he has made, in company with Mr. De Nabat, on a boat 8 meters in length running at a speed of 8 kilometers per hour. He employs the geometrically perfect screw constructed after a new process that he presented to the Academy of Sciences on the 12th of July, 1886.

HORSE-RACING AT NIGHT.

It is said that a novel experiment in connection with horse-racing is to be made in St. Louis, Mo., by the management of the South Side Park. The idea is to have racing at night, and for this purpose it is proposed to have the track lit up by numerous electric lights, through the agency of which it is believed sufficient illumination can be obtained to enable the judges to distinguish the colors and numbers of the jockeys.

SNOW-FIGHTING IN OTTAWA.

The question of successfully operating electric roads during heavy snow-storms is one which is of great importance to every one interested in the subject of electric traction, and especially to the managers of existing electric roads in locations where a rapid fall of snow is likely to take place many times during the winter season. The following description of the vigorous method pursued by the Ottawa Electric Railway Co. in keeping the streets of Ottawa which are occupied by their tracks free from snow will show what has been done during the present winter in a city where the average fall of snow is probably as great, if not greater, than any other city operating electric roads.

The road, which consists of 8 miles of double and 4 miles of single track, was constructed in seven weeks, and cars were put into service in the latter part of June of last year. The excellence of this service in all kinds of weather has been the subject of much favorable comment from press and public. The climatic difficulties made the question of running in winter a subject of much discussion, but the vigorous manner in which the snow was handled led the citizens generally to believe that the cars would run. So far this winter, the cars have not lost a trip, and their warmth and comfort, combined with their smooth running, have made the service a luxury, one of the most satisfactory features being the excellent condition of the streets which the railway follows, sleighing being better than upon the other streets of the city. This good record in the face of frequent and long-continued snow-storms has been most carefully watched by other Canadian cities in this latitude, which in winter are visited by more snow than any other part of America. The rails used are 52-lb. Johnson girder and 40 and 56 lb. Tee. The gauge is standard, 4 ft. 8½ in. The car-bodies are of the ordinary and vestibuled type and were manufactured by Paterson & Corbin, St. Catharine's, Ont. Brill trucks are used. The electric system employed is that of the Westinghouse Electric and Manufacturing Co.'s Single-Reduction motors, with two of 20 H. P. to each car. The plant consists of sixteen cars. The dynamo-room is located at the famous Chaudiere Falls, where two turbine water-wheels drive two 100 H. P. Westinghouse compound dynamos, and a third machine is kept in reserve. The difficulty in supplying steady current by water-wheels was at first a matter of serious difficulty as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water-wheels were liable to race. By an ingenious mechanical device the water-wheel gates are now raised and lowered instantly, and by the introduction of a novel electric device sufficient load is kept on the dynamos at all times to keep down the speed of the water-wheels. This device consists of several coils of iron-wire, which are connected in shunt to the trolley-circuit and are so arranged that any current from 12 to 72 ampères may be made to flow through them. The wire is kept cool by being immersed in water which is changed as it becomes warm. This useful device was designed by Mr. T. Ahearn, of the firm of Ahearn & Soper, the builders of the road and its principal owners.

The arrangements and facilities of the Ottawa Electric Railway Co. for battling with and removing the heavy snow-falls are of the most complete character. The snow is swept off the tracks by a Lewis & Fowler Electric Sweeper, and two "Walkaway" snow-ploughs drawn by horses follow the

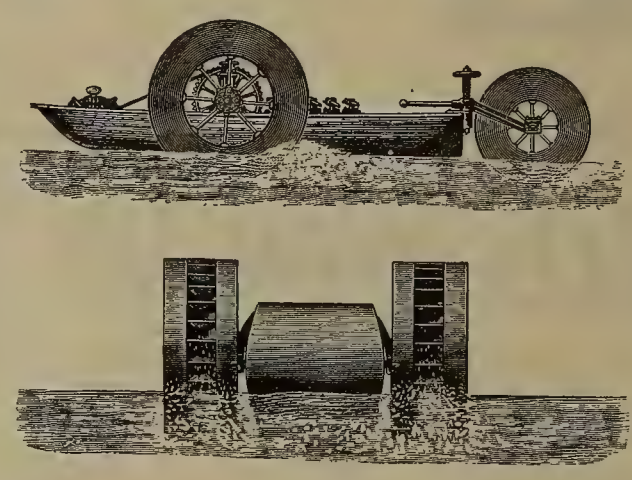


FIG. 2.

sweeper and remove the snow bodily to the curb; a third "Walkaway" shoves the snow between double tracks on to the unswept track, which is immediately gone over by the Electric Sweeper and in turn is followed by the "Walkaways." In this manner snow-falls of nine to twelve inches have been handled in half a night throughout the whole length of the line. The snow is then shovelled into large boxes mounted on double runners and drawn away. A second Lewis & Fowler Sweeper will be in harness in a few days. Preparations for winter were commenced as early as August; all the ordinary platform cars were in turn neatly (temporarily) vestibuled to make them comfortable for the motormen. Heavy duck canvas is fixed all around the trucks and almost reaches the rails. This prevents snow from reaching the motors and contributes to the comfort of the car. Special track-sweepers and brooms are used on each car. The whole outfit is so very complete that a more efficient service does not probably exist anywhere in America, and the



SNOW PLOUGH IN OTTAWA, CAN.

successful and profitable operation of a winter electric railway service has been so convincingly demonstrated that the influence upon other Canadian cities will no doubt be immediately felt. Much of the success of the road, especially under the severe conditions of the present winter, is due to the efforts of the Superintendent, Mr. J. E. Hutcheson, who, as an employé of the Canadian Pacific Ry., acquired an experience in snow-fighting which has been made use of on this road. The excellent construction of the Westinghouse motors has contributed to no small extent to the regularity and success of the service.

The officers of the Electric Railway are J. W. McRae, President; G. P. Brophy, Vice-President, J. D. Fraser, Secretary-Treasurer.

SAWYER-MAN ENGINE-ROOM.*

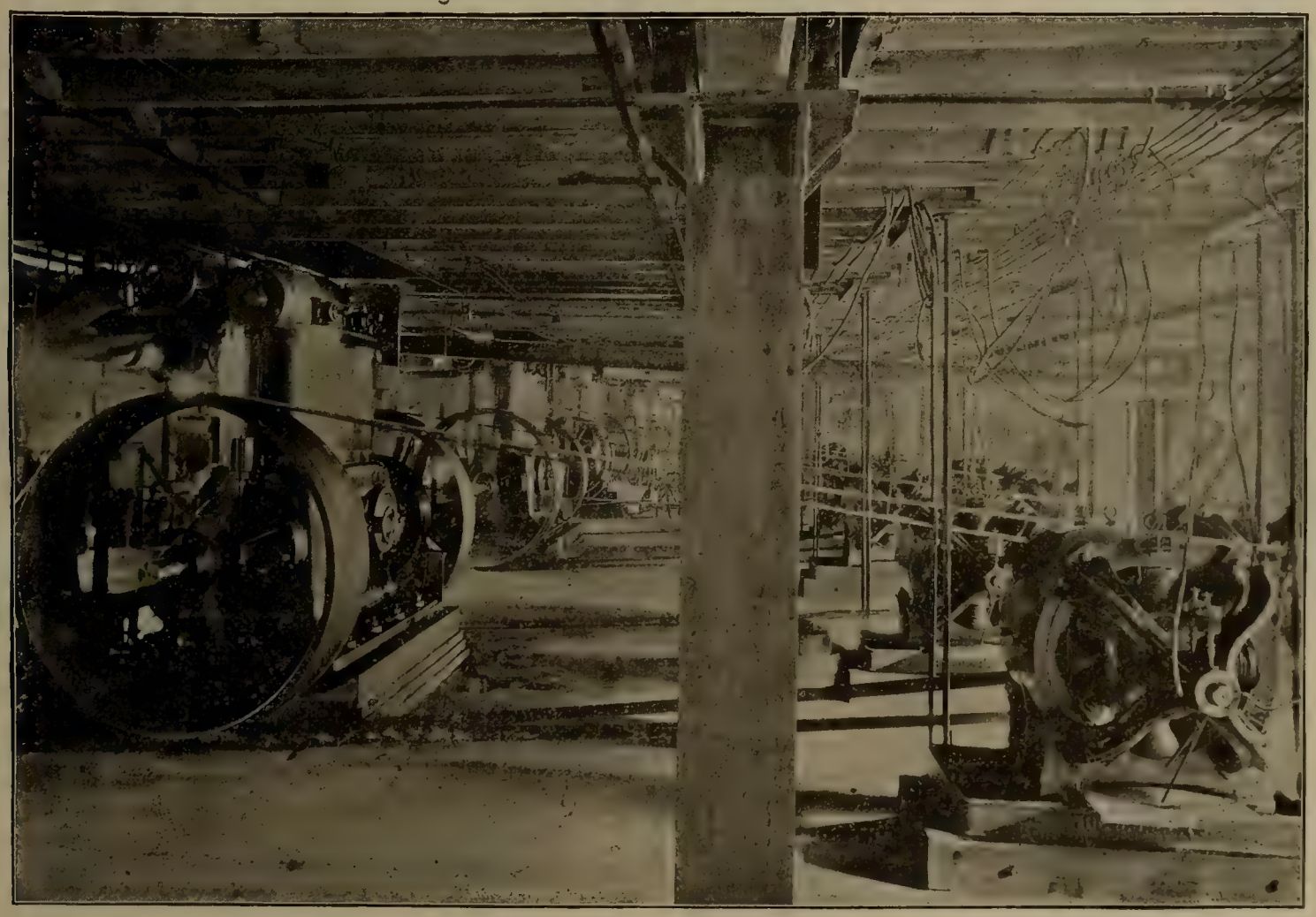
The Sawyer-Man Electric Company, New York, has a producing capacity of 10,000 incandescent lamps per day. As one-tenth of a horse-power is required to test and standardize each lamp, it can be readily understood that the power necessary to operate such a plant for its electric purposes alone must be enormous. Our illustration presents an interior view of that company's remodelled engine-room, with the engines ranged in a single row down one side of the room, and belted direct across to the generators. There are ten engines, as follows:

1 $5\frac{1}{2}''$ x $5''$ Westinghouse Standard Automatic, 1 $7\frac{1}{2}''$ x $7''$ Westinghouse Standard Automatic, 1 $10''$ and $18''$ x $10''$ Westinghouse Compound Automatic, 1 $13''$ and $22''$ x $13''$ Westinghouse Compound Automatic, 6 $14''$ and $24''$ x $14''$ Westinghouse Compound Automatic, aggregating 1,125 H. P. With the exception of the $13''$ and $22''$ x $13''$, which drives the machine-shop together with 20 geared or belted vacuum pumps, these engines are used to drive the dynamos alone, as follows: 2 Westinghouse Alternating Current, each delivering 35 ampères at 1,000 volts; 9 United States Alternating Current, each delivering 300 ampères at 110 volts; 1 Westinghouse Direct Current, delivering 1,000 ampères at 80 volts; 6 Westinghouse Direct Current, each delivering 300 ampères at 110 volts; 1 United States Direct Current, delivering 110 ampères at 110 volts; 3 United States Direct Current, each delivering 300 ampères at 110 volts; 7 Thomson-Houston Direct Current, each delivering 300 ampères at 750 volts.

In the case of the $14''$ and $24''$ x $14''$ engines, these dynamos are driven in groups of four by overlapping belts, two from each side of the engine.

Westinghouse Compounds have been recently substituted for Single-Expansion Engines, thereby reducing the daily coal consumption from 18 to $9\frac{1}{2}$ tons, and it might be here said that a difference in engine-water rates is not a perfect measure of the change in fuel consumption. In point of fact it is only an index of the direction of the change which is ordinarily much greater than the indication. While in the present instance there was probably not more than 30 % saved by the gain in water rate, the commercial result was nearly 50 % gain owing to decreased leakage and condensation with fewer boilers in operation.

* The Westinghouse Machine Co., Pittsburg, Pa.



ENGINE-ROOM SAWYER-MAN ELECTRIC CO., NEW YORK.

WORLD'S CONGRESS AUXILIARY.

In our issue of March 5 a communication from Prof. Carhart, Secretary of the World's Electrical Congress Committee, was published, to the effect that the section of the Engineering Congress relating to electrical engineering had been merged into the World's Electrical Congress. Many of our readers possibly have a vague idea of this congress and its plans, and some probably, as yet, know nothing at all about it. The following facts, therefore, will be of interest to those who are in quest of such information.

The World's Congress Auxiliary is an adjunct of the World's Columbian Exposition, maintained by the latter for the purpose of promoting a series of World's Congresses in 1893. The Congress Auxiliary gets its authority from the United States Government through the exposition authorities. The latter will contribute $200,000 towards the building, which is to be erected on the lake front, which, after the Fair, is to be a permanent Art Institute; but during the Fair it is to be devoted entirely to this World's Congress Auxiliary, which is to hold a series of congresses, beginning with the opening and closing with the close of the Exposition. The building will be subdivided into rooms, the use of which will be free of cost to all the congresses. According to the scheme as laid out, it is seen that there are 12 or 13 different departments of the Auxiliary. Some of those departments are subdivided into separate congresses.

The idea of the Auxiliary is that the entire world may participate in the congresses.

The Electrical Congress, as in the case of all others, will be international in character, and all local features will be for the time being unrecognized. Any individuals belonging to any of the electrical societies may attend the meetings as members of the World's Congress, and not as members of the American Institute of Electrical Engineers, National Electric Light Association or any other association. It is, however, manifest that every individual interested and every society conducted in the interest of electrical science in all its departments, should co-operate to make the Electrical Congress a success. It is proposed to hold meetings where all of the different sections will be represented, such as Electric-Light Sections, Railroad Sections, Telegraphy and Telephonic Sections and the Sections on the Theory of Units and Standards, etc., and hear papers that will be prepared a year in advance by speakers selected from the very best men in the world, on some original topic relating to the science in some of its features.

The World's Congress Auxiliary is constituted as follows:

First. A central organization authorized by the Directors of the World's Columbian Exposition, and recognized by the Government of the United States as the proper agency to conduct a series of World's Congresses in connection with the Exposition.

Second. A local managing committee for each congress. This committee constitutes the means of communication and action between the Auxiliary and persons and organizations desiring to participate in a given congress. Each committee must necessarily consist of a comparatively large number of persons, who are resident in or near the place where the congress is to be held.

Third. But a World's Congress obviously requires the co-operation of the world. Each committee, therefore, has adjoined to it, and constituting its non-resident but active branch, an Advisory Council, composed of persons eminent in the work involved, and selected from many parts of the world. The members of such councils will co-operate with the proper committees by individual correspondents.

Fourth. General, honorary and corresponding members are also appointed, and they are invited to give their advice and co-operation in relation to the whole series of the proposed congresses.

Fifth. Committees of co-operation appointed by particular organizations are recognized by the Auxiliary as representatives of their respective societies or institutions.

Sixth. The chairmen of the general committees constitute the President's Advisory Council.

That is the general outline of the organization upon the lines upon which we are to proceed. The congress is to begin with a joint meeting and appropriate address, and in view of the wide scope of engineering specialties, it is to be divided into seven general divisions as follows:

A—Civil Engineering.
B—Mechanical Engineering.
C—Mining Engineering.
D—Metallurgical Engineering.
E—Electrical Engineering.
F—Military Engineering.
G—Marine and Naval Engineering.

These divisions may be divided into as many chapters or sections as may be found desirable.

The following is a list of the subjects to be considered in the Electrical Engineering Division:

Telegraphy.—Systems: duplex, quadruplex, multiplex, etc. Rapid telegraphy. Cable telegraphy and instruments. Batteries and telegraph dynamos. Circuits. Induction telegraphy.

Telephones.—Systems, transmitters, switch boards. Automatic apparatus. Magneto bells. Long distance telephony. Induction and retardation.

Lamps.—Arc lamps and carbons. incandescent lamps and filaments. Manufacture and durability. Sockets.

Wires.—Overhead systems, underground systems, cables. Insulation.

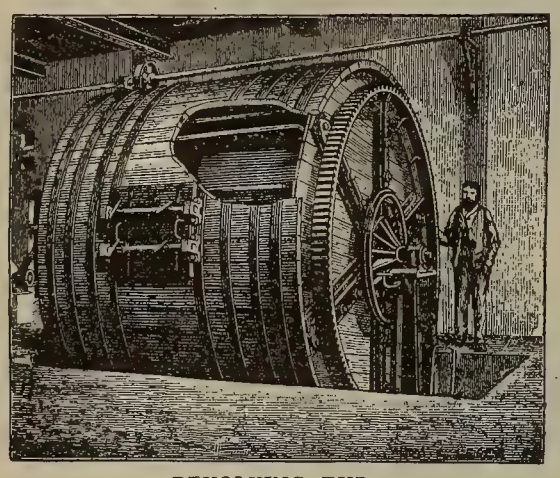
Distribution.—High tension, direct; low tension, direct; alternating. Simple circuits, compound circuits. Series and parallel systems.

Batteries.—Primary and secondary.
Generating Machinery.—Dynamos, alternating and direct. High and low tensions. Armature and field windings. Methods of regulation. Commutators. Mechanical details.
Motors.—Direct and alternating current motors. Armature windings. Regulating devices. Commutators and mechanical details.
Appliances.—For measuring and controlling currents of electricity. Switches, rheostats, meters, safety appliances.
Transformers.—Methods of winding, loss in conversion, heating, designs.
Mining and Metallurgy.—Boring, drilling and firing, pumping. Reduction of ore.
Welding.—Welding, brazing, soldering, tempering and forging.
Transmission of Power.—Short distances, long distances.
Signals.—Bells, annunciators, automatic calls, individual calls, etc.
Railways.—Single and double wire systems, rail transmission systems, geared and gearless motors, generators. Trolley and underground systems. Storage-battery systems.
Electro-plating.—Currents, solutions, time, etc.
Heating.—Resistance devices. Thermostats.
Execution.—Apparatus for destruction of life.
Photography.—Electrical devices for same.

The above classification is not final. Suggestions are invited in relation thereto, and in regard to all other matters connected with the congress, to be used in the formation of the final plans.

TANNING BY ELECTRICITY.

The active principle of tanning is the absorption of tannin by the hide, and in tanning by electricity this is accomplished by passing a current through hides immersed in a tanniferous solution made from



REVOLVING TUB.

extracts of oak, chestnut, hemlock, etc. The electrical current draws the tanning liquid from one electrode to the other, and during its passage through the hide the tannin is absorbed by the cells, and which, combined with the hide, prevents putrefaction and constitutes leather.

The phenomena designated by Hittorf as the carrying of the ions in electrolysis enables us to make this hypothesis: The ions are displaced in the electrolyte, at different speeds, and give birth to mechanical phenomena. By this mechanical phenomena, and the resulting increase of pressure of the liquid at the surface of the hide, the pores are forced open, and the diffusion of the liquid being made under pressure, the result is attained quicker than by any other process.

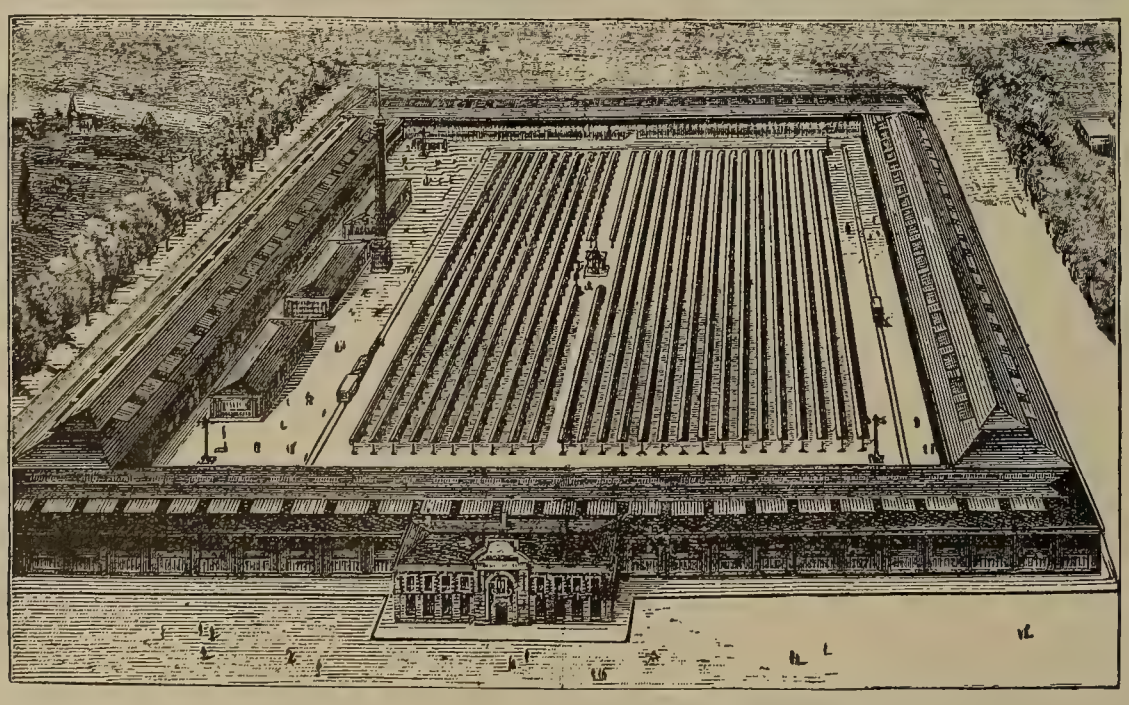
A great length of time is consumed in tanning by the ordinary method, as the tannin juice works very slowly; and the application of electricity is to hasten the diffusion. It is now possible to tan hides in four days where formerly it occupied from ten to twelve months.

In the process of tanning by electricity a cylindrical tub made of wood, which turns around a horizontal axis, is used. While revolving, the hides strike against the walls of the tub and are prevented from sticking by pegs in the walls. The electric current is transmitted through the two extremities of the rotating axles where the connections are made by brushes from the collectors. The electrodes are composed of eight large copper wires, which enter the tub and are laid symmetrically upon the inner circle at the base of the cylinder throughout its entire length to the opposite base, which also carries a like number of wires. The interior lateral surface of the tub is carpeted with sixteen alternate positive and negative wires, and the two bases have thus eight wires proceeding from the centre. The electric current is thus enabled to flow in every portion of the interior of the tub filled with hides and fluid.

Ten ampères and seventy volts represent the working current employed, and the time occupied in tanning varies from twenty-four to one hundred hours, according to the hides. The current is reversed every twelve hours by a switch, to regulate the wear of the electrodes, the positive wires wearing faster than the others.

Particular attention must be paid to the temperature of the apparatus, if it gets too warm to let it cool.

Our illustrations show an electric tannery at Bona Vista, near Rio de Janeiro, Brazil; a revolving tub for electric tanning, and a tanning workshop. We are indebted to the *Shoe and Leather Review* for our cuts and facts.



ELECTRIC TANNERY, BONA VISTA, BRAZIL.

TRANSMISSION OF POWER.

One of the features of the Buffalo Convention of the National Electric Light Association, last month, was the paper read by Carl Hering on the subject of Transmission of Power, and its subsequent discussion. This was one of the most important and interesting papers read during the Convention, and the remarks of Prof. Elihu Thomson which followed were full of valuable information and suggestions.

Referring to Mr. Hering's paper, Prof. Thomson said:

"In the beginning of the paper he referred to various modes of transmission, and justly selected electrical transmission as the coming means of the transmission of power. We have in the case of the cable railway an example of wire-rope transmission, and we all know—all those who have taken any pains to look into the matter at all—that there are very great losses in such a transmission unless it is confined within narrow limits. It is a common saying that very much the larger portion of the power in a cable system is used in pulling the cable around, and that the addition of the loaded cars to the cable makes only a moderate addition to the power required to move the cable. This is certainly true if we have a system in which there are a number of curves—the cable has to turn corners—and I have no doubt the figures given by Mr. Hering relate to cases of cable transmission in which the transmission is practically straight, where there is an open country as it were, and the rope transmission can be carried across. If a good many curves or bends are to be made in the system of course the efficiency runs down very rapidly. But in reality with electrical transmission we may bend our wire as much as we please; we may turn as many corners as we please, and it simply adds a little to the length of the line, which can be made up by adding to the copper used a slight amount.

"He has spoken also of the compressed-air system, which is used in Paris. I believe the system was originally introduced there for the operation of clocks and finally extended to the working of compressed-air engines. In that system it was found that the engine did not work efficiently unless the air was put through a heater, the reason being that when the air is compressed at the station it loses during compression a large amount of energy, which is converted into heat, and it has to be thrown away by cooling arrangements, cooling the compressing pumps. It then passes along the distributing points at low temperature—at the ordinary temperature. The moment it reaches the engine and begins to be expanded in the engine, it demands to resume its normal condition, that the heat which is lost during compression be put back into it, and of course if it does not get that heat it simply chills, cools, and comes away from the engine very cold. The bad effect of this cooling of the air is that it not only shrinks the air in volume and therefore relieves the pressure on the piston, on which you rely for the development of power, but it hurts the mechanical working of the engine; so that the practice in Paris is to put up a little stove and pass the water through a coil of pipe in this stove before it reaches the engine, and in that way they get a very fair efficiency out of the compressed-air system. But it is by the addition of this extraneous heat and the consumption of fuel. It is true that the heat which is added to the compressed air as it enters the engine is very efficiently used. It is almost all converted into mechanical power. In fact, if we had a supply of compressed fluid at our disposal at very high pressure, and then were to heat that and allow it to expand down to ordinary temperatures, we would have a very efficient way of using heat and converting it into



TANNING WORK-SHOP.

mechanical power. But the pressure would have to be very high to make that a system that was useful.

It has been aptly stated in a paper read to you that the commutator difficulty is the one which stands in the way of the application of direct or continuous currents to power transmission. It is an actual fact that a commutator which is to stand indefinitely 3,000 volts is very expensive in construction. It requires very high insulation, very careful construction, and very numerous segments. It has been found impracticable to raise the electrical pressure existing between two adjoining segments on the commutator beyond a certain amount. The current is apt to leap the gap between the segments and form short circuits. Therefore for high voltages we need to divide the commutator up into very fine divisions. But that also involves dividing up the winding. It makes it very difficult to wind the armature and connect it to such a commutator, and the difficulties are undoubtedly great. I think the limitation would naturally be found somewhere between 2,000 and 3,000 volts for actual practical usage—that is, so far as the commutator is concerned; and if we attempt to transfer power at that one potential, reducing it, we do not get rid of the commutator at any step of the process whether we use direct or continuous currents. Now we are driven, then, as Mr. Hering says, to alternating currents; and he has shown in a paper that a very excellent example of power transmission by the alternating current is to use what is known as the three-phase system with "double conversion," as it is called. * * * The only thing against it is the addition of apparatus and the necessity of taking great care of the insulation in a transformer. This difficulty of insulation, however, in the transformers seems to be overcome by immersing the transformer in a bath of insulating oil, when we find that it takes a very high potential to puncture even a moderately thin layer of oil. We find, for example, that one-half inch of oil will stand many thousands of volts, a voltage beyond what we are likely to be called upon to use in practice, far beyond it. In other words, we can

construct our apparatus with a considerable margin of safety by allowing the oil insulation to be thick enough.

"I am greatly in favor of the three-phase system. It seems to me that it is a symmetrical system, one allowing you to do almost anything you please with it. You generate at one end of the line by the use of power obtained from, it may be, steam; from coal burnt at the mines, or from coal slack, which is a waste product oftentimes of the mines. You generate your power very cheaply. You transmit those currents to the line; or if you have a water-power you do not generate the steam, but you use the water-power to drive this dynamo. You are ready then to make the transmission. The only question in my mind is as to whether you should take your lines overground or underground. It is certain that if you went underground you would not require to paint on every pole a skull and cross-bones. Currents of voltage, up to 20,000 volts are, of course, certain death if a person come in contact with them. We are approaching the condition of lightning—continuous lightning—that is, not simply a stroke, but a continued stroke, a great number of strokes following each other in rapid succession; and it does seem to me that, all things considered, perhaps it would be a little more costly to begin with, but for moderate distances should not be prohibited cost to put the lines in pipes filled with oil, and use, in other words, the same insulation which is used on the transformers throughout the line. Beginning with a transformer in oil, you carry a high-potential conductor in a pipe filled with oil to the further end. In other words, put the whole high-tension part of it in oil—insulate the whole thing in oil—and bury the pipe. In that case, of course, unless somebody digs it up and interferes with it or gets into the iron pipe which encloses the three conductors you are practically free from any leakages due to wet insulators or interference due to lightning. A thunder-storm may come up, and the three lines on the poles are innocent enough, until a stroke of lightning falls somewhere near, when you have damages to your transformers or to your machines. This can be said, however, in favor of a high-potential system that the liability of damage by lightning is less the higher your potential. In other words, the nearer you approach lightning in the operation of your plant the less liability there will be that lightning will interfere with the operation of such a plant. It is constructed to stand a moderate phase of lightning, and it would take a considerable addition to break it down. At the same time, the oil insulation regulates itself the moment it is punctured. Such a line might in a measure be struck by lightning and might be deranged for a moment, but the oil passing in between, that would be the end of the difficulty. It is very different where the apparatus is not constructed to stand more than 3,000 or 4,000 volts instead of 20,000 or 30,000. There if lightning comes on to the line and you are not provided with all safeguards—and, in fact, if you are provided with them all, if a direct stroke of lightning falls on the line the question is whether damage is not going to result. There are some other points about the three-phase system that I would like to bring out and emphasize. It seems to me that we can do a great many things with it. For example, we can get alternating currents at the receiving end for the running of lights direct from the mains—that is, by conversion down at any voltage. We can, therefore, run any kind of apparatus which operates with single-phase alternating currents or with multiphase alternating currents. We have at our disposal, as Mr. Hering has shown, motors which can be run, and efficiently run, by the means of three-phase currents directly fed to them without excitation field. That is, motors which do not synchronize, motors which do not run at proper speed quite under load, but nearly the proper speed, very nearly—they run fairly well, and they are adapted to distribution here and there. But we can also run a machine from the same system of mains which we use, a reserve alternating dynamo, perfectly synchronized—that is, if the generating plant runs at 120 or 150 turns, the motor plant at the other end of the line may run at a definite speed depending upon the generator speed, at the same speed or some definite relation, and stay at that speed during operation, not vary a particle, be perfectly synchronous. Now in case, for example, we wish to lump our power in the receiving station and run at absolutely steady speed, we might use the reserve dynamo—reserve three-phase dynamo—as a motor, and get synchronizing speed. We can distribute by the other form, non-synchronized form of motor, without any field excitation at all, and we may run lines. But suppose we desire to get continuous currents from three-phase currents; suppose, in other words, we have an existing plant which is based upon the use of continuous currents. There may be street cars that are already equipped; there may be mains laid in the streets which are adapted to use just certain pressures, and there may be motors running from those mains which are only adapted to use continuous currents. Then we have resort to another kind of a machine, a machine which takes continuous three-phase currents and delivers from the other side continuous currents, which has no commutator on this end but simply three wires, and on the other end a low-potential commutator, a commutator which gives you no difficulty in running 110 volts, 220 volts, 500 volts. We may then convert directly from the three-phase currents into a continuous current and supply the existing mains which are to be found. And we may do that efficiently. We can have from the same system a motor generator, it would be called, which is supplying 220, 110, 500 volts—separate machines. Or we could even put them in the same machine; and, furthermore, we can make such a machine so that it will compound itself. In case, for example, the machine is running with very little load, its potential will be, say, 220 volts. In case the load is thrown on naturally there will be a fall of potential in the whole transmission from one end to the other; there will be a fall of transmission all the way through, and a fall of potential even in the mains which are found in the streets. That fall of potential can be made up by the construction of that machine. In other words we can compound this motor generator by simply turning the accessary field which Mr. Hering showed in the slide, and exciting that, making that field by the secondary currents. That will raise the potential, and the system then becomes a completely compounded one.

"Now, in closing my remarks I will simply state that you can imagine what such a system would do for New York City. We have separate plants, stations, in the city here and there using expensive ground, expensive buildings. Supposing we go up the Hudson somewhere and establish a power plant, get our coal very cheaply delivered, get water for condensing the steam in the engines, get rid of ashes by making land somewhere, and we simply lay pipes down to the city, a distance of whatever number of miles is convenient, making the pressure what we find is proper for economy in transmission. We deliver current, three-phase it may be, to the different stations—that is, simply use motor generators feeding into the existing mains. Should we wish to run out new mains transformed down to low pressures we can do it very easily. In other words we can satisfy almost every need, even down to the plating current; we can give everybody what is required from such a system. At least that is how it strikes me.

"Now the question as to what pressure is the limit—what is the electrical pressure that would limit us in such transmissions as we are talking of—well, there really seems to be no particular limit. It would seem to me practicable, if it were necessary, to raise the pressure to 100,000 volts. It simply means that you have got to have your oil laid thick enough not to be perforated—your insulator oil thick enough not to be perforated by 100,000 volts. And in some recent experiments I have made I find that oil is excellently well adapted to stand such pressures. It is even better than solid glass. Where glass breaks down with perfect ease I find the oil stands up; and if it does break down it re-insulates itself. If there is a puncture through the oil and a spark flies, it is not necessarily the case that that is the destruction of the plant, but the oil slips in and covers up the defect."

THE EDISON GENERAL AND THOMSON-HOUSTON CONSOLIDATION.

The committee appointed to carry out the consolidation of the interests of the Edison General Electric Company and the Thomson-Houston Electric Company on February 9 issued a notice that the majority of the stockholders of the two companies having signed the agreement to consolidate, the agreement has now become operative, and is binding on all the parties thereto. All parties who have signed the agreement are required to deposit their stock without delay with the New York Guaranty and Indemnity Company, in New York, or the Old Colony Trust Company, in Boston, and receive in exchange therefor the temporary receipts of said depositaries.

Parties to the agreement and all the stockholders of either company who have not signed the same, who shall fail to deposit their stock as above, on or before the 20th day of March, 1892, shall then forfeit any right to come in under said agreement, except by the express permission of the committee, and on such terms as it may impose.

The committee is composed of the following well-known gentlemen: J. Pierpont Morgan, H. McK. Twombly, D. O. Mills, Frederick L. Ames, T. Jefferson Coolidge, H. L. Higginson.

BIOGRAPHICAL SKETCHES.

PROF. FRANCIS B. CROCKER.

The subject of our sketch was born in New York, July 4, 1861, where he has since resided. Mr. Crocker graduated at the School of Mines, Columbia College, in 1882, with the degree of E.M. Since then he has become one of the professors in his Alma Mater.

From 1882 to 1883 he was associated with Charles G. Curtis, C.E., in the firm of Curtis & Crocker, Electrical Engineers. He subsequently, with Mr. Curtis, invented an electric motor and battery, the motor now being known as the C. & C. motor (from the initial letters of their names), which brought him prominently before the public. In April, 1888, he formed, with Dr. Schuyler S. Wheeler, the firm of Crocker & Wheeler, electrical engineers, for electric-motor and electric-power work. This firm has since been incorporated under the name of the Crocker-Wheeler Electric Company, of which Mr. Crocker holds the office of vice-president. Mr.



PROF. F. B. CROCKER.

Crocker is a member of the National Electric Light Association and of the American Institute of Electrical Engineers, and his writings for the electrical press have made his name a familiar one to all interested in the subject of electric power.

Mr. Crocker is an indefatigable worker, and after the cares and responsibilities of a large and increasing business may be found in his study working out new problems and developments of an industry that has actually become a part of himself and which finds vent in voluminous contributions to the electrical press of this country and Europe. He is a gentleman of pleasing manners and appearance, and is easily recognized as a man of no ordinary importance among the many laborers in his chosen field. Active, alert and energetic, it is no wonder that he has made an indelible mark in the world.

Prof. Crocker has frequently been selected by his co-laborers in the American Institute of Electrical Engineers, of New York City, to contribute original papers before its members, and has always acquitted himself with marked distinction, and the further compliment of their reproduction by the electrical press of the world is significant of their merit.

DR. SCHUYLER S. WHEELER.

Dr. Wheeler was born and brought up in New York City, where he attended Columbia College, from which he graduated in 1881, becoming assistant electrician of the branch of the Jablochkoff Electric Light Company. When that company dissolved he joined the United States Electric Light Company, and subsequently left them to become a member of Mr. Edison's staff, taking part in the opening of the famous Pearl street station, of which he afterwards became electrician. He afterwards became superintendent of the Newburg Edison Company, resigning that position to accept the post of electrician to the Herzog Telesame Company. In 1888 he organized the firm of Crocker & Wheeler, and also about that

time accepted the appointment of Electrical Expert to the Board of Electrical Control of New York.

Dr. Wheeler is now the president of the Crocker-Wheeler Electric Company (incorporated), manufacturer of the popular Crocker-Wheeler Perfected Electric Motors. His active interest in the management of this concern has brought it to the front rank of successful electrical manufacturing enterprises.

Dr. Wheeler is a member of the National Electric Light Association, a member of the conservative American Society of Civil Engineers, a member of the council of the American Institute of Electrical Engineers, and has received the honorary degree *Scientiæ Doctris* for the work done in electricity.



DR. SCHUYLER S. WHEELER.

Dr. Wheeler is a young man of great activity both mentally and physically, and belongs to that class of men who are bound to achieve success by not only being worthy of it, but because of their untiring energy and industry.

Dr. Wheeler is a liberal contributor to the electrical periodicals of the day.

MR. FRANK B. RAE.

Mr. Frank B. Rae, the well-known electrical engineer, formerly with the Detroit Electrical Works, and the author of the Rae system of electric railway, is now conducting a business on his own account at 302 Hammond Building, Detroit, Mich.

Mr. Rae is one of the pioneers in the development of the electric motor for street-car propulsion, and the system to which his name is attached is known throughout the world for its extreme efficiency. He is an old telegrapher, and distinguished himself in that field by the publication of a book, some years ago, on the subject of telegraphic apparatus. Mr. Rae, though yet a young man, has had a vast experience in electric-railway work, and in his new enterprise he will act in the capacity of supervising and consulting engineer for electric-railway enterprises. His reputation as an authority in this line is so extensive that it is hardly necessary to refer to the fact now. Suffice it to say that promoters of new electric-railway enterprises looking for expert advice and guidance cannot find any better than that which Mr. Rae can give.

Mr. Rae also gives personal attention to the drawing up of plans and specifications for electrical plants, and makes railway work a specialty.

NEW ELECTRIC ROAD IN CANADA.

The Reliance Electric Mfg. Co., of Waterford, Ont., which is constructing electric railroads in Canada on the Rae system, has secured the contract for the equipment of the Toronto and Mimico Electric Railway. This road will start from the terminus of the Toronto City Railway Company's lines on Queen street and extend to the village of Mimico, and eventually to Long Branch, a total distance of about seven miles. The road runs along the lake shore the entire distance.

The Reliance Company has the contract for the entire equipment, exclusive of track. The power station will contain one Armington & Sims engine of the compound condensing type, 125 H. P., and the Rae station electrical apparatus, consisting of one 85 K. W. generator and necessary appliances.

The motors for this road are of Mr. Frank B. Rae's latest design of Single-Reduction Motors, which are at present built only in Canada.

THE USE OF EXTRA LOCALS IN AUTOMATIC REPEATERS.

BY J. H. BUNNELL.

Almost any of the various forms of Automatic Repeaters in which extra locals are employed would work reliably and with perfect satisfaction in every way if the Extra Local Battery were perfectly constant. But this is just where the trouble comes in, and as a matter of fact more than half of the trouble which causes any form of extra local repeater to be regarded as unreliable is owing to the extra locals. They are much of the time not in use at all, or are being run down by being on "dead closed circuit" while the repeaters are disconnected and the relay armature points open. Or, if the extra locals are arranged so as to be open when the Repeater is not in use, then when first put at work on starting a Repeater they are above normal strength for a minute or two and then down below par, and so on continually, until they get worked into a natural condition.

Hence, it appears that the battery which is to serve as extra local in a repeater should be one which is kept pretty well exercised beside being otherwise in perfect order and so capable of furnishing a perfectly steady current—an unvarying current being much more important on the extra local than on the regular locals.

It would save much trouble if the extra locals could always be switched on the repeater from the regular local work on active tables, when the repeaters are called into temporary use.

The form known as Milliken-Hicks, which is now very generally used, can be better operated without any extra local by using two good reliable regular locals only on it, and connecting, according to the following diagram, to the corresponding points and posts on the instruments as regularly made, no change whatever being required from the usual construction of the instruments.

This suggestion is made for the benefit of those who are already using Milliken-Hicks repeaters, as well as for the application to new ones, as being a much better way of working that form than with the use of extra locals.

The function of the extra locals is, by this plan, made to be performed by the regular local current *after* it has closed its own sounder with full strength of stroke. Then, when its own sounder closes, the latter gives half of its own current to the extra magnet on the opposite side of the repeater instead of the usual action of directing an extra local current into that extra magnet. In the meantime the relay of the side which is working opens both the sounder and the extra magnet at the same instant, so that nothing is lost in the timing of the movements. In fact there is an actual gain by reason of the slight but desirable lag given to the closing of the extra magnet, so that the latter gives time to close the forcibly held silent relay, before withdrawing pressure from its armature. This prevents "Kicking," especially when adjustments are "high" in bad weather, which, by the way, is usually the time when repeaters are most needed.

INDUCTION.

BY JOHN H. GLOVER.

Electric induction is the influence which a conductor or body charged with electricity exerts upon another conductor or body in its vicinity, the conductors being insulated from each other. Take, for example, two parallel circuits (Fig. 1), one charged with a current from any usual source, and the other having no connection with any source of current or with the first wire. The moment a current is established in the first wire (A) a current is induced in the second wire (B), as will be shown on the galvanometer, and when the current is broken in A

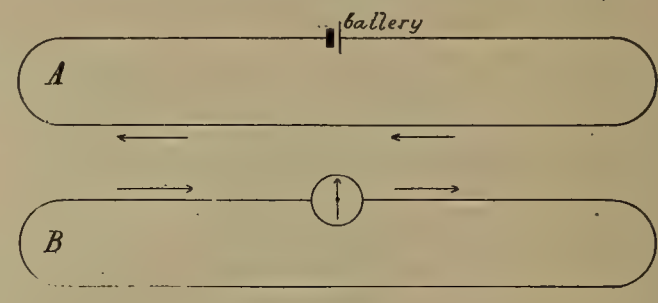


FIG. 1.

another current will be induced in B, but in a direction opposite to the first one. It is evident, therefore, that in order to induce a current in B a *change* must take place in the current flowing through the first wire A. A change in the inducing current may be effected in any of the following ways:

1. By establishing the primary current.
2. By breaking the primary current.
3. By increasing the intensity of the primary current.
4. By decreasing the intensity of the primary current.

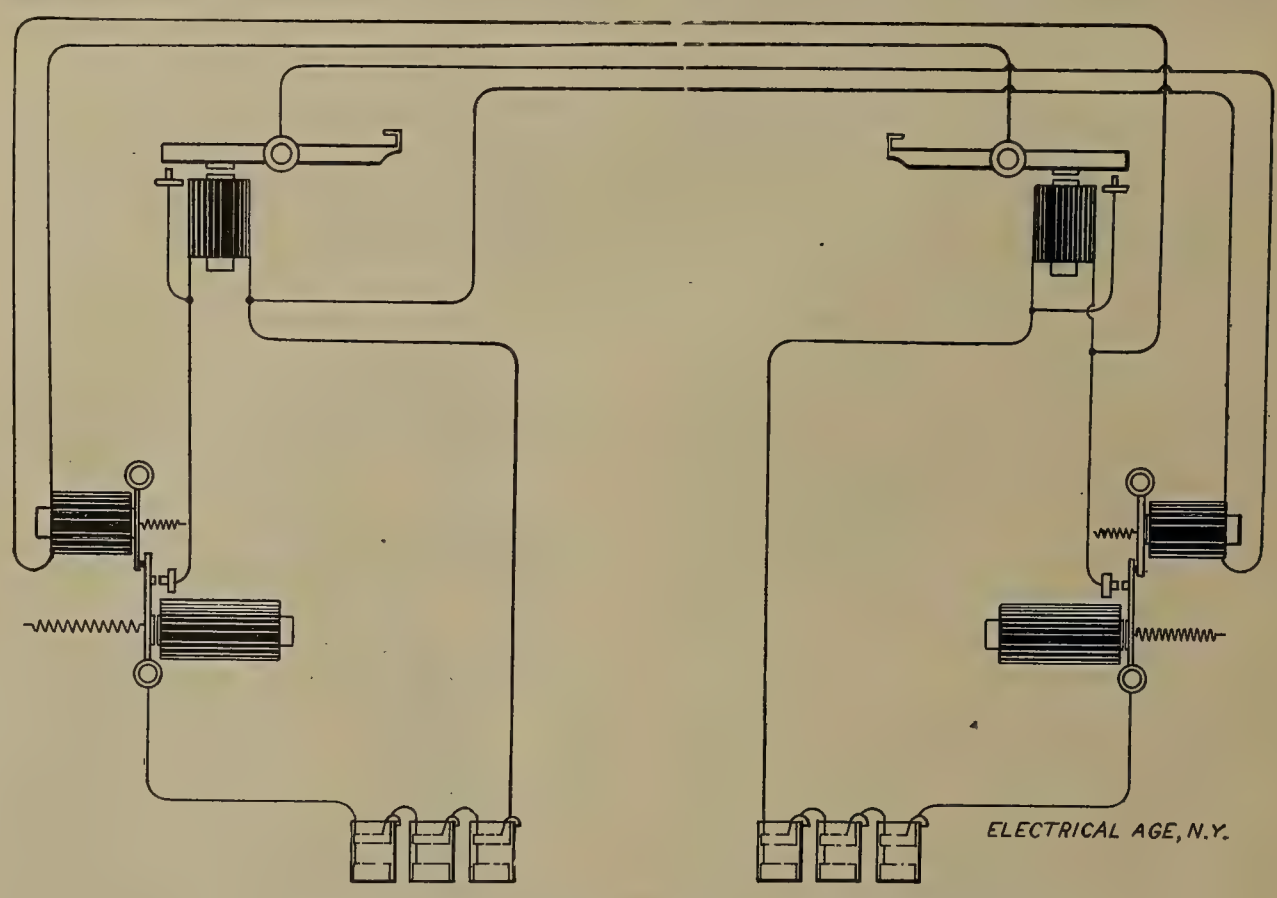
A steady current will not induce another; a rise or fall in the power of the inducing current is necessary.

There are two kinds of electric induction—static and electro-magnetic. Static induction relates to the influence of one body charged with static electricity upon another body, and electro-magnetic induction refers to the inductive action of current or dynamic electricity.

Induction takes place only through insulating bodies or media—such as india-rubber, glass, dry air, etc. Its nature is, however, not fully understood, but since there is no actual transfer of electricity through the insulating medium, it is evident that the latter in some unknown manner becomes a medium of the influence.

The circuits A and B in Fig. 1, in their relation to each other, are called "primary" and "secondary," respectively, and the current in each is designated in the same manner.

The nature of the inductive action of circuit A



IMPROVEMENT IN TELEGRAPH REPEATERS. DIAGRAM OF CONNECTIONS.

upon B may be represented by a diagram (Fig. 2). As the current always flows from the higher to the lower potential, it will, as represented in A, flow from left to right, the potential at the left being represented by 10 and that at the right by 1.

As the inductive action radiates from the charged wire equally in every direction, it is evident that very few of the lines of force generated in A are intercepted by B. For illustration we will represent these few by $-\frac{1}{10}$ at the right hand and -1 at the left, and inasmuch as the positive current in A induces a negative current in B, the positive potential in A represented by $+10$, produces under the conditions laid down a negative potential in B, which is represented by -1, while at the right hand the $+1$ produces in B $-\frac{1}{10}$. Under these conditions it is evident that the induced current, obeying

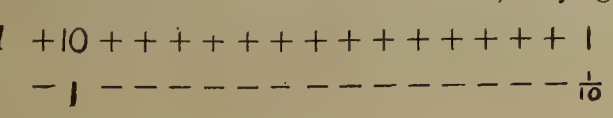


FIG. 2.

the laws of dynamic electricity, will flow from the right to the left.

This action of one circuit upon another is the underlying principle of converters used in electric lighting.

The practical converter consists of two coils of wire, the primary and secondary, both enclosed in an iron case. The wire of the primary coil is much smaller in diameter than that of the secondary, and the effect of the latter in practice is to reduce the potential of the original current. In ordinary induction coils the object is to increase the intensity of the original current, but in the converter the opposite result is desired.

The primary coil (fine wire) of a converter is connected with the wires leading to an alternating-current dynamo, and the wires of the secondary coil are attached to the lamps.

SELF-SETTING ANNUNCIATOR.*

This apparatus is new and useful, and is the invention of Mr. A. B. Lyman, General Superintendent and Manager of the company.

This annunciator differs from any other, in that the indicating needle is self-adjusting. By its peculiar construction the needle always points to the last call, and remains in that position until a call is made from another location.

While this instrument can be used in factories, offices, etc., it is especially adapted to dwellings to

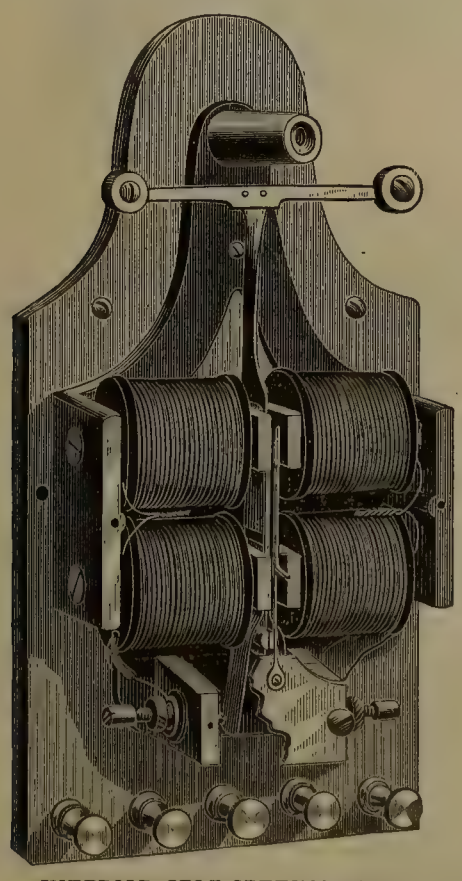


FIG. 1.—INTERIOR SELF-SETTING ANNUNCIATOR.

indicate, say front door, side door and dining-room. The bell call from the different doors is so adjusted that the sound from each call is different from all the others, so that a person in hearing from a distance can tell by the sound of the bell where the call comes from without going to the instrument. As is shown in Fig. 3, the battery on the right operates the single-stroke call, while the one on the left operates the other two calls, thus making a complete three-number annunciator for a trifling cost.

The instrument is very reliable, as it is substantially made, and there are no delicate springs or adjustments in its construction.

*American Electrical Works, Cleveland, O.

Fig. 1 of our illustrations shows the interior construction. The bell armature is provided with two hammers, and is operated by two pairs of ordinary electro-magnets, one being placed on each side of the armature, and so arranged that when the circuit

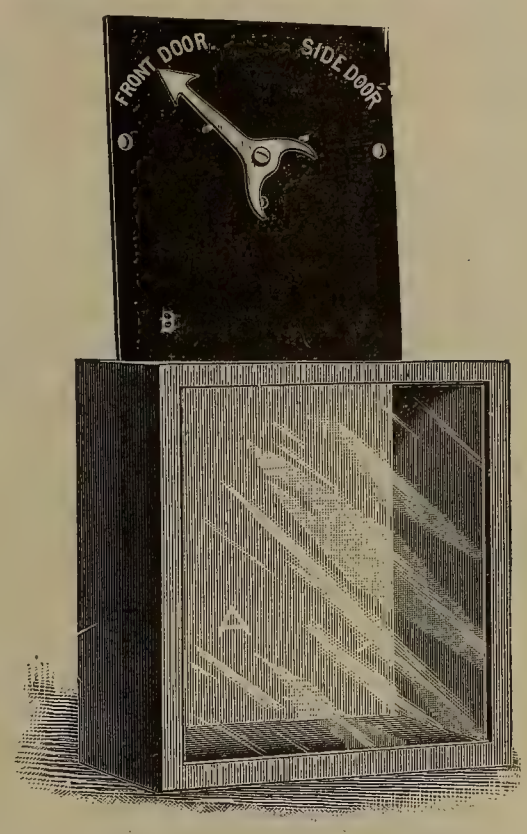


FIG. 2.—DIAL PLATE AND NEEDLE.

is closed through either pair of magnets they cause the bell to ring, at the same time attracting a separate armature, which operates the indicating needle separately and independently of the bell armature.

In Fig. 2 "B" shows the dial with indicating needle attached removed from the frame of bell.

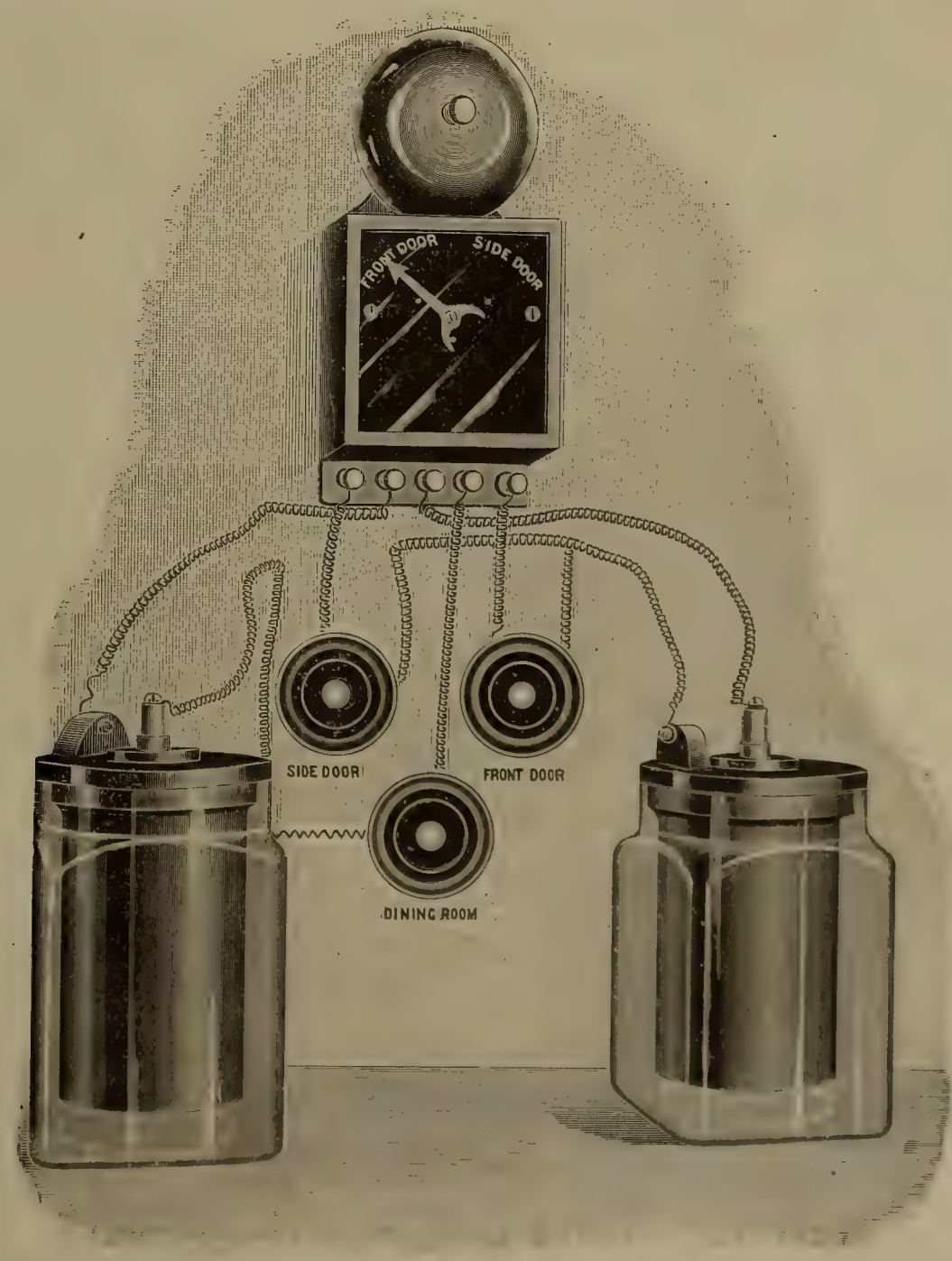


FIG. 3.—SELF-SETTING ANNUNCIATOR APPARATUS COMPLETE.

"A" shows the box or case with glass front which, when in place, covers the magnets, dial and indicating needle.

Fig. 3 shows the apparatus complete, with batteries, wires and connections for front and side doors, also dining-room call, which can be connected with wall-buttons or floor-pushes, as may be desired.

This concern has spared neither pains nor money to make its factory of the first rank, and with its present facilities it is enabled to turn out goods with neatness and despatch.

The factory is run by a 10 H.P. Otto gas-engine which, Mr. Lyman says, does its work to perfection, and at a very small cost.

NEW LAMP-SUPPORTING PULLEY.

Since the introduction of this device nearly a year ago, stations in all parts of the country have been eager to have their arc lamps hung from pulleys that will hold them securely under all circumstances. The pulley, as previously illustrated by us, was found well suited to this purpose, especially as the few and simple parts were well protected from the weather.

George Cutter, of Chicago, has now brought out a pattern which embodies a number of improvements, and is somewhat neater in appearance. It has a swivel-clamp, which is readily secured to the suspension wire or cable, and which allows the pulley to work quite freely. The same simple means are employed for catching and releasing the lamps, and all that the trimmer has to do is to pull on the hoisting rope until the knob reaches a dead stop.

This new form is of a very neat design, and has been given a severe test in all parts of the country, with most gratifying results.

CATALOGUES.

Milliken Bros., 55 Liberty street, New York City, have just issued the third edition of their catalogue. It contains illustrations and complete descriptions of their celebrated poles for electric street railways, electric light, and all forms of line work. A full report of the test of their poles made at Ithaca, N. Y., is also embraced in the catalogue. A copy of the catalogue will be sent free on application to any one interested in their specialties.

The Interior Conduit and Insulation Co., 42–44 Broad street, New York, has just issued an illustrated and descriptive catalogue of the celebrated Johnson Switches manufactured by it. It is called catalogue No. 6.

The American Electrical Manufacturing Company, 2011 to 2017 Pine street, St. Louis, Mo., has just issued a catalogue and price-list of the incandescent lamps manufactured by it.

NEW INCORPORATIONS.

East Side Power Company, Portland, Ore , incorporated February 25, with a capital stock of $50,000. Incorporators: David Goodsell, A. A. Franklin, G. A. Steel, all of Portland, Ore.

The K. A. P. Electrical Novelty Company, La Crosse, Wis., incorporated February 25, with a capital stock of $15,000. Incorporators: D. Frank Powell, William D. Kurz, Hans Amundson.

Columbia Electric Transmission Company, Chicago, Ill., incorporated March 1, with a capital stock of $500,000. Incorporators: Gustave Monrath, Charles G. Armstrong, Clarence Griggs.

Tremont Light and Water Company, Portland, Ore., incorporated February 23, with a capital stock of $10,000. Incorporators: W. C. Avery, A. C. Churchill, E. E. Howes, all of Portland, Ore.

Longmount Electric Light and Power Company, Highlands, Col., was incorporated February 26, with a capital stock of $50,000. Incorporators: Robert H. Porter, Irving R. Darrow, E. A. Arbuckle.

The Ithaca Electric Lighting Company, Ithaca, Mich , was incorporated February 4, with a capital stock of $20,000. Incorporators : J. B. Crawford, I. J. Heath, M. F. Chafey, all of Ithaca, Mich.

The Creeda Electric Light and Power Company, South Creeda, Col., was incorporated February 25, with a capital stock of $50,000. Incorporators: John H. Pools, William G. Burker, John W. Flintham.

Chicago and Edison Park Electric and Street Railway Company, Chicago, Ill., incorporated February 29, with a capital stock of $500,000. Incorporators: William Zuetell, N. H. Hanchette, E. Noel.

The Northern Electric Subway Company, Duluth, Minn., was incorporated February 4, with a capital stock of $100,000. Incorporators : N. J. Miller, C. R. Haines, R. M. Hunter, all of Duluth, Minn.

Union Electric Company, Seattle, Wash., incorporated February 24, with a capital stock of $1,000,000. Incorporators: J. M. Frink, C. P. Stone, James McWilliams, M. L. Wright, T. H. Tyndale, Seattle, Wash.

The Arlington Heights Electric Light Company, Fort Worth, Tex., was incorporated January 30, with a capital stock of $100,000. Incorporators : H. W. Fallant, W. C. Winthrop, Robert McCart, G. B. Paxton.

The South Bethlehem and Saucon Electric Street Railway Company, South Bethlehem, Pa., was incorporated February 23, with a capital stock of $100,000. Incorporators: Thomas Ganey, J. B. Meixell, John Evran.

The Knightstown Electric Light Company, Knightstown, Ind., was incorporated February 15, with a capital stock of $10,000. Incorporators: George W. Williams, John S. Patterson, S. E. Test, Harry Watts.

Buffalo and Lancaster Electric Railway Company, Checktowaga, N. Y., incorporated February 28, with a capital stock of $200,000. Incorporators: George M. Browne, Charles Rossler, Richard R. Ditzel, all of Buffalo, N. Y.

Sanger Electric Light Company, Sanger, Fresno Co., Cal., incorporated February 26, with a capital stock of $75,000. Incorporators: H. W. Chase, Ede Reynier, R. H. Elder, C. B. Presley, George W. Bates, all of Sanger, Cal.

The Deer Lodge Electric Company, Deer Lodge, Mont., was incorporated February 10, with a capital stock of $25,000. Incorporators: Nicholas J. Bielenberg, Samuel L. Larable, Conrad Kohts, Henry Reed, of Deer Lodge, Mont.

Colby Specialty Supply Company, Chicago, Ill., was incorporated February 4, with a capital stock of $100,000, among other things it will deal in electrical devices. Incorporators : Edward J. Colby, Albert J. Fisher and Harry Fox.

The Carbon County Electric Railway Company, Pennsylvania, was incorporated February 4, with a capital stock of $60,000. Incorporators : A. B. Clemmer, Richard Greenwood, Philadelphia, Pa.; Harvey Barton, Germantown, Pa.

The Wright Universal Electric Company (incorporated in W. Va.), New York, N. Y., was incorporated February 25, with a capital stock of $5,000,000. Incorporators: William Wright, Julius Hershfield, Andrew Morison, New York, N. Y.

Menomonia Electric Light and Power Company, Menomonia, Wis., was incorporated February 26, with a capital stock of $30,000. Incorporators: E. Marks, A. H. Johnson, A. Quilling, F. B. Wilson, L. S. Tainter, F. E. Fletcher, J. D. Hills.

Cayadutta Electric Railroad Company, Gloversville, N. Y., incorporated February 27, with a capital stock of $120,000. Incorporators: Thomas C. Frenyear, Buffalo, N. Y.; A. N. Broadhead, Jamestown, N. Y.; Charles M. Gibson, Schenectady.

The Springfield Electric Light Company, Springfield, Ore., was incorporated February 1, with a capital stock of $10,000. Incorporators : J. C. Boyd, George H. Thurston, B. P. Pengra, A. Mande, M. L. Wilmot, all of Springfield, Ore.

The Freeman Holland Company, Portland, Me., was incorporated February 2, with a capital stock of $500,000, to manufacture and deal in electrical appliances. Incorporators : E. W. Freeman, Portland, Me., Dwight S. Woodworth, Boston, Mass.

Buffalo and Niagara Falls Electric Light and Power Company, Buffalo, N. Y., incorporated February 26, with a capital stock of $100,000. Incorporators: George Urban, Jr., Checktowaga, N. Y.; James Roberts, Buffalo, N. Y.; Daniel O'Day, New York, N. Y.

Ferguson Ruthenberg Company, Louisville, Ky., incorporated February 26, with a capital stock of $25,000, to buy and sell electrical and other machinery. Incorporators: Richard Ferguson, T. Ferguson, Louisville, Ky.; Marcus Ruthenberg, New Albany, Ind.

The American Elevator Company, Milwaukee, Wis., was incorporated February 13, with a capital stock of $500,000, to manufacture and sell hydraulic, steam and electric engines and elevators Incorporators: E. H. Smith, S. R. Miller, William J. Kayser and L. M. Sherman.

The Black Hills Electric Railway Company, Hot Springs, S. D., was incorporated February 16, with a capital stock of $250,000. Incorporators: Walter E. Lenhart, W. E. Prentice, Chicago, Ill.; Charles G. Fargo, James E. Parke, Hot Springs, S. D.; Charles A. Greely, Nashua, Ia.

The Chicago Insulated Wire Company, Charles City, Ia., was incorporated February 15, with a capital stock of $300,000. Incorporators: William H. McKinlock, M. A. Knapp, N. P. Lucas, E. R. Baker, W. P. Pearson, William Alton, Jr., Chicago; E. Buck, Charles City, Ia.

The Duwamish Construction Company, Seattle, Wash., was incorporated February 13, with a capital stock of $200,000. Among other things it will operate and maintain electric-light and power plants. Incorporators: John S. Patterson, A. Mackintosh, Hugh L. Thomas, all of Seattle, Wash.

The Lebanon and Myerstown Street Railway Company, Lebanon, Pa., was incorporated February 4, with a capital stock of $100,000, to operate an electric street railway. Incorporators : Jacob M. Shenk, Lebanon, Pa.; S. L. Brightbill, Annville, Pa.; and E. H. Brooks, Lebanon, Pa.

Sioux City and Leads Electric Street Railway Company, Sioux City, Ia., incorporated February 29, with a capital stock of $200,000. Incorporators: A. M. Coffman, W. E. Higman, W. M. Stevens, C. C. Peirce, Maris Peirce, E. W. Skerry, Sioux City, Ia.; A. W. Gates Fairbanks, Boston, Mass.

The Warren Investment Company, Indianola, Ia., was incorporated February 23, with a capital stock of $500,000, to build an electric road from Des Moines to Indianola. Incorporators: John A. Campbell, C. P. Campbell, J. McKenzie Cleland, Theodore P. Shontz, J. H. Carruthers, Chicago, Ill.

Johnson Standardizing Company, New York, N. Y., incorporated February 19, with a capital stock of $10,000. Among other things it will manufacture, sell, lease and use articles of every kind appertaining to electricity. Incorporators: Edward H. Johnson, E. W. Little, E. T. Greenfield, New York.

The Land and River Improvement Company, of New Alexandria, Fairfax County, Va., was incorporated February 9, with a capital stock of $1,000,000. Among other things it will operate electric-light works. Incorporators: G. E. Abbott, Bryn Mawr, Pa.; P. Agnew, Alexandria, Va.; L. W. Spear, Duluth, Minn.

The Pioneer Carriage Company, Seattle, Wash., was incorporated February 2, with a capital stock of $100,000. Among other things it will deal in material used in the construction and equipment of electric street railroads, telephone and electric light wires and plants. Incorporators : Fred. E. Sanders, J. W. George, L. D. Bruns, Seattle, Wash.

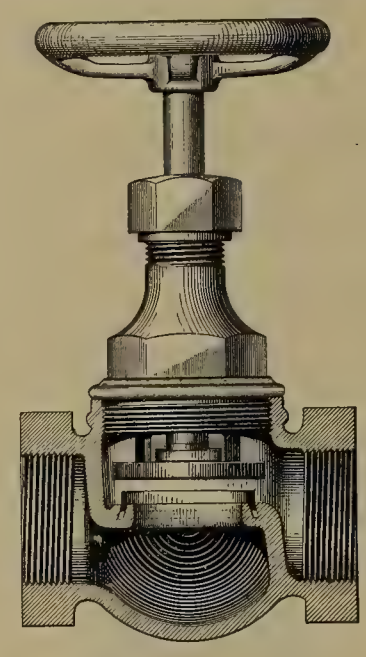
Tacoma Mint and Manufacturing Company, Tacoma, Wash., incorporated February 24, with a capital stock of $200,000. Among other things it will operate electric-light plants. Incorporators: Erasmus Bennett, Topeka, Kan.; Jackson Hunt, James W. Rowley, Isaac H. Durboraw, J. M. Hayes, W. P. Bonney, W. H. Hollis, C. L. Hoska, all of Tacoma, Wash.

The Paso Robles and Cayucos Railroad Company, Paso Robles, Cal., was incorporated February 20, with a capital stock of $700,000, to build and operate a railroad 30 miles long by steam or electricity, also telegraph lines. Incorporators: George R. Adams, H. Eppinger, A. F. Jack, E. A. Stowell, O. C. Bryant, all of Paso Robles, Cal.; M. M. O'Shaughnessy, J. N. E. Wilson, both of San Francisco, Cal.; J. W. Watson and A. M. Hardee, both of Cayucos, Cal.

TIGHT VALVES.*

A stop-valve is simply a device to make a joint between surfaces by contact. A proper contact assures the efficiency of the joint.

The conditions to which stop-valves are subject, and that tend to impair their efficiency, have not all been provided for in existing valves. New valves, though well tested when made, often fail to be tight when put in service. A leaky valve soon works its own destruction. The joint's position in the body does not admit of noting the condition of the valve when in service. The condition of the valve when operated indicates only the success or failure in making a joint. Should it fail and leak, the application of a lever or wrench to the valve handle is usually resorted to, and a collapsed seat, bent stem, bulged disc or strained body are the common results of such practice. New and old pipe systems contain sand, scale, grit, borings and other substances that are trapped in the valve body and lodge on the surface of the seat. This is one of the prime causes of valve injury, and may happen at any time to the ordinary patent composition seat-valve. The end and side thrust or sagging of expanding pipe lines, or the force used in fitting the screwed or flanged ends of the valve body, will often distort the face of the seat and cause it to be out of true. The ordinary commercial stop-valve has not sufficient strength in its parts to resist the usual strains that it is subject to in general practice, and such valves, even when first applied, are unfit for service in some locations.



ROY VALVE.

What is wanted is a seat that will not be injured by the ordinary force of a wrench applied to the valve handle and which will afterward be efficient when operated in the usual manner.

The above defects are overcome in the "Roy Valve," which also possesses numerous original features peculiar to this valve itself. It contains a method of making a joint that is a radical departure from the usual manner of joint making, in a valve body, and assures a tight joint under conditions in which all other valves fail. It makes a simple metallic joint which combines the essential features of a ball and socket, and of the well-known expanded joint, such as is used in boiler tubes, in heads.

It is simply a jointless ring of expansive material, inserted in the body, and is as simple in application as a washer. Any kind of malleable material is used, such as copper for steam, iron for ammonia, lead alloys of different kinds for water, etc.

The ring rests on a conical base and its action to compensate for distortion of the joint is as follows:

The ring resting on a conical base will make contact on its entire inner edge, if both ring and base are true. If the base be distorted, the ring will touch on two or more spots, depending on the degree and nature of the distortion. When a pressure is put on the upper edge of the ring by means of a flat disc, the ring is forced outward by the prominent points on the conical base, and drawn inward to fill the depressions. The plane of the top surface of the ring remains undisturbed, but free to move laterally on the face of the disc. It is obvious that an extraordinary degree of distortion is provided for.

The method of inserting the ring is as follows: The annealed or soft ring is placed in the recess intended for its reception in the valve body. The bonnet is then screwed down in the usual manner, and the spindle operated to close the valve. The ring coming in contact with the disc is resisted in its passage to the lower part of the recess by the conical base, which causes the ring to permanently expand

* Roy Valve Company, 15 Cortlandt street, New York.

its lower edge, thereby locking it under the outer wall of the recess. As the circumference of the base of the recess is greater than its entrance, it follows that the ring will assume a degree of expansion similar to the base of the cone, and the elasticity of the ring in combination with the conical base of the valve, with the flat disc, will compensate for the usual distortion met with in practice.

The application of the ring is quickly made, and its removal, if injured by scale or grit, is by a pair of plyers, or similar means that will collapse the ring to a slight extent inwardly, and thus at once free it from the recess.

Its continuous line of contact affords no outlet for the escape of fluid or gas, as is usual with threaded joints, and will, no doubt, with the other original features of this valve receive the endorsement of the engineering profession.

ELECTRICAL SOCIETIES.

CALIFORNIA ELECTRIC SOCIETY.

The annual meeting of this society was recently held at its headquarters in San Francisco, and the following officers were elected for the ensuing year: President, George P. Low; Vice-President, C. O. Poole; Treasurer, O. Brooks; Secretary, W. Crosset; Executive Committee, E. A. Roe, C. T. Ryland, Jr., R. B. Elder.

LOUISVILLE ELECTRIC CLUB.

Several gentlemen connected with the electrical industries in Louisville met recently and organized an electric club. A constitution and by-laws were adopted, and it was decided to hold meetings regularly every Monday night. The following officers were elected: President, Campbell Scott; Vice-President, Charles Smith; Secretary, W. Lea; Treasurer, H. Donigan; Directors: E. Willard, G. S. Maxwell, H. Donigan and M. Ruthenberg.

BROOKLYN INSTITUTE.

A meeting of the Department of Electricity, Brooklyn Institute, will be held at 502 Fulton street, Brooklyn, at 8 P.M. March 18. Mr. T. C. Martin will describe the Hollerith Electrical Tabulating Apparatus, used in enumerating, tabulating and classifying the data of the 11th census.

DIVIDENDS.

The Commercial Cable Company has declared its usual quarterly dividend of 1¾%.

The Western Union Telegraph Company has declared its usual quarterly dividend of 1¼%, payable April 15.

SUCCESS OF MR. WESTINGHOUSE.

The annual meeting of the Union Switch and Signal Company was held in Pittsburg March 8. The Westinghouse interest was represented by 14,183 shares, against 6,596 on the other side. It is stated that Mr. Westinghouse can have the presidency of the company if he desires, and if he declines it will probably go to Mr. Beyers.

DISASTROUS FIRE.

Fire recently destroyed the People's Electric Light and Power station at Moline, Ill., including sixteen dynamos and other machinery, along with the wheelhouses and other property of the Moline Water Power Company. Damage, $50,000, divided as follows: Electric Light Co., $30,000; Water Power Co., $20,000. Insurance, less than $20,000.

TO ABOLISH ELECTRICAL EXECUTIONS.

It has been agreed by the Assembly Committee on Codes to favorably report Assemblyman Stein's bill amending the Capital Punishment Act of the State. The bill provides for the substitution of hanging for electricity, and is reported without amendment.

Its author was one of the witnesses at the execution of McElvaine, and at the time expressed his opinion as to its being a most unnatural and horrible sight, and stated his intention of presenting a bill to the Assembly with a view to abolishing it and restoring hanging as soon as possible.

POSTAL-TELEGRAPH SYSTEM.

A bill was introduced in the national House of Representatives, Washington, March 11, authorizing the Postmaster-General to contract with telegraph companies in this country and, with the consent of the President, with foreign countries, to establish a postal-telegraph system. Telegrams are to be prepaid with stamps. No new offices are to be created, and no money expended in excess of the receipts of the service.

The Asbury Park Electric Light and Power Co., Asbury Park, N. J., desires to purchase some good second-hand dynamo machinery, and also second-hand engines.

NEW YORK NOTES.

FIRST FLOOR, WORLD BUILDING,
OFFICE OF THE ELECTRICAL AGE,
NEW YORK, March 12, 1892.

W. W. GRIFFIN, of the New England Electrical Company, Bridgeport, Conn., was in town last week.

MR. E. T. PARDEE, electrical contractor, and agent for the Mather Electric Company, Syracuse, N. Y., gave the ELECTRICAL AGE a call last week.

MR. W. D. SARGENT, general manager of the New York and New Jersey Telephone Company, sailed on March 10 for Nassau, West Indies, for the benefit of his health.

THE TYPEWRITER EXCHANGE, 10 Barclay street, New York, of which Mr. George A. Hill is manager, has just issued a 12-page illustrated catalogue, setting forth in a concise manner the many benefits to be derived from dealing with the "Exchange."

MILLIKEN BROS., 55 Liberty street, manufacturers of the celebrated Milliken poles for street railway, electric light and all sorts of line work, owing to the great demand made for the poles in all parts of the world, have made arrangements with parties in England, France and on the Continent to manufacture these goods.

MR. E. V. CAVELL, general manager of *Street Railway News*, sailed for Nassau, West Indies, March 10, for the benefit of his health. Mr. Cavell expects to be absent several months. A large party of his friends assembled at the dock to bid him good-by. Mr. Cavell's many friends hope that he will return greatly benefited.

MR. A. B. LAURENCE, 225 Pearl street, city, New York representative of the Shultz Belting Company, of St. Louis, has just closed an order for a 72-inch main-driver belt, to be 186 feet in length, for the Amoskeag Mills. Mr. Laurence has also received a number of orders for belting from R. H. Macy & Co., New York, and others.

MR. JOHN M. TUFTS, manufacturer of the celebrated Tufts' roll-top desks (formerly sold as the Derby), and also manufacturer of bank and office furniture, has moved from the corner of Fulton and Nassau streets to the large and elegant store, 83 Nassau street, between Fulton and John streets. Mr. Tufts is also the Eastern agent of the Indianapolis Cabinet Company.

L. J. SOMOFF, 1 Ann street, this city, has just issued a circular of chandelier and wall bracket lamps. He is doing a large business in the fancy incandescent lamps which were described in a recent issue of the ELECTRICAL AGE. These lamps are unequalled for decorative purposes, and range from one-half to six candle-power. Mr. Somoff will have his catalogue ready April 1.

SOME of the largest churches in the United States have lately, and are having, electric and gas fixtures put up by I. P. Frink, manufacturer of electric and gas fixtures and reflector shades at 551 Pearl street, New York. Mr. Spencer, the general manager, takes pride in showing visitors around, and during my recent visit he showed me some new designs in electroliers and gas-fixtures that are indeed praisewo thy.

J. W. LATTIG, formerlv superintendent of telegraphs of the Lehigh Valley Railroad, and more recently superintendent of the National Switch and Signal Company, of Easton, Pa., has accepted the position of general superintendent of the Electric Secret Service Company, of New York, in especial charge of their telegraph and signal department. We are told that this company has a surprise in store for the railroad and telegraph worlds.

T. J. MURPHY, Electrical Exchange Building, New York, is sending out a price-list, giving such instruction to buyers ordering slate (and also Vermont, Tennessee or Italian marble for switchboards) as will make it an easy matter to send in an order for any size. He recently received the following order from the Metropolitan Railroad Company, Washington, D. C.: Marbleized blood-stone slate; size of board, 10 x 6 feet, made 1½ inches thick, in 3 sections, each section 6 feet long by 3 feet 4 inches wide. Everybody ought to have his price-list.

LLOYD & PAXTON, Limited, electrical engineers, of 2 Wall street, this city, have recently been appointed American agents for the sale of Sir William Thomson's electric instruments, manufactured by James White, of Glasgow. This firm is now enabled to place these instruments on the American market at the Glasgow prices, plus the 45 per cent. duty and the cost of transportation. Special importations for use in colleges and educational institutions are admitted free of duty. Particular attention is called to the electrostatic instruments, which can be used equally well for alternating and continuous currents.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,825,000	100 00	62 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Engineering Co., N. Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	81 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	202 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush ElectricLight Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	80 00
Brush Elec. Ill., 6s, N. Y	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	30 00
Commercial Cable Co	7,716,000	100 00	155 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	112 50
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	17 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	81 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	97 00
Edison General Receipts		100 00	97 25
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	46 00
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 75
Franklin Electric Co., N. Y	5,000,000	100 00	+83 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	105 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	51 00
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	105 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hunt Engineering Co., N. Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	18 50
Laclede Gas pref	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*81
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30 000		*95
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa	6?,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	+20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	98 00
Montclair E Lt. Co., Denver, 8s	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N. Y	50,000	100 00	101 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Elec. Manuf. and Const. Co., N. Y	50,000	100 00	101 00
Nat'l Lead Trust	9,000,000	100 00	19 50
New England Butt Co	100.000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	+20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s	1,500.000		*98
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	58 00
Newark E. L. & P Co. 6s, Ohio	50.000		*95
North American Railway Co	39,767,200	100 00	16 25
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50.000		*90
Postal Telegraph	10,000.000	100 00	37 00
Pennock Baty. E. L. & Impt. Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s	500,000		*90
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*96
Rockaway Elec. Light	50.000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300.000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich	50.000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation. N. Y	100.000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16.000	100 00	+80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000.000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co., N. Y	900.000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Ongley Electric Co., N. Y	250.000	100 00	85 00
The Railway Impt. Co., N. Y	10,000.000	100 00	100 00
The Washington Wat. Pow., Wash.	1,500.000	100 00	80
Thomson-Houston Electric Co	6,000.000	25 00	58 50
Thomson-Houston pref	4,000.000	25 00	29 00
T.-H Electric Co. 5s, Boston	500,000		*100
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50.000	100 00	100 00
United Elec. Light and Power	3,000.000	100 00	40 00
United States Elec. Co	1.500.000	100 00	25 00
United States Illuminating, N. Y.	1,250.000	100 00	26 00
Universal Arc Lamp Co	100.000	100 00	
Western Union	86,188,852	100 00	88 00
Westinghouse Electric Co	7,000 000	50 00	16 50
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	50 00
West End L., Boston	13,550,000		19 25

*Per cent. +Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

To investors in electric securities the rule of age applies with as much certainty as in any other business. An electric plant fairly well managed should pay a dividend out of earnings the second year, and if it does not there is generally a good cause to examine the books and see where the commercial or mechanical discrepancy lies, or grant the manager a short holiday and carefully note the expenses during his absence. Extension of the plant or other extraordinary expense or purchase may tide the dividend over to the third year, but that is the extreme limit. The number of corporations who scarcely earned the interest on their bonds, and who this year have laid up enough to pay from five to eight per cent. on the common stock, proves to be very large, and the list is increasing rapidly. Every five-year-old plant in the country should be as well known for its producing capacity to its owners as any healthy tree of the same age in an orchard, and should be pruned or cultivated accordingly. The first expenses of constructing and equipping an electric plant vary to a considerable degree, and the running expenses are different in almost every State in the Union. I often wonder, as an investor and bondholder, how that question would be equalized if the labor federations and employers agreed on a wage rate universal and equal in the United States. The present pay-roll, man for man, of the Municipal Electric Co., of Brooklyn, must be fully as much again as that of the Hickory Electric Co., of North Carolina. Just fancy fuel at $1.25 per cord all ready to slip into the furnace, and all other expenses on the same ratio. No wonder they can pay 8 per cent. on the shares and get along without any bonds, and yet that plant can be purchased for the small sum of $13,000 clear and clean, with a thirty years exclusive franchise for electric light, railroad and telephone, and that with only the light going the company is earning eight per cent. the year round, which will increase considerably this fall when the cars are added. This should soon be increased to 16 per cent. What a fine thing this plant is for a man with say $ 5,000 to $16,000 in hand. The climate of Hickory is the finest on the Atlantic sea-board, and we all know that the man owning the electric business in such a city would be practically a king, honored by the community as the Crœsus of the municipality, and with an assured income fully equal to the occasion. Is there a prominent business in New York in which so inconsiderable an investment will secure an equal amount of happiness? There are other opportunities for the young as well as the old. Take for instance the Montclair electric plant, a suburb of Denver, growing rapidly, and the income this year is expected to not only earn all fixed charges, including 8 per cent. on $20,000 of bonds, but 9 per cent. on the capital stock of $50,000. There are $20,000 of the common stock in the treasury which can be had at par, and, if desired, a seat at the board of directors. What better opportunity can a young man have than that to grow up with the country? Colorado is just beginning to show the world what she is capable of. Denver is to Colorado what Paris is to France, and five years from now the young owner of two-fifths of that stock will be far beyond any financial trouble. Another developed opportunity for a full purchase is the Fremont Gas and Electric Company, under one management and ownership. These corporations are earning to-day 10 per cent. on the price at which I can turn them over without a cent of indebtedness; a first-class plant in complete and perfect running order for $100,000—a very nice business for one or more men to invest in and carry on. The reason for selling is that the present owners are ambitious and have a much larger business in hand, or think they have, which in this case amounts to the same thing. On the other hand, if you desire bonds paying 6 per cent., with solid business behind them, I can furnish $100,000 of the Detroit Light and Power bonds. The corporation lights the city of Detroit, and the bonds are well worth par as an investment, that figure being refused for a large block of no better 5 per cent. bonds this week in this city. A small block of the common shares can also be had at something under par. Make me a *bona-fide* bid and I will submit it. Read the list through carefully; it embraces nearly every phase of the electrical industry (except electrical railways which will be found in Street Railway News); and not only that, but I wish to say to our readers that there is no charge for quoting your bonds and stocks in the list regularly. If you want them quoted you have simply to send me the data as covered by other names and figures in the list; secure the next Electrical Age and you will find your corporate name a part of the active electrical history of the nation.

The Hon. Byron G. Stout, who represents Michigan in Congress, is reported as drafting an amendment to the Constitution giving the Federal Government jurisdiction over all corporations doing business in more than one State and paying taxes where the levy is lightest. Would it not be very much better to enact a general law covering all corporations, to compel them to register with the Secretary of State at Washington, and to eventually wind up and notify the department; or a limitation clause to end their corporate existence? The extra expense should not be over $25 for the first $100,000 or part thereof, and scaling down on each $100,000, or fractional part above; one object being to make the department (a new one if necessary) self-sustaining; the other to have a single house of record, where all corporate papers could be found. This need not interfere with any State law, and would add stability to every corporation. It would give greater value to public securities by enabling investors to make an entirely independent examination of the charter and by-laws where no interested party could interfere unless asked. Capital less than $10,000 could be exempt, but capitalists should be permitted to use their own discretion. One or more sub-record offices might be established, say, in Washington, Boston, Minneapolis, San Francisco and Atlanta.

The late boom or spurt among a few of the controlled securities has subsided, and quiet once more reigns in the neighborhood of the Stock Exchange. A new "Trailer" has opened publicly on New street, and the boys pay their nickels and ride down to the, to them, bursted end of the line with as much assurance as the coon sticks to his gig. There should be about six Stock Exchange holidays, on which the "Trailers" should be permitted to keep open and prove to the public that they are legitimate by making their own quotations and deliveries, which should be noted over a seal in the next day's press. It is asserted of late that less than a dozen individuals control the prices of all the securities dealt in, and that they name, not only the prices, but the stocks which are to be used for the purpose of returning the loaned money back into its regular channel. It would certainly expedite matters to give the boys a chance every sixty days to fight it out among themselves and create a healthier market, beside adding several plunges each year. The only cure for this is investment instead of speculation, and for the purpose there is no equal to the electric and kindred stocks of incorporated local corporations: I say local, because the parent companies cover so much, with full systems, that their line of profit is small as the competition among them can make it, while the local company has no opposition, but can figure out their expense and income for periods of ten years ahead with approximate certainty, and these securities earn and pay from four to eight per cent. with a stock dividend possible every five years. The cost of producing and distributing electric energy is practically stationary and a standard price for it is current all over the country. These securities all seek New York to meet the investors' capital, which can here alone find employment in sums and channels to suit. I could name many golden opportunities, but prefer to draw attention to our regular list, which is free to all who desire to be quoted and will send me the data as it appears in the list, over their official signatures. Your market price is mine, and changes in it will be made as often as sales are concluded. If you have faith in the continued increase of the population of the United States you must know that the demand for electric power must also increase. Gas as an illuminant has passed its zenith; its passage down the incline will be rapid. The incandescent lamp is taking its place everywhere, and a death-thrust was made at it most intelligently in the New York *Sun* a few days since, when some gentleman suggested (with a sketch) that it be used by the legal anthorities in state prisons to execute convicted murderers. Gas has killed and to-day is killing so many innocent people who simply blow it out, that no technical scientific question is involved. Gather the invited guests, witnesses and press representatives, place the murderer in a glass case, close the entrance, turn on the gas and the desired result will be obtained.

The gas companies are merging into electric corporations as fast as the public they serve can compel them to, and in every case it means that soon the gas security will be changed entirely to electric, and the coal produce from ten to fifty times the profit. The man who puts his surplus cash into local or industrial electrics to-day is as safe as those who bought U. S. Government Bonds thirty years ago at fifty cents on the dollar, paying for them in gold at a premium of one hundred per cent.

Lockport Gas Co., Lockport, N. Y., has added another 100 H. P. Ball Engine, manufactured by the Ball Engine Co., Erie, Pa., to its present very complete electric light plant.

WESTERN NOTE.

Mr. C. E. Wilson, well known through his connection with the Knapp Electrical Works, has just made arrangements to represent the Electric Merchandise Co., Chicago. Mr. Wilson's long experience and large acquaintance will make him a valuable addition to the staff of the company.

PHILADELPHIA NOTES.

The J. G. Brill Company, of Philadelphia, has received an order from the Buffalo and Tonawanda Street Car Company to build more coaches. As the firm is piled up with orders, it will be some time before they can have the cars ready.

Mr. Otis K. Stuart, 927 Chestnut street, Philadelphia, is having great success in the sale of Germania incandescent lamps. Six out of the nine central stations in Philadelphia are using these lamps in large quantities. The proprietor of one of the largest isolated plants in the city speaks very favorably of the Germania lamp, and says it is the best he has ever used. In a large bolt and nut manufacturing establishment here, some of these lamps, which are still in use, have burned up to the present time 1,258 hours. The transformers handled by Mr. Stuart are claimed to be more efficient, better protected and cheaper than any other in the market. Mr. Stuart is also doing well with the Germania shade-holders, and is securing many orders.

ANSWERS TO INQUIRERS.

Is there any work published covering the subject of electrical engineering comprehensively and yet in small compass? B. K., Easton, Pa.

"Electrical Engineering," by Slingo and Brooker, is as comprehensive a work as we know of. This book can be obtained at this office. Price, $3.50.

What is the cause of the variation of terrestrial magnetism? M. C. V., Washington, D. C.

There are three kinds of variation, viz.: secular, annual and diurnal, and your question, we presume, refers to variations in general. The annual and diurnal variations are apparently due to change of temperature, the annual maximum variation occurring in summer and the minimum in winter. The diurnal maximum occurs during the day, and the minimum at night. The greatest diurnal variations take place at regularly recurring periods of about 11 years each, corresponding to the periods of greatest solar disturbances. Secular variations occur during long periods of years, such periods being called secular periods.

LARGE CONTRACT.

The Hunt Engineering Company, 126 Liberty street, New York City, has closed a contract with the Portland Electric Light Company, of Portland, Conn., for the complete installation of an electric light and power plant in Portland, Conn., opposite Middletown, which will comprise the following: 200 H. P. steam plant; 1,000 light alternating machine; 35 light Ball 1,200 C. P. dynamo and lamps; 80,000 watt electrical generator for power purposes.

The Portland company has the contract for lighting the town for ten years with arc lights, and has subscribers to fill the 1,000 light alternating machine.

The extensive brown-stone quarry industries which are carried on in Portland will absorb the electrical generator for drilling, hoisting and pumping purposes, and it is the intention of the Portland Electric Light Company at an early date to increase the power capacity to 1,000 horse-power.

It is expected that the plant will be in operation on or about the 1st of July.

QUEEN & CO.'S TESTING SETS.

We are informed by Queen & Co., of Philadelphia, that their Portable Testing Resistance Sets still meet with great favor wherever they are introduced. The new style, known as the "1891" type, which was brought out last fall, is especially appreciated, as its peculiar construction has overcome many previous difficulties in both outside and inside testing.

As is well known, great trouble has been experienced with the galvanometers usually supplied for such work, those with fibre suspension being too delicate for street use or where running machinery jars the station, and those moving on a central point being too sluggish. To overcome these defects Queen & Co. devised a new galvanometer which, as has been proved by use, meets the requirements of all-around testing to a most satisfactory degree.

The features of this instrument which render it of such value are dead-beatness and sensibility. In consequence, it is not affected by mechanical vibrations and proximity to masses of iron or intense magnetic fields, and can be used alongside of dynamos when running, in the streets of large cities, on shipboard and in fact everywhere. The makers claim that no other galvanometer is adapted to such universal use.

The coils in the rheostat and bridge are wound with platinoid wire and guaranteed accurate to one-fifth of one per cent. A special "reversing attachment," employed by Queen & Co. in their standard resistance boxes, is supplied, which gives a maximum range from .001 to 11,110,000 ohms.

The makers have just issued a neat circular, No. 285, which sets forth the advantages of their testing sets, and we have no doubt they will gladly send a copy of the same to interested parties.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued March 1 and 8, 1892.

Issued March 1.

469,802. Electric Alarm-Clock. Joseph Yungbauer, St. Paul, Minn., assignor of one-half to Theodore B. Myers, same place. Filed June 22, 1891.

469,806. Commutator Brush and Holder. Charles D. Jenney, Indianapolis, Ind., assignor to the Jenney Electric Motor Company, same place. Filed Jan. 16, 1891.

The combination, in a commutator-brush, of the brush-head, an opening therein adapted to receive and hold contact-points, ways also in the opening, followers mounted in the ways, and springs attached to the head and the followers, whereby they are adapted to operate upon the contact-points.

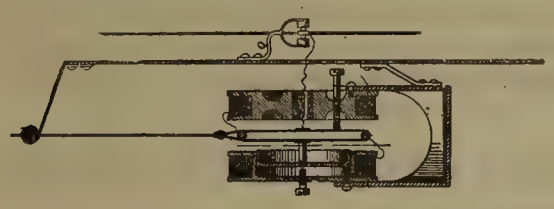
469,809. System of Electrical Distribution. William Stanley, Jr., Great Barrington, Mass., assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Aug. 15, 1888.

In a system of electrical distribution, and in combination, an alternating-current dynamo and converters electrically connected with the main-line conductors in multiple arc and organized to transform the current in the main conductors into currents of less potential and greater quantity in the secondaries, each converter made with a primary coil containing such length of wire exposed to magneto-electric induction that when operated by the dynamo with which it is to be used with its secondary circuit open the electrical pressure and counter-pressure in its primary circuit shall be equal with incandescent lamps or other translating devices in the secondary circuits.

469,856. Telegraph Apparatus for Branch Offices. John B. Hurd, Red Bank, N. J., assignor to The Western Union Telegraph Company, New York, N. Y. Filed March 7, 1890.

469,862. Electro-Magnetic Machine. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Aug. 5, 1891.

The combination of a disc armature and a double field-magnet having a set of positive and negative poles on each



470,341.—ELECTRICAL MEASURING INSTRUMENT.

side of the disc armature, each set of pole-pieces being magnetized by a single magnetizing-coil.

469,865. Telephone System. Thomas W. O'Brien, Wilkes-Barré, Pa. Filed Nov. 12, 1890.

469,895. Extension-Electrolier. Charles Deavs, New York, N. Y., assignor to the Archer & Pancoast Manufacturing Company, same place. Filed Nov. 23, 1891.

469,905. Electrical Releasing Device for Target-Traps. Paul North, Cleveland, Ohio. Filed May 6, 1891.

469,917. Armature-Winding for Dynamo-Electric Machines. Rudolf Eickemeyer, Yonkers, N. Y. Filed June 1, 1891.

469,940. Insulator. Charles N. Hammond, Boston, Mass. Filed Sept. 30, 1891.

469,949. Electric Soldering-Tool. Johann J. Ritter, Basle, Switzerland. Filed Aug. 27, 1891.

469,995. Electro-Magnetic Annunciator. Francis W. Dunbar, Newark, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed Nov. 23, 1891.

470,008. Electric-Light Attachment for Lamps. Ralph C. Putnam, Philadelphia, Pa., assignor to the J. E. Caldwell & Company. Filed Sept. 5, 1891.

470,013. Lightning-Arrester. Charles F. Scott and Alexander Wurts, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed July 17, 1891.

470,014. Fuse for Electric Circuits. Charles F. Scott and Alexander Wurts, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 16, 1891.

470,038. Electric Link-Welding Machine. Charles L. Coffin, Detroit, Mich. Filed April 25, 1891.

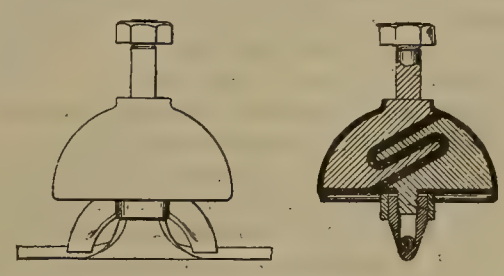
470,057. Dynamo or Motor. Ralston C. Kintzing, Brooklyn, N. Y. Filed Oct. 13, 1891.

470,073. Electric Battery. Erminio Ortelli, Cadenabbia, Italy. Filed Sept. 18, 1890.

470,080. Adjustable Suspension Apparatus for Electrical Translating Devices. Harry D. Sisson, Pittsfield, Mass., assignor of one-half to Charles H. Robinson same place. Filed Sept. 24, 1891.

470,123. Voltaic Battery. Henry I. Harris, London, England. Filed April 4, 1891.

470,155. Electrical Device for Stopping Horses. Albert B. Holson, Chicago, Ill., assignor, by direct



470,356.—INSULATOR FOR OVERHEAD ELECTRIC RAILWAYS.

and mesne assignments, to the Holson Electric Harness and Supply Company, of Illinois. Filed Feb. 14, 1891.

470,158. Electric Elevator. Carson J. Sturgeon, Erie, Pa., assignor to the Keystone Electric Company, same place. Filed Jan. 27, 1891.

The combination, in an electric elevator, of elevator mechanism and an electric motor having its field-magnet cores wound with coils connected in series with the motor-armature and also wound in the same direction with coils shunted around the armature, coils being both connected with the incoming conductor in a manner whereby the current passes from the outgoing end of the series coils to the armature, operatively geared to and actuating elevator mechanism, with a current controlling and reversing mechanism adapted to turn the current on and off the motor and reverse its direction through the armature, and non-rheostatted conductors between current controlling and reversing mechanism and the motor, whereby the full force of the current is turned directly into the motor to start it.

470,161. Circuit-Interrupting Device. Alexander Wurts, Pittsburg, Pa. Filed April 23, 1891.

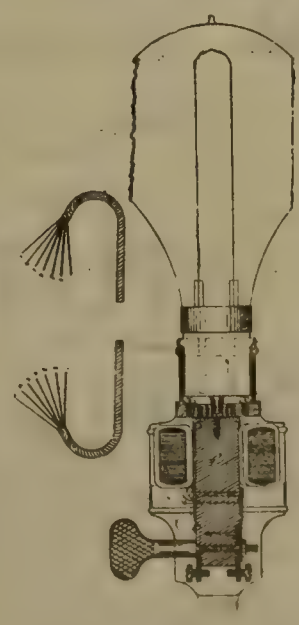
Issued March 8.

470,194. Electric Motor or Dynamo-Electric Machine. Henry H. Hosford, Cleveland, Ohio, assignor of one-half to Charles W. Foote, same place. Filed June 4, 1891.

A dynamo-electric machine or electric motor having a rotary field-magnet and a stationary ring-armature provided with laminated core-pieces bolted together and to sustaining or side supports, with a fixed commutator composed of conducting bars or strips having an angular relation to the commutator-brushes and their holders.

470,199. Electric Motor or Generator. Rankin Kennedy, Glasgow, Scotland. Filed Sept. 24, 1890.

The method of operating an electric motor by alternating



470,402.—REGULATING SOCKET OR HOLDER FOR INCANDESCENT LAMPS.

currents, which consists in maintaining an alternating current in the coils of both the field and armature until a speed has been reached which is synchronous with the pulsations of the actuating-current, and then transmitting through an independent winding of the field-magnet a second alternating current of like periodicity, but of different phase, the same having been first rectified by a commutator revolving at the synchronizing speed.

470,204. Electric Cut-Out and Safety Device. Charles R. Meston and Alexander W. Meston, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, same place. Filed Jan. 12, 1891.

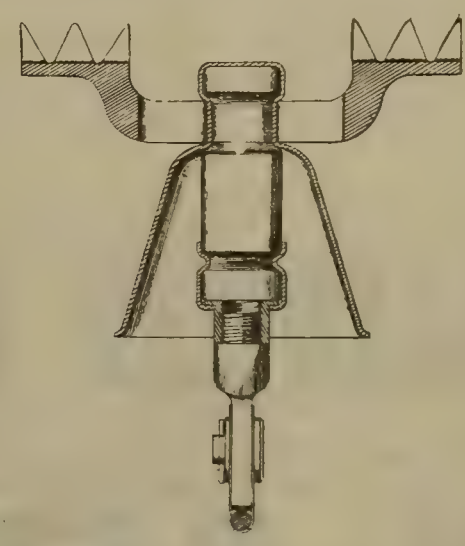
In an electric cut-out, the combination, with a base-block having projecting contact-pieces and a projection or ridge, of a detachable cover having projecting contact-pieces adapted to take under the contact-pieces of the base-block and an interposed spring-tongue, arranged to engage with the ridge or projection on the base-block, when the contact-pieces are in juxtaposition.

470,217. Connection for Armature-Conductors. George Stephens, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 13, 1891.

The combination of the bared portions of the armature-conductor and connecting-conductor, the sleeve around the same, and a clamp supported by the armature and clamping-sleeve.

470,231. Fire-Alarm and Telephone Apparatus. Edward H. Amet, Chicago, Ill., assignor to himself and Herbert A. Streeter, same place. Filed July 26, 1890.

The combined telephone and fire-alarm signalling apparatus comprising a telephone and telephone-circuit, an automatic fire-alarm signalling device, a thermostat and its circuit, including a magnet, and an induction-coil circuit having a secondary circuit adapted to be included in the telephone-circuit, the magnet in the thermostat-circuit operating to cut out the telephone and throw the secondary circuit into connection with the telephone-line, so that the signalling device may send a signal to the signal-receiving instrument at the central office in case of fire.



470,417.—INSULATOR FOR TROLLEY WIRES.

470,237. Conduit for Electric Wires. Charles A. Freeman, Steubenville, Ohio. Filed Sept. 25, 1891.

A conduit for electric wires, formed of a series of tubular sectional tiles having longitudinal partition-walls extending through the same, the ends of the outer walls of tiles having tongues and grooves formed within their walls, and arranged at angles to one another, and adapted to bring the outer walls and inner partition-walls of each tile into coincidence with its counterpart, and to lock it against lateral or vertical displacement.

470,256. Electric Gas-Lighting Burner. Horace A. Pinkham, Wollaston, Mass., assignor to George F. Pinkham, same place. Filed Sept. 25, 1891.

In an electric gas-lighting burner, the combination, with the fixed electrode and a movable electrode, of a cam for actuating said movable electrode, cam having two inclines, one outside the other, extending upward in opposite directions and adapted to act alternately upon said movable electrode.

470,260. Electric Battery. Vincenzo Riatti, Milan, Italy, assignor to Julian Goldsmid, London, England. Filed June 9, 1891.

470,294. Electrical Attachment for Pianos. Fritz A. Feldkamp, Newark, N. J., assignor to Feldkamp, Schoenhaar & Lehr, same place. Filed Nov. 9, 1891.

470,318. Electrical-Wire Stripper. Arthur Cuthbert, Maidenhead, England. Filed Oct. 6, 1891.

A tool for severing the covering of covered wire, having a pa of cutting-blades with projections, with dull points sharpened on the inside, and cutting-edges between projections.

470,329. Underground Conduit for Electric Cables. Carl A. W. Hultman, Stockholm, Sweden. Filed June 9, 1891.

PATENTS—Continued.

As a means for strengthening and holding in place cement or other blocks employed as conduits for underground electric cables or wires, metallic bars or tubes combined with such blocks and lodged in the exterior longitudinal grooves therein, larger in cross-section than such bar or tube, and secured therein by a suitable cementing material.

470,340. Movable Coil for Electrical Measuring-Instruments. Edward Weston, Newark, N. J. Filed March 11, 1891.

An insulated coil-conductor having numerous turns cemented together to form a compact annular body and provided with pivots.

470,341. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed June 4, 1891.

The combination, in an electrical measuring-instrument, of a fixed coil, a movable coil supported in front of one face of fixed coil, a rotary index-needle, and transmitting mechanism between movable coil and index, whereby the movement of movable coil due to the passage of a current through coils is transmitted to and causes a rotary movement of index.

470,356. Insulator for Overhead Electric Railways. Henry D. Winton, Wellesley, Mass., assignor to the Hersey Manufacturing Company, of Portland, Maine, and of Boston, Mass. Filed Oct. 22, 1891.

An insulator for overhead electric railway trolley-wires, composed of an insulated body portion formed to shed rain or moisture and having at its extremities projecting studs formed to receive interchangeable attaching-pieces for clamping the trolley-wire and securing the insulator to supports.

470,382. Safety Cut-Out. Max Kerstein, Boston, Mass. Filed June 8, 1891.

The combination, with an electric wire composed of sections and provided with slip-joints to connect the sections, of supports for the sectional wire and springs connected at one end to one of the supports, and at the other end to one member of the said slip-joints.

470,402. Regulating Socket or Holder for Incandescent Electric Lamps. Elias E. Ries and William S. Horry, Baltimore, Md., assignors to the Ries Electric Specialty Company, same place. Filed May 5, 1891.

A socket for incandescent electric lamps operated by alternating or intermittent currents, comprising an iron ring or core wound with a strand or cable composed of a number of separate insulated wires, a non-conducting support for the core, having a series of contact-terminals, to which the ends of the wires composing the strand or cable are connected, a contact-making holder or receptacle for the lamp, also secured to support, a key or switch suitably mounted in support and arranged to make contact with the terminals, and a shell surrounding support and enclosing the coil, the contact-terminals, and the lamp-holder or receptacle.

470,417. Insulator for Trolley-Wires. William S. Andrews, New York, and Henry P. Ball, Brooklyn, assignors to the Edison General Electric Company, New York, N. Y. Filed Oct. 1, 1891.

The combination of the insulating-body consisting of a block of wood having a groove or depression at one end, a metal bell into which the body is placed, the metal of the bell being formed into groove or depression, whereby the body and bell are secured together, and means at the other end of the insulating-body for supporting a wire.

470,418. Electrically-Heated Oven. John V. Capek, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed March 24, 1891.

The combination of a holder, an electrical heater having a heating or supporting plate, and an insulated heating-conductor, plate fitting into the holder, and holder being constructed with inwardly-extending edges to hold the same without separate securing devices.

BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48-inch double belts and six 25-inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., Street Railway Company, two 24-inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway, of Wheeling, W. Va.

EMPIRE STATE EXPRESS.

The Christmas number of *Harper's Weekly* contains a full-page cut of the "Empire State Express" of the New York Central & Hudson River Railroad. This is the fastest train in the world. The cut was made from a photograph taken by A. P. Yates, of Syracuse, while the train was running sixty-miles an hour. It shows distinctly the locomotive, No. 862, and four coaches. It is a perfect picture of the train. Some idea of how rapidly a photographer's camera works may be gained from the fact that a train running at the rate of sixty miles an hour moves eighty feet in a second, and the shutter of the camera has to be opened and closed in the eightieth part of a second, in order that the picture be not blurred on the plate. That is quick work; but photography has reached that degree of perfection that it can be done. "The Empire State Express" leaves New York daily at 9 A.M., and makes the run from New York to Buffalo, 440 miles, in 504 minutes, the actual running time being 52⅓ miles an hour. It is a pleasure to ride in such a train.

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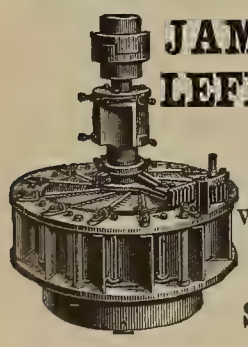


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THE ELECTRICAL AGE.

VOL. X. NEW YORK, MARCH 26, 1892. No. 13.

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NEW YORK, MARCH 26, 1892.

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UNDERGROUND WIRES IN BROOKLYN.

There is a promise that Brooklyn will have an experience with overhead wires similar to that of New York two or three years ago. A bill has been introduced in the Legislature at Albany, providing for the appointment of a subway commission for Brooklyn, from which it may be inferred that there exists a desire on the part of the Brooklynites to "see the wires out of sight." For several reasons we think it will be an easier task to get the wires in Brooklyn underground than it was in New York. There is already a considerable mileage of underground wires in that city, and from all we hear the systems in use are giving good satisfaction.

ALL OPPOSITION WITHDRAWN.

The authorities of the World's Fair having in charge the lighting of the great show are just now greatly exercised over some recent developments in the plans for lighting. It is stated that bids were received from two electric companies for lighting, and afterwards one of the companies withdrew its bid, leaving the other alone in the field. This company, it is said, has demanded a price for the light which is far above what the chief-in-charge was led to believe it would be, and to which the Fair authorities demur. The latter claim that the consolidation of the Edison General Electric and the Thomson-Houston Companies is responsible for the present state of affairs, in having caused the withdrawal of opposition, and that if the company making the bid does not revise its figures the Siemens & Halske Company, which is to take root in Chicago soon, may appear as a competitor.

The result of this disagreement between the two parties will be watched for with interest.

IMPROVED PHONOGRAPH.

We publish on another page in this issue an interesting article on Lieutenant Bettini's new microphonograph, with two illustrations of the same. The great value of this new instrument is based on the discovery that the diaphragm of the phonograph does not vibrate as a whole but in numerous small sections, so that with but one contact point much of the vibratory movement is likely to be lost to useful purposes. In order that several of the vibratory areas may be covered by contact points so as to gather up and concentrate all the vibrations in the various parts of the diaphragm, Lieutenant Bettini has constructed a "spider leg" frame, the feet of which rest upon the diaphragm at different points. Through these branches the vibrations are transmitted to the central point, and in this way sounds are reproduced with greater volume of intensity.

It is stated that the instrument reproduces sounds of all kinds with marvelous distinctness and volume and it would seem that the principle of covering various portions of a vibrating diaphragm could be applied to valuable uses in other directions.

THE TELEPHONE.

What will occur when the so-called fundamental telephone patent expires is a theme that has been given a great deal of consideration during the past year or more in the technical and daily press. Like all other questions it can be viewed from more than one standpoint, and there is no agreement of opinion as to what will be the effect on the Bell Telephone Company's interests of the expiration of that much-talked-of fundamental patent.

This fundamental patent relates to the Bell receiver, with which every one is familiar, and one party takes the ground that when it expires, and the right to make receivers is as free as the wind, capital stands ready to jump in and establish an opposition to the existing company. Another party contends that the telephone industry will be little affected by the expiration of the patent. Mr. Herbert Laws Webb, who is a practical telephone man, takes this view of the situation, and in the *Engineering Magazine* for March discusses the subject at considerable length. He argues that the expiration of the patent will have a certain effect on the telephone industry which will redound to the benefit of the public, but it will have little or no effect on the main branch of the industry, namely, supplying telephone service in large cities, and he thinks that if the public looks for competing systems in large cities it will likely be disappointed.

The branch of the service that will likely be affected is the private line business, and it is probable that this, when the receiver becomes free property, will develop into a large industry; then there will be no reason, Mr. Webb thinks, why private telephones should not become as common as electric bells.

Whichever way the matter is considered one fact is obvious, and that is that the Bell Telephone Company is already on the ground with a fully equipped plant and all the experience, and with these immense resources at its command it will not be a case of "plain sailing" for any new company to come into the arena for the purpose of subjugating the giant which has had the field all to itself so long.

The people want cheaper telephone service and it is to be hoped that in some way their wants may be satisfied. Should an opposition company be started to bring about this result, and it should go into the business with a determination to fight and attain its object, there is no doubt that the public sentiment would be wholly on its side. The public, we think, can be depended upon to encourage and sustain well-meant opposition, but will not countenance any effort that has the semblance of a stock jobbing scheme.

NEW METHOD OF CONTROLLING INDIVIDUAL LAMPS.

In our issue of July 4, 1891, we, illustrated a new and ingenious system of individual telegraph calls and answer backs shown by the Electric Secret Service Company, of 45 Broadway, New York, at the Cincinnati Convention of Railway Telegraph Superintendents. The principle of individual selection, as therein applied to electrical instruments operating on one circuit, attracted much attention, and the exhibiting company announced that it was engaged in perfecting an application of its method to electric light circuits and railroad signals. At the recent



FIG. 1.—EXHIBIT AT THE IROQUOIS HOTEL, BUFFALO.

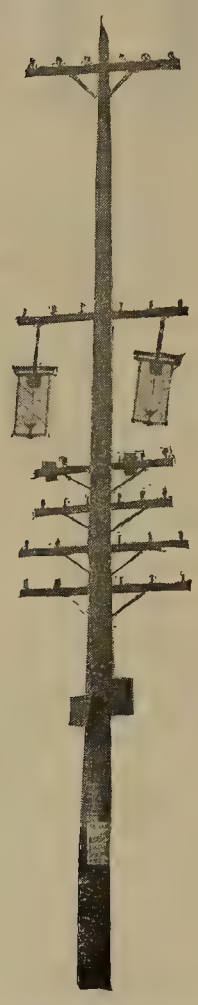


FIG. 2.—POLE WITH LAMPS.

Buffalo Convention of the National Electric Light Association, the Electric Secret Service Company made good its promise by showing in actual operation upon the Main street circuit of the Buffalo Electric Light and Power Company its new individual arc light and motor controller. The interest which this novel device attracted among the central-station men present at the Convention was unmistakable, and if we may judge from the expressions of approval which reached ourselves, the general opinion was highly flattering to the new system.

The company had four of its instruments in operation, two of them in the arc light circuit on the street, and two of them attached to incandescent lights in its parlor. In the latter case the single lamp represented groups of incandescent lights of any desired number, as of course when the switch was thrown all the lights attached to it would be affected. On a table in the parlor was set the small transmitter (see Fig. 1), which is the only appliance needed in a central station whatever may be the number of instruments to be operated. This transmitter was furnished with as many removable discs as there were locks and cut-outs. Each disc varied in the number of its teeth and their arrangement, so as to correspond exactly with the teeth on some one of the locks. The locks themselves consisted of two magnets with their armatures working upon two wheels, which were cut differently on each lock. There was also a simple throw-out attachment by means of which, if the pawls on the armatures did not encounter the tooth on the wheels which corresponded in position with the impulse received from the transmitter, the wheels would revert to zero and the lock would not work through its particular "combination." Attached to the lock was a new form of alternating switch, so adjusted that one set of impulses would throw it in and a repetition of that set would throw it out. On the wheel-shaft of the lock was set a circuit-closing device so fixed that when the lock received its own particular "combination" and its wheels were revolved to their full extent a contact would be made and the succeeding impulses diverted from the lock into the switch. Upon the switch being thrown, the mechanism was restored to zero and everything stood at readiness for the next operation.

From this description it will be seen that no lock could work through its phase to close its contact and operate its switch unless the disc on the transmitter was cut with exactly the same sequence of teeth as that upon the particular lock, for if the disc rotating on the transmitter did not make and break the current in conformity with the teeth on the lock, the armatures of the latter, not finding the same sequence of teeth to engage with, would throw out the wheels of the lock, and thus no contact with the switch be made. On the contrary, if the disc making and breaking the circuit on the transmitter corresponded for example with the wheels on lock A, the armatures on the latter would at each impulse from the transmitter advance the wheel-shaft by just that much, until, upon the completion of the "combination" the contact points would be closed and the last impulses from the transmitter would throw the switch and cut the lights in or out as the case might be.

The practical operation of the system seemed to be simplicity itself. Calling the locks A, B, C and D for convenience sake, and remembering that the wheels of each lock were cut to a different combination, it will be seen how little effort was necessary to extinguish the lights at a distance. If the disc corresponding to lock B was placed upon the transmitter and set in motion, it would make and break the circuit in accordance with the teeth cut upon it. These impulses passed over the wire running through the locks, and the armatures of locks A, C and D not finding teeth on their wheels to correspond with the transmitted impulses, threw the wheels of those locks back to zero and accomplished nothing. On lock B, however, as the armatures moved in response to the transmitted impulses, they met with teeth exactly corresponding in position to the impulses received; with each stroke the wheel-shaft was advanced until at the close of the combination the switch was brought into circuit and the final impulses from the transmitter threw it in or out. When this was done lock B also reverted to zero and all were ready for another operation. The fact was demonstrated beyond all cavil that only one lock would operate at a time, and that under no circumstances would any other lights be affected than those controlled by that one lock. The arc lamps on Main street to which the locks were attached (see Fig. 2) were cut in and out at intervals of a few seconds, while those on either side of them indicated no disturbance whatever of their own illumination. The wire used in practice by the company for connecting up its locks is of No. 12 size, and is either returned or grounded, as may be preferred. The current used to operate the exhibition we have described was the house current of the Iroquois Hotel. In practice the company winds its magnets to conform to whatever current its customers may find convenient to employ. At Buffalo the instruments were erected in multiple, but it is desirable to wind them for series whenever possible. So far as we could observe, all the necessary precautions have been taken for proper insulation, etc., and for regular service the machines will be mounted on slate bases and securely protected from the weather by iron covers. They are about 6 inches wide and deep by 9 inches high, and can be attached either to poles or buildings as may be necessary.

The advantages claimed for this invention are that it enables several classes of lights to be worked on the same circuit, and permits the operator in the central station to cut each class off or on in accordance with contract requirement without affecting the other lamps on that circuit. This would involve a considerable saving in mileage of circuit as well as in maintenance, and effectually prevent the unwarranted use of current. It is also claimed that distant groups of lights can be economically controlled from the central station, and that commercial and city lighting as well as motor work be done off one circuit when it would not pay to run more than one. The practical men who examined the system had many usages to propose for it, and to all appearances it will prove a valuable and efficient adjunct to many classes of electric light work. We understand that another important development of this principle will shortly be brought before the public.

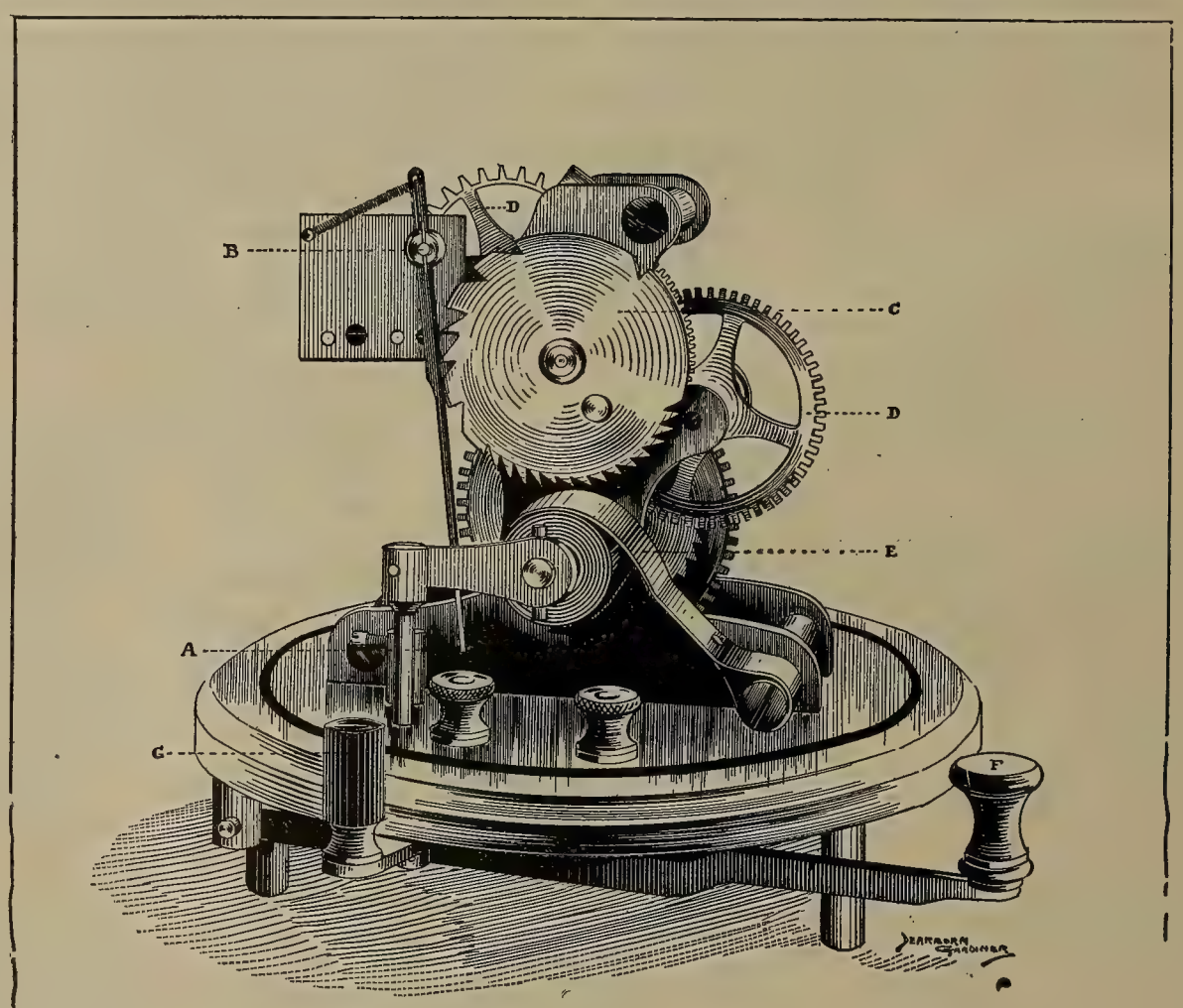


FIG. 3.—THE TRANSMITTER.

Referring to our illustrations, Fig. 1. shows the apparatus as exhibited and practically operated in the company's parlors at the Iroquois Hotel, Buffalo, during the recent convention of the National Electric Light Association. Out of the windows of the

corner room could be easily seen the lights on the pole on Main street which were controlled by the transmitter in the room, and the practical operation of the system could thus be encompassed at a glance.

Fig. 2 shows the pole to which the two arc lamps were attached, the two small boxes below the cross-arms containing the "locks." Fig. 3 shows the "Transmitter," and fig. 4 a "lock" and switch.

THE FUTURE OF THE TELEPHONE.

"The Future of the Telephone Industry" is the title of an interesting article by Herbert Laws Webb, in the March number of the *Engineering Magazine*. Considerable speculation has been indulged in recently by newspapers, concerning the effect on the telephone business of the expiration of the fundamental telephone patents. These fundamental patents control the telephone receiver, and regarding them Mr. Webb says :

"It appears to be the general belief that when these patents no longer exist, when the public has the free right to make, install and use the Bell telephone, and to transmit speech by means of undulatory currents of electricity, and the mainstay of the business controlled by the American Bell Telephone Company will have disappeared, and that what the newspapers love to term the "grinding monopoly" will be robbed of its powers to grind and to monopolize. The extraordinary sensation which the newspapers managed to evolve from the tardy issuance of the Berliner transmitter patent has lent considerable color to this view.

"In holding to such a belief, the public and the newspapers have stood still for about 12 or 15 years. If, say, in 1880, or even a few years later, these two patents had been given to the public, the telephone company would have been robbed of its stock in trade ; but to assume that at this date, or rather two years hence, when the second of the two patents will expire, the same conditions can hold good, is to shut one's eyes entirely to the real facts of the case. If a young firm were to start out in business with a very small capital, its business might easily be ruined in the early stages by the withdrawal of that capital; but if the firm prospered and in the course of ten or twelve years built up an enormous business with widespread connections and a large market for its wares, any man of affairs would smile at the idea of such a firm being seriously hampered in its operations by having to refund the original small amount of capital that enabled it to begin its business career.

The American Bell Telephone Company started out with a very insignificant capital, in the form of a few patents to which nobody but a few wise and discerning spirits attached any particular value. Of course there were discerning spirits on each side, among those who held the patents and among those who wanted them or thought that they had a right to them, and a fight for their possession ensued. By

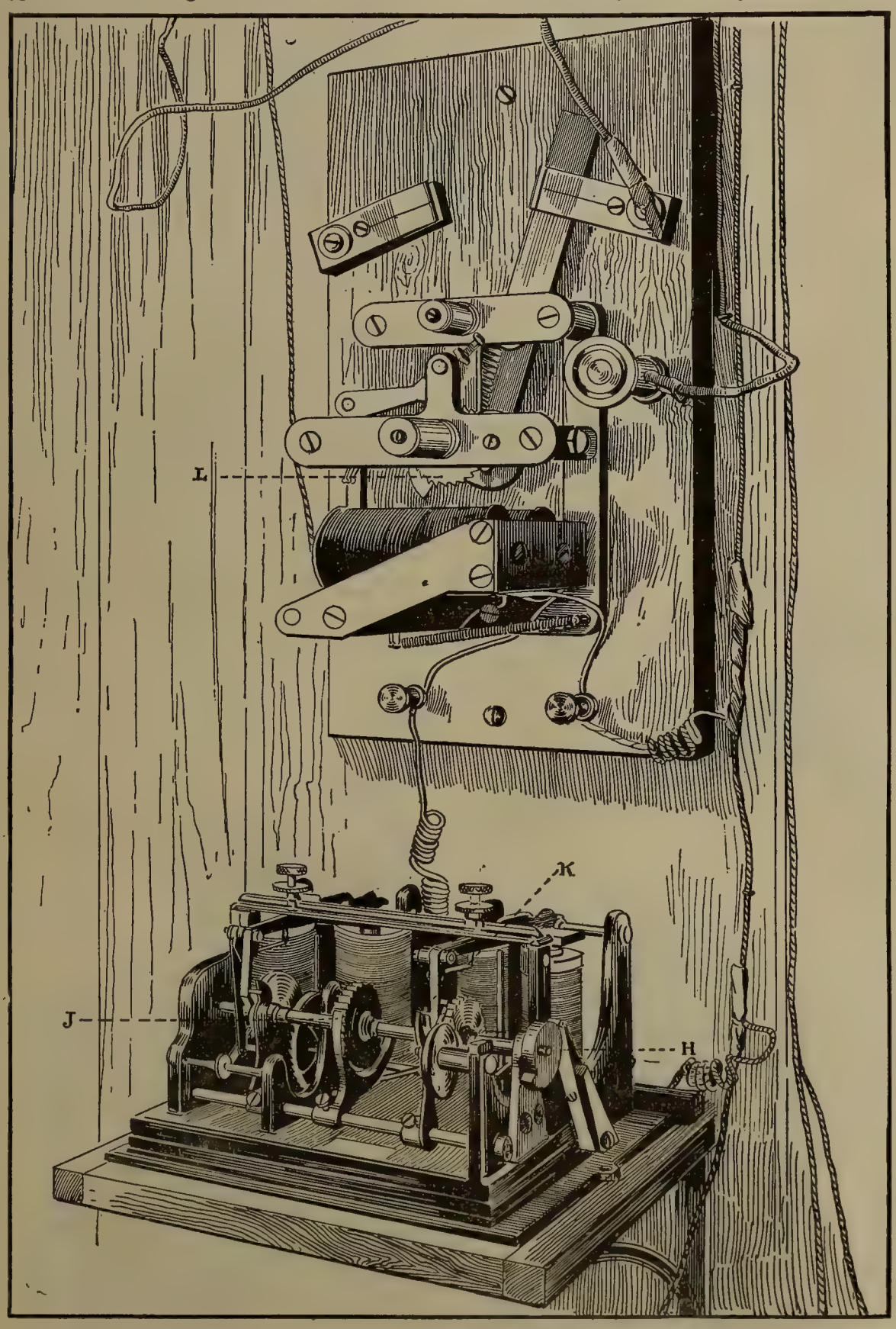


FIG. 4—LOCK AND SWITCH.

and by the knowledge spread abroad that the patents formed the corner-stone of an industry of great commercial importance, and the fight waxed hotter and fiercer. How the contest was eventually decided is a matter of history and needs no repetition or comment. The telephone company vindicated its right to the possession of the patents and proceeded to build up a vast and powerful industry. The fundamental patents were the nucleus and foundation of this industry, but they no longer hold the same important relation to it that they did in former years. They do not form the key-stone of the telephonic arch, as the public and the newspapers appear to believe that they do.

The expiration of these patents will undoubtedly have a certain effect on the telephone industry, at any rate on some branches of it, which will redound to the benefit of the public. On the principal branch of that industry—the supply of the telephone service in large cities—it will have very little effect, if any. If the public looks for competing systems in large cities in the course of the next few years, it is moderately certain that the public will be disappointed. It does not need a very deep analysis of the telephone industry to prove this, as will presently be shown. On the other hand, what is known as the private line business will receive a marked impetus. At present, all private lines and all telephone instruments used in buildings, private and public, are rented from the telephone companies ; but with the expiration of the fundamental patents, the telephone proper and the right to use will become public property. Telephones are not expensive to manufacture nor difficult to install, and there is no reason why private telephones should not very soon become as common as electric bells.

The telephone industry proper, *i.e.*, that of supplying telephone service in large cities, is quite a different matter. It is an industry that has been built up laboriously, step by step and year by year, upon the slender foundation of the Bell telephone, which now forms a comparatively insignificant item of the total equipment of a large telephone system. It is an integral part of the equipment, of course, but the importance of its position has dwindled until it occupies that of a mere accessory in a vast and complicated organization of apparatus. All this apparatus, the product of years of invention, research and experience, is protected by patents which belong to the telephone interests; much of it is indispensable to the efficient operation of large telephone exchanges. The equipment of these large exchanges and the construction of the general plant of a large telephonic system have been a work of slow growth, carried out under continually changing conditions and at an enormous cost. A telephone exchange to-day is something entirely different from a telephone exchange of five years ago ; it would be safe to mark a shorter period of transition and to say three or four years, but it is generally held in telephone work that the plant undergoes almost a complete change in every five years.

We are generally informed through the newspapers that the telephone companies suppress the improvements that are continually introduced in the apparatus used by them. Like much of the information disseminated through the same channels this is entirely untrue. During the past few years so many improvements and modifications have been made in every detail of the equipment of telephone exchanges, that they amount practically to a complete remodelling of the system, while the extensive introduction of underground wires has wrought a radical change in telephonic engineering and has necessitated the designing and erection of special telephone buildings, of which there are four now in New York City alone. In having forced on it these constant changes and rapid revolutions in its plant, involving large expenditures of capital, the telephone company stands quite alone among the corporate servants of the public ; for it must be borne in mind that such changes are not solely accounted for by additional business nor absolutely rendered necessary by the increase in the number of subscribers, but are brought about by the introduction of improvements in the methods and apparatus, which, by increasing the efficiency of the service, render it more valuable and place the telephone exchange industry on a firmer basis. There is no public service which is liable to the upheavals that occur in the telephone business and there is none that is the object of such constant modification and improvement."

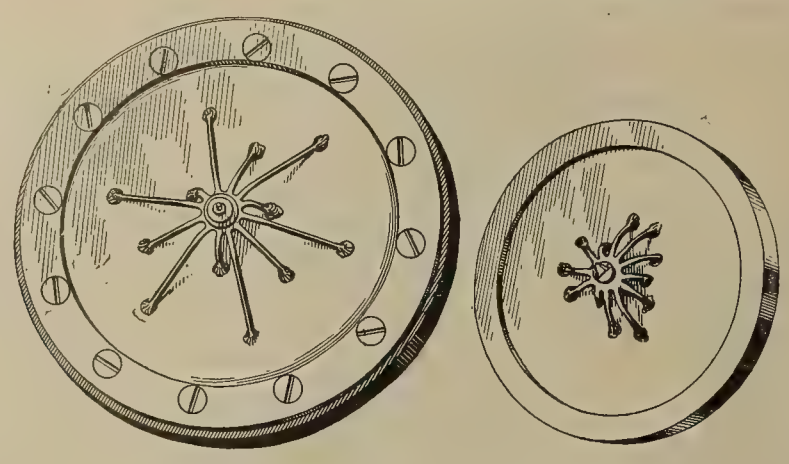
NEW STATION.

Work is being pushed with all possible speed on the reconstruction of the Boston Electric Light Company's plant on Ferdinand street, Boston, which was recently destroyed by fire. The new building will be thoroughly fire-proof. The roof is to be of iron beams with 2-inch planking and ⅞-inch boarding, the flooring will also be of iron, with brick arches. The floors and roof will be supported by iron columns. A new freight elevator, with platform nine feet square, will be put in, and iron staircases will take the place of the old wooden ones. The use of shafting will be entirely obviated. The engines on the ground floor and dynamos on the first story will be directly connected, the belt-boxes to be of iron. The heavy engine formerly used has been disposed of, and in addition to the smaller ones now remaining, five 200-horse power engines of the Armington & Sims pattern, will be added. The boiler-room was not affected by the fire, and the battery will be increased by the addition of two 250-horse power boilers. The plant will be complete in every respect, the ground floor to be devoted to the engines, the fire-room being in the rear, the first story will contain the dynamos and the top room will be utilized for storage purposes.

A NEW PHONOGRAPH.

To Edison belongs in all fairness the honor and glory of having been the first one to invent a machine which would record and reproduce the human voice and other sounds, and ever since the introduction of his phonograph in 1877 many people have been trying to construct a similar apparatus, but in vain. They only succeeded in making improvements in the recording mechanism, the scientific principle ever remaining the same.

At last, however, success seems to have crowned the labors and perseverance of one who has been diligently at work for the past three years, in the person of Lieut. Gianni Bettini, who has invented a machine, which he designates as the micro-phonograph.



Reproducer Recorder

of Lieut^ant Bettini's Micro-phonograph.

The underlying principle of his phonograph is to be really found in the diaphragm. As the result of his researches, Lieut. Bettini discovered that the diaphragm did not vibrate as a whole, but in numerous small sections which happened to be in sympathetic unison with the vibrating organs of the voice or tones directed against it. This led him to make use of a device termed a "spider," which consists of a little frame having several legs, the feet of which rest upon the diaphragm at different points and distances from the centre, instead of having the needle point fixed directly and firmly to the centre, as has hitherto been the practice.

The value of this device is easily explained and understood. Let us suppose, for instance, the centre of the diaphragm not to be in sympathy with some particular sound directed against it and some other section to be exactly so, through the medium of the spider leg resting on that section, the needle would be caused to respond, and not only is the whole diaphragm utilized but the sounds are reproduced with a greater volume of intensity than could be accomplished by the use of a single point of contact only. By its use record of a much larger number of voices and musical instruments may be obtained.

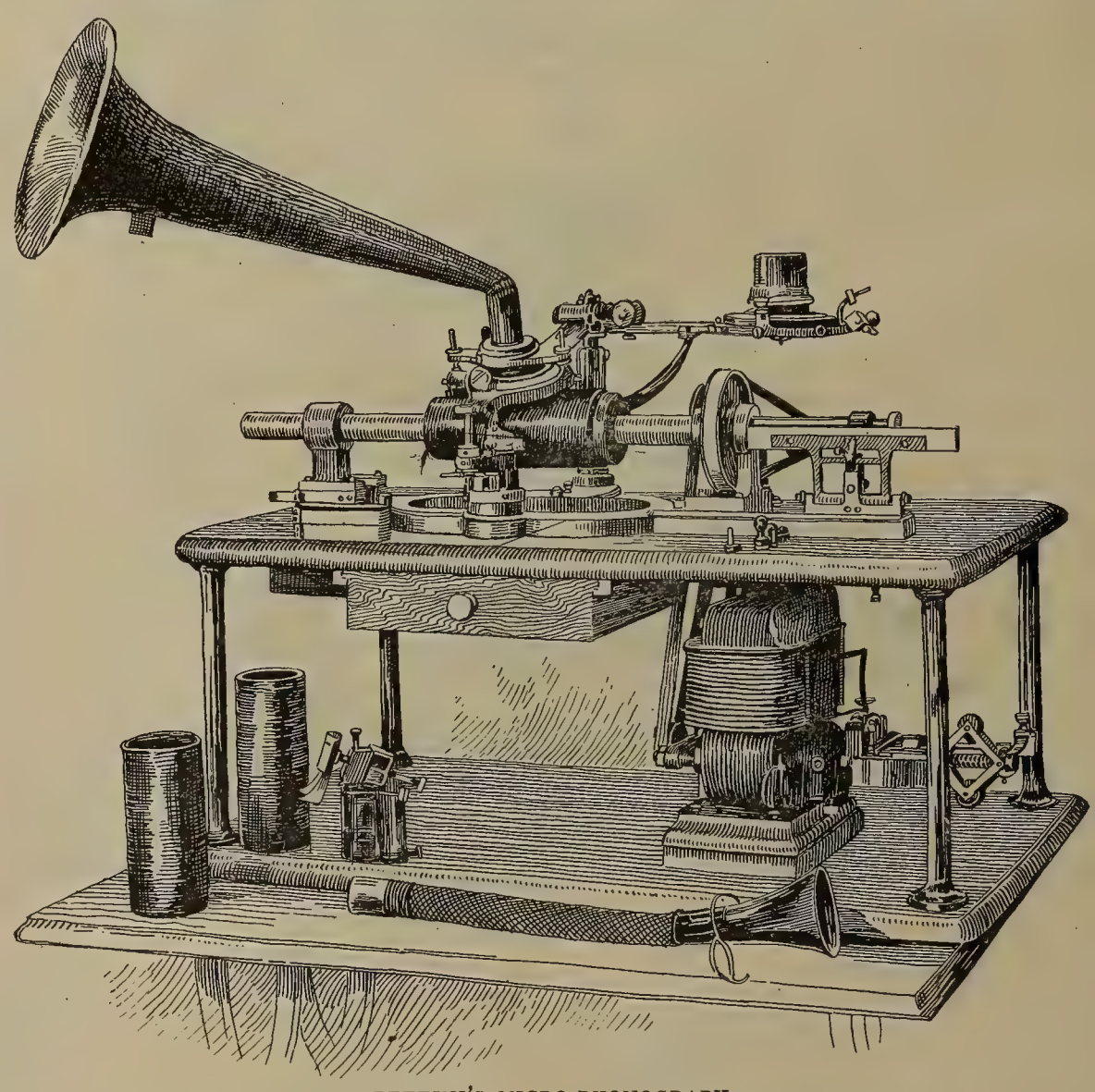
Our first illustration represents the arrangement of the "spider legs" on the diaphragms, the illustration on the left showing the attachment on the reproducer, and that on the right the recorder.

Those who have heard the instrument reproduce the sounds recorded on it state that their volume and distinctness are marvellous, and that it far surpasses the Edison phonograph in this respect.

Lieut. Bettini has rooms in the Judge Building in this city, which are daily visited by scientists and others interested in this novel invention.

Sarah Bernhardt was a recent visitor and spoke into the micro-phonograph. Her words were reproduced with startling clearness and distinctness, and the great Sarah, it is said, was charmed with the result.

Our second illustration gives a view of the micro-phonograph. The recording and reproducing parts of the apparatus, it will be noticed, much resemble those parts of the Edison phonograph, which is a familiar object to all. It is operated by a small Perret motor.



BETTINI'S MICRO-PHONOGRAPH.

THE FIRST TELEGRAPH.

One of the very few persons alive who were prominently connected with the electrical investigations of early days is Dr. Philip Ten Eyck, of Albany, N. Y.

Dr. Ten Eyck was born in Albany March 10, 1802, and is consequently 90 years of age. During his boyhood he was the companion of Joseph Henry, and they attended school together. In 1826, while Henry was Professor of Natural Philosophy and Mathematics in the Albany Academy, Ten Eyck spent his spare moments in the laboratory of the academy, in company with Henry, studying and investigating matters pertaining to the natural sciences. Ten Eyck, who was then a practising physician, abandoned his profession and devoted his entire time to scientific investigations.

While Henry was engaged in the upper rooms instructing his classes in natural philosophy, Ten Eyck was in the basement experimenting with the crude instruments that he had at hand. As opportunity offered between classes and after school hours, Henry would run in to see how Ten Eyck was progressing. The suggestions that led to the experiments in electro-magnetism were of the united minds of Ten Eyck and Henry. Ten Eyck borrowed 1,000 feet of copper wire from the firm of Pruyn, Wilson & Vosburgh, hardware merchants on State street, and arranged it around the upper room of the academy, known as the chapel. Ten Eyck got the instruments in order and made the first experiment by which a current was passed through the wire that sounded the alarm bell that electrified the world. On the sounding of the bell Henry was greatly agitated. To use Dr. Ten Eyck's own words, "Henry was wild when he heard the sound of the bell." There are substantial reasons for believing that these experiments would not have been successful without the unremitting labor of Ten Eyck.

The apparatus used is described by Prof. Henry as follows: "I arranged around one of the upper rooms in the Albany Academy a wire of more than a mile in length, through which I was enabled to make signals by sounding a bell. The mechanical arrangement for effecting this object was simply a steel bar permanently magnetized, of about 10 inches in length, supported on a pivot, and placed with its north end between the two arms of a horse-shoe magnet. When the latter was excited by the current, the end of the bar thus placed was attracted by one arm of the horse-shoe and repelled by the other, and was thus caused to move in a horizontal plane and its farther extremity to strike a bell suitably adjusted."

Regarding this experiment Prof. A. M. Mayer says: "This was the first electro-magnetic telegraph which had been worked through so great a length of wire; it was the first telegraph in which an electro-magnet had worked successfully; it was the first sounding electric telegraph."

In November, 1832, Prof. Henry resigned his professorship in the academy and accepted the professorship of natural philosophy in the college of New Jersey at Princeton. Dr. Ten Eyck was selected to fill the vacancy, which he did with rare ability and distinguished honor until 1848, when he retired to private life. Being possessed of sufficient income, he has since that time devoted himself to the business of his estate and quiet scientific research.

Though Dr. Ten Eyck's brain and hand had largely to do with the great discoveries in electro-magnetism, it is thought by Ten Eyck's friends somewhat strange that Prof. Henry never made any public acknowledgments of the great assistance rendered him by his early friend and associate.

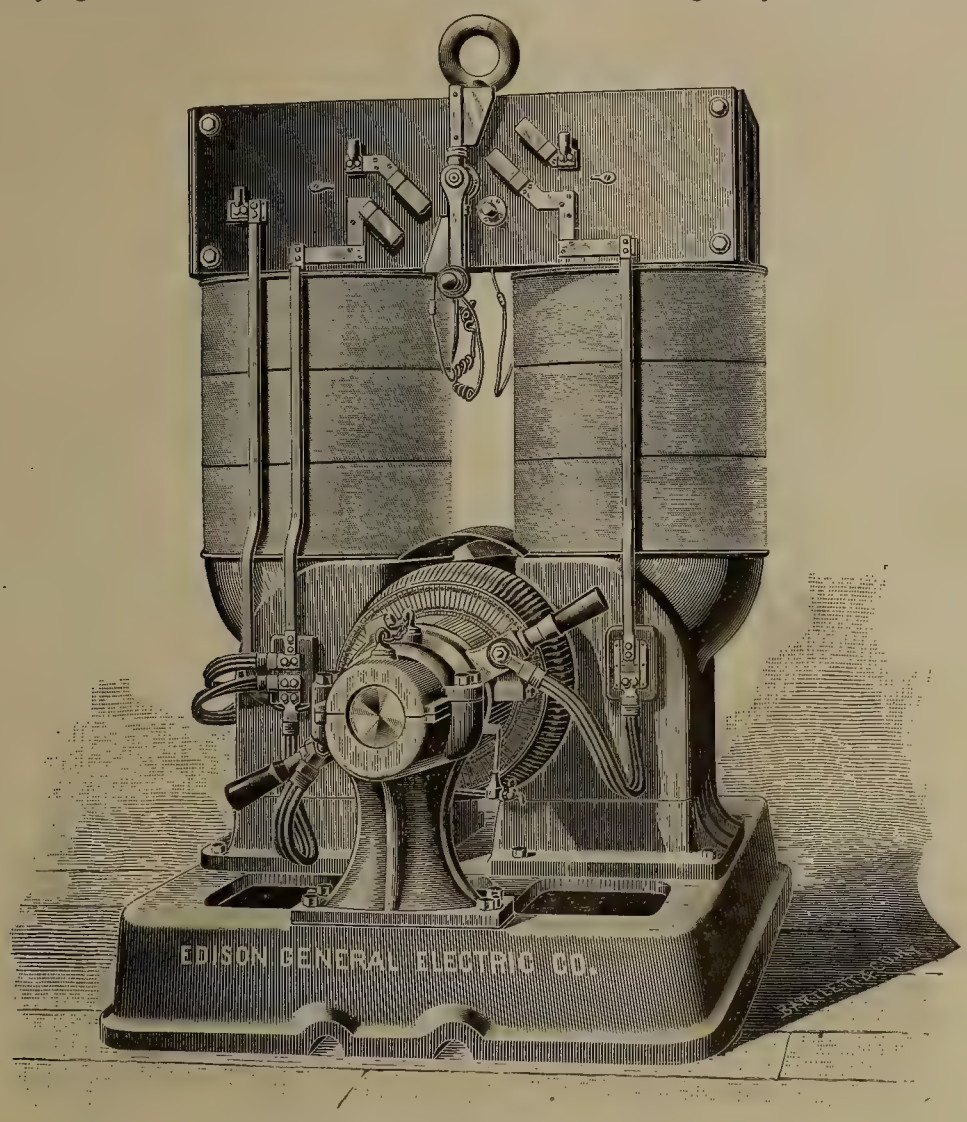
Dr. Ten Eyck has been so modest and so indifferent to his claims in connection with this matter, that he has repeatedly refused to be interviewed on the subject; but there are a score or more of old residents of Albany who were students at the academy at that time, who remember the circumstances which culminated in the great discovery in 1831, and the part taken in it by Prof. Henry and Dr. Ten Eyck respectively.

In the memorial address delivered by Dr. Edward N. Dickerson, June 16, 1885, presenting to Princeton College a tablet designed to commemorate the contributions to the electric telegraph of Prof. Henry, that gentleman, in referring to the means possessed by Henry as compared with those possessed by Faraday, pays this honest tribute to Dr. Ten Eyck: "For thirteen years Faraday had been pursuing his investigations amply supplied, and was in the full career of successful experiment when, in 1826, his great rival first looked upon the course over which he was to run; and even then Henry had to depend upon the meagre facilities of the Albany Academy and the voluntary assistance of an appreciative physician, Dr. Philip Ten Eyck, of Albany—a name to be held in grateful remembrance by all who feel a pride in the achievements of the great scientist, whose early efforts were assisted, and whose hopes encouraged, by this enlightened friend."

Dr. Ten Eyck resides at 9 Hall place, Albany, and enjoys the distinction of being the oldest native-born Albanian.

IMPROVED GENERATOR.*

The elimination of objectionable features from electric lighting and electric power apparatus, and the introduction of improvements, is the present aim of all manufacturers of electrical devices. We show in the accompanying cut an Edison 200 kilowatt



IMPROVED EDISON GENERATOR.

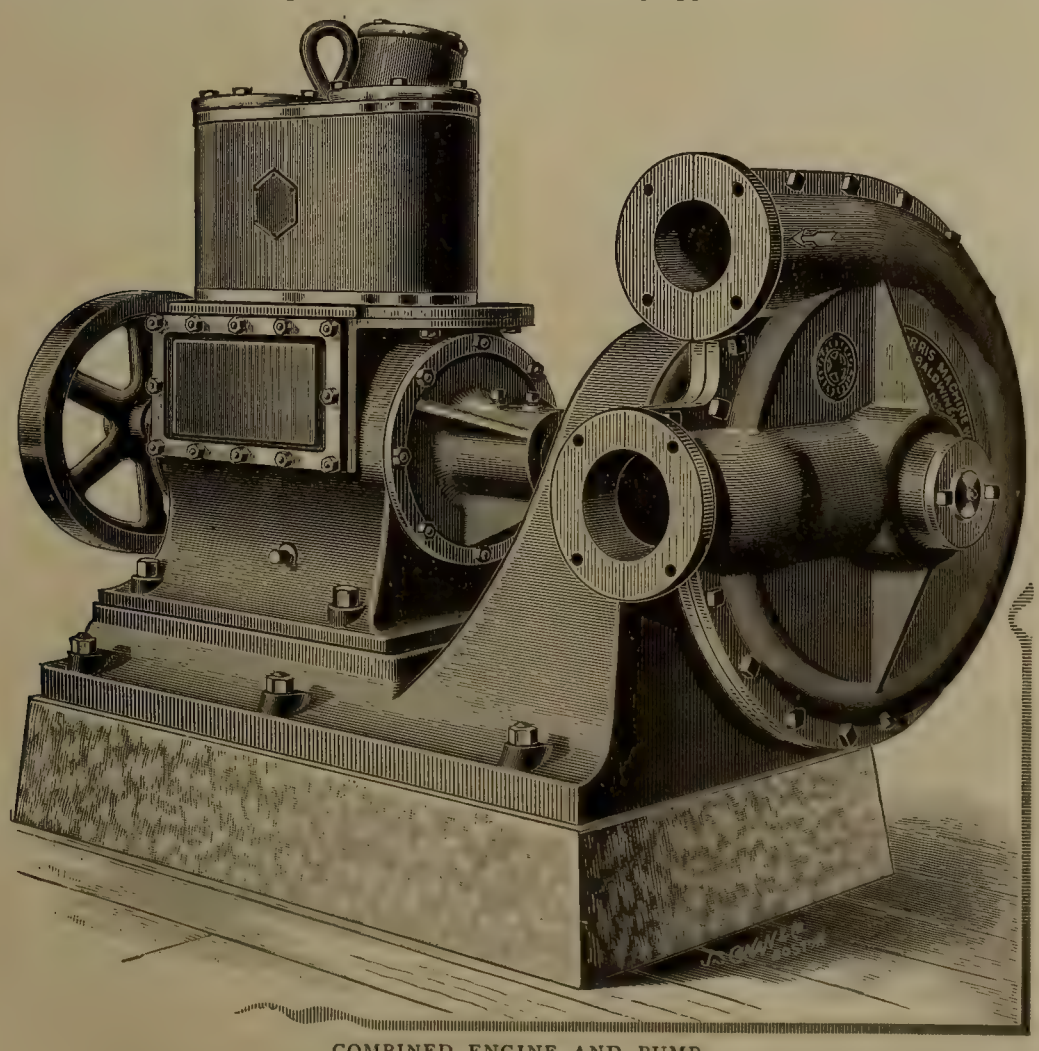
generator of the latest form illustrating this. It is of the well-known bi-parlor type, with the general features of which every practical electrician is acquainted.

The series field is built up of sections, wound on spools which are slipped over the cores and then properly connected up. Should a fault manifest itself, it can be located, and the spool in which it appears can be removed, repaired and replaced, or another substituted at once without loss of time. Expenditure for repairs is thus reduced to a minimum.

To adapt this generator to the demands of electrical railway service, the field has been provided with a compound winding, easily adjusted to meet the necessary requirements by means of a shunt coil, conveniently placed in the back-board of the keeper. The bearings being located close to the base frame, the centre of gravity of the armature is low and great stability is thus secured. Self-oiling bearings and carbon brushes contribute to diminish the attention necessary to the operation of the generator to a minimum.

A considerable number of these high capacity generators have already been installed throughout the country, and the advantages they offer have been duly appreciated.

* Edison General Electric Co., New York.



COMBINED ENGINE AND PUMP.

COMBINED ENGINE AND PUMP.

Before the introduction of high-speed engines, in order to operate centrifugal pumps it was necessary to connect the latter with the engine by means of a belt. Now pumps of any size are run direct from a high-speed engine.

The accompanying illustration shows a contractor's outfit, consisting of a Standard Westinghouse engine and a Morris Machine Works centrifugal pump coupled together. The following are the advantages claimed for this outfit: compactness; lightness, considering capacity; efficiency, giving a greater quantity of water for a given amount of steam in the engine, and simplicity and reliability.

The construction of the pump is such that the passage of solid matter found in water is allowed, as the pump contains no valves or moving parts that will give trouble or be liable to wear.

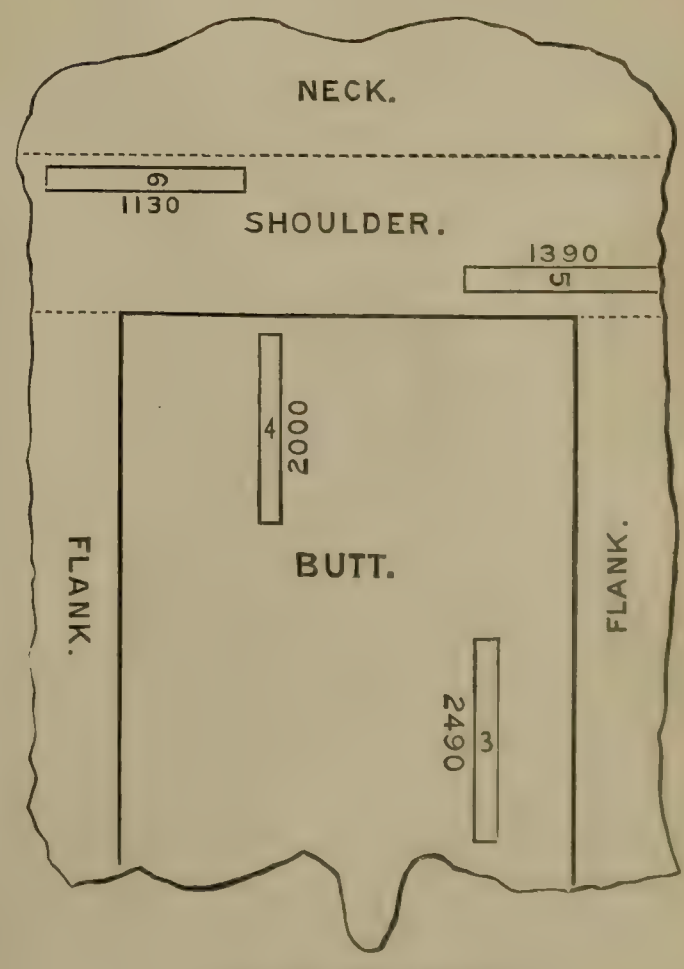
This style of outfit has found favor in tanneries, where a composition pump is used to resist the ravages of the tan liquor; for circulating purposes on ship-board, and circulating brine in freezing tanks of ice machinery; for raising sand and gravel from river-beds, and conveying it ashore by means of a discharge-pipe; for dredging and filling at one operation; for irrigation and drainage purposes; and, in fact, for thousands of places where the maximum quantity of water is to be moved at the minimum of expense.

The pump is manufactured by the Morris Machine Works, of Baldwinsville, N. Y., while the engine is made by the Westinghouse Machine Co., of Pittsburg, Pa.

LEATHER BELT MAKING.

At the meeting of the Polytechnic section of the American Institute of New York, on Thursday evening, March 17, Mr. Chas. A. Schieren read a paper on the "Art of Tanning Leather and Making Belting." He showed in the lecture the various processes through which a hide passes in the tannery, all of which were beautifully illustrated by lantern slides. The various departments through which the hide passes in the tannery, the machinery used for manipulating the leather, as well as the grinding and leaching of the bark, were illustrated and thrown on a large canvas by lantern slides. This made the lecture doubly interesting because the audience could get a clearer idea of the manipulation of leather in the tannery.

In the making of belting Mr. Schieren showed a hide of leather from which were taken four pieces of equal length and width; they had been submitted to a test by a powerful testing-machine of the Fairbanks Scale Co., of New York. These pieces were all eighteen inches long and two inches wide, and were numbered. Number three, being cut from the lower part of the centre, broke at 2,490 pounds strain, which would give the piece a transverse strength of 14,940 pounds per square foot. Number four, cut from the upper part of the centre of the hide, broke at 2,000 pounds. Number five, cut from the lower part of a shoulder-piece, broke at 1,390 pounds. Number six, cut from the upper part of a shoulder, broke at 1,130 pounds.



LEATHER BELT MAKING.

The lecturer explained that very many belts were sold and offered in the market which were made

from one piece of centre on one side and a piece of shoulder on the other side. He clearly proved that such belts were defective because of the shoulder being so much more liable to stretch, and not being able to withstand the strain of a centre-piece by at least 43 per cent., it would be a serious mistake to put the two pieces together for transmission of power, on account of the unequal tension. A belt would be superior if two shoulders were used, or two centre-pieces, separately. He claimed that a belt made from two centres could withstand a transverse strain of nearly 26,940 pounds to the square foot, whereas a belt made from shoulders would hardly stand 15,120 pounds strain, and such belts would not be reliable, especially on dynamos or swift running machinery; in fact, for almost any drive where a belt is subjected to severe strain.

LIGHTNING ARRESTERS, AND THE DISCOVERY OF NON-ARCING METALS.*

BY ALEXANDER J. WURTS.

In designing the arresters already described, I had followed closely the rut of previous practice, which had always been to provide with each discharge circuit a circuit-interrupting device. Upon reflection, however, it was evident that one circuit-interrupter placed in the main-circuit would interrupt the arc on any discharge circuit. For a moment the problem of a simple pole arrester seemed solved, but on second thought the difficulties and inconveniences inseparable from any automatic main circuit interrupter appeared to be insurmountable, and the idea was no sooner conceived than it was abandoned. And yet, poor as it was for practicable purposes, it proved a good stepping-stone, and led to the following plan, viz.: To provide the line with ordinary discharge-circuits, that is, with the well-known saw-tooth protectors, made of carbon, so that they would not easily burn away; and then in the station, between the generator and the first discharge-circuit, provide an automatic device which, upon the passage of an abnormal current from the generator, would instantly short-circuit the dynamo and as quickly open again, the intention being that should a short-circuit occur out on the line through any of the discharge circuits, a short-circuit at the dynamo would so reduce the pressure on the line as to render it impossible for an arc to maintain itself. Then, any such arc having been extinguished, the short-circuit at the generator could be interrupted, and the service would continue as before. This idea meeting with general approval, steps were at once taken to put it to a test in the following manner: To a 1,000-volt alternator there was connected a circuit consisting of about 100 yards of line wire, and in this circuit there was placed a pair of carbon dischargers having saw-tooth edges, and a ^{1} in. air gap, also a switch. In shunt with this circuit, that is, directly across the terminals of the generator, there was connected a single device (it will not be necessary to explain its construction) which, upon the passage of an abnormal current in the circuit containing the dischargers, would instantly short-circuit the generator and as quickly open again. All the connections being made, the air-gap was bridged with a bit of tinfoil to start the arc, and the switch thrown. The actions that followed in an inconceivably short space of time were these: The tinfoil burst with a snap, an arc was formed, the automatic short-circuit device operated, the arc was extinguished and the short-circuiting device opened. So far, this was exactly what was anticipated, but no sooner had the short-circuiting device opened and the electromotive force returned to the line and the dischargers, than the dynamo pressure forced an arc across the air-gap once more, and the whole operation was repeated. This repetition was found to be due to the fact that when the arc was first established between the carbon saw-tooth plates, the carbons were heated to a white heat, which, not having time to dissipate itself before the pressure returned, the dynamo current found a sufficiently easy path over the heated air-gap to re-establish an arc. However, the test being otherwise satisfactory, success seemed assured, for all that was necessary now was to use solid metal dischargers that would readily conduct the heat away, and the trouble above cited would no doubt be avoided. So the test was repeated, using the same apparatus as before, except the dischargers, which now consisted of three solid, round, brass rods, 1 in. in diameter and 1¼ in. long, placed side by side with their axes parallel to each other, and having air-gaps of $\frac{1}{16}$ in. That is, the line was connected to the two outside bars, leaving the middle one idle to be connected to ground, as would be the case in a double-pole lightning arrester. The air-gaps were bridged as before with tinfoil to start the arc, and the switch thrown. The test was successful in the highest degree—too succcessful, in fact, not to arouse suspicion. So I thought I would repeat the experiment, and see how the dischargers would behave without the short-circuiting device. The result was an overwhelming surprise, for at the dischargers there was merely an insignificant spark scarcely larger than a pea. The experiment was tried again and again, with the same result. Any electrician would have predicted a brilliant display of fireworks. The most plausible theory advanced to explain this action was that the electric motor driving the dynamo being small, its speed was probably reduced to such an extent by the overload suddenly thrown upon it, that the electric pressure was at once reduced below that which would be necessary to maintain an arc across the air-gaps. On second thought this theory would have seemed improbable, but at the time it was accepted without a question. In a few days a test was again made, this time a small engine being used for motive-power, and the same results were obtained as before. The afternoon of the same day both engine and generator were charged, with like results. In the meantime a little reflection seemed to indicate that perhaps this strange action was not, after all, due to the slowing down of the motor, but to the possible cooling effect of the metal dischargers on the arc. With this idea in mind I had constructed a set of three dischargers similar to the first, but much larger, 2½″ diameter by 3″ long, thinking that if a little metal was good more would be better, and that perhaps with a large generator the mass of metal would have to be greatly increased to produce the results already obtained. This large discharger was connected to a 3,000-light 1,000-volt alternator; the air spaces were bridged as before; and the scene which followed beggars description. The large metal bars were melted like beeswax in a great ball of fire. My disappointment was keen, for I thought I was on the verge of making a discovery, and that in the previous cases the comparatively feeble engine had not been the cause of the action. Thinking, however, there could be no harm in melting up the smaller discharger, I connected it in where the larger one had been, bridged the air space, and threw in the switch. Imagine my astonishment on hearing an insignificant snap like the crack of a toy pistol, and seeing an arc as before no larger than a pea. I then pushed a nickel down into one of the air-gaps to short-circuit it, and leave only one air-gap for the arc, and tested again, with the same results. Two questions now presented themselves, viz., what were the differences between the large and small dischargers other than size, and why did the small discharger behave in this altogether unlooked for manner? The answer to the first question was readily found by tracing the two dischargers back to their source, and there learning that the larger one of the two was made of cast brass, containing certain proportions of tin and copper, and that the smaller one was made of hard-drawn brass containing certain proportions of zinc and copper. These facts at once established two differences between the dischargers other than mere size: one was, their physical structure, the other their composition. Which of these two differences caused the difference in their actions? A discharger composed of cast brass containing the same proportions of zinc and copper as the hard drawn brass discharger was made and tested, and found to work perfectly. It was thus determined that the physical structure of the metal had no influence in suppressing the arc. The important difference between the two dischargers then lay probably in their composition, and I was now rapidly becoming convinced that in brass, consisting of certain proportions of copper and zinc, there must exist certain properties which do not permit of an arc being maintained between two dischargers, even with the high pressure of 1,000 volts. It also occurred to me that possibly the shape of the dischargers had something to do with the results obtained. So the next step taken was to have a number of dischargers made up in different shapes and sizes, such as spheres, ovals, solid half-cylinders, tubes and cubes; all worked well with the exception of the cubes. The cubes were placed so their faces were separated by $\frac{1}{16}$″. Now when the tinfoil was placed over their edges, the action was favorable, but if the tinfoil were pushed down between the faces, the arc would hold on indefinitely, and yet without any demonstration whatever, thus, even when the arc did hold on, showing a very different action from the other metals. The size of the dischargers did not seem to affect the results so long as there was sufficient metal to prevent actual melting—¼-in. brass rod melted on the third trial. It was next decided to make dischargers of other metals, and thus learn whether there were any other substances that would give these results, and if so, perhaps some light would be thrown on the real cause of the action. The metals first tested were hard steel, hard-drawn copper, phosphor-bronze, aluminium bronze, and aluminium, all of which failed utterly. The next metal tested was zinc, and with this, most successful results were obtained. Perhaps you will now think the experimenter very slow to put two and two together, but who is there who is at all familiar with the properties of zinc, that would have suggested this metal as one likely to resist an electric arc and 1,000 volts in this manner? With such results before me, I was ready to try anything. The next metals were tin and nickel. Both of these failed. Tin made the most brilliant display of all the metals. The next tried was antimony, and it worked perfectly. The theory now advanced to explain the phenomena was that with the metals that do not allow the arc to be maintained there is formed at the instant the arc is started an oxide of the metal, which, becoming instantly volatilized in the intense heat of the arc, chokes up the air-gap with vapors of high resistance, and so presents an effective barrier to the further passage of the current. With metals that do maintain the arc, instead of the vapor of the oxide of the metal, there is formed a pure vapor of the metal itself, and this offers comparatively no resistance to the passage of the current. When tests similar to the above were made on a 500-volt direct current generator, every one of the metals failed. The arc, however, was small and quiet with the special metals, thus even with the direct current showing a very peculiar action. Another curious phenomenon connected with zinc and antimony is this: the smaller the air-gap the less tendency there is to maintain an arc when using an alternating current at 1,000 volts pressure. In fact, when the air-gap is two inches long the arc, when once started, will be maintained, while at ½ in. or ¼ in. the arc will not give up without a struggle, and at $\frac{1}{32}$ in. there is only a small spark caused by the fusing of the tinfoil, and the circuit is instantly interrupted.

The next step taken was to try higher pressure. A short circuit on a 2,000-volt generator, through the double air-gap discharger, failed to be interrupted; five and six air spaces also failed. Six air spaces of $\frac{1}{32}$ in. each interrupted the short circuit instantly, but six air spaces, which would make three on each side of the circuit for the lightning charge to jump through, were strongly objected to as offering too great a resistance. A test was then made to determine the pressure needed to strike an arc across three air-gaps, and was found to be 3,500 volts, measured with a Cardew on an alternating current generator. The experimenter then procured a lightning arrester well-known in the market, and one which is known to take the lightning discharge successfully, and tested it for the striking electromotive force, which was found to be between 8,000 and 9,000 volts. In order, however, to avoid any prejudice that a series of air-gaps might arouse, the following plan was hit upon: Pairs of non-arcing dischargers were mounted upon thermostatic supports in such a manner that the pairs would normally rest in contact with each other, and so that any current traversing the system would be forced to pass through the thermostats and dischargers in series. The thermostats were so arranged as to cause the two dischargers in each pair to open a way from each other upon the passage of the current. If, then, a single and permanent air-gap were connected in series with this system, that is, an air-gap just sufficient to prevent the normal pressure of the line from striking any arc, and if an arc were started across it, the sudden rush of current through the thermostats would instantly introduce a number of air-gaps in the circuit corresponding to the number of pairs of thermostatic dischargers, and thus automatically open the short-circuit. This device was tested and found to work admirably. Of course after the circuit has been interrupted, the thermostatic dischargers at once return to their normal positions. In fact, this action is so rapid that if a series of these dischargers be connected in a short circuit without a permanent air-gap, the circuit will be automatically opened and closed every two or three seconds. In order to appreciate the very remarkable action of this thermostatic device, it must be well borne in mind that a very small air-gap is all that is necessary for the interruption of the circuit.

Thus far, although I had tested a number of metals, my selection had been quite at random, so that by this time I was desirous of making a more thorough and systematic investigation of this new property. The chemical properties of zinc and antimony were carefully compared without any new light. The various groups of metals were examined, and then it occurred to me that of all the metals tested, not one of them belonged to the two groups in which zinc and antimony are found, according to Mendelejeff's grouping. The metals of the zinc group are, zinc, cadmium, mercury and magnesium, and of the antimony group are antimony, bismuth, phosphorus and arsenic. I first tested cad-

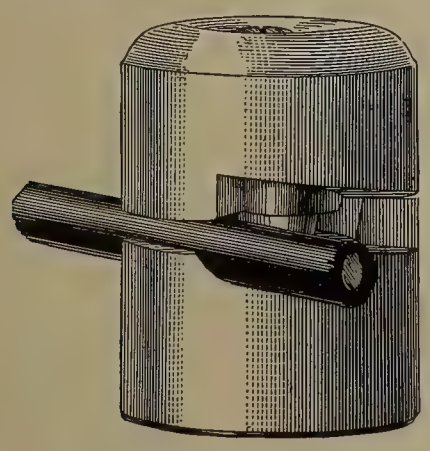
*Abstract of paper read before the American Institute of Electrical Engineers, New York, March 15, 1892.

mium, and found it non-arcing. Then magnesium —more, however, from a sense of duty than because I had hopes of anything but negative results. Fortunately I made this test on much lower E. M. F.'s, and found it non-arcing at 100 volts over two air-gaps of $\frac{1}{32}$ in. each. On 250 volts the magnesium caught fire, which was of course anticipated. I then wanted to try mercury, but for the moment, not seeing how to make such a test with a liquid, I was diverted to the antimony group, and upon testing bismuth found it to be non-arcing. Phosphorus and arsenic were not tested. A final attack was now made upon the zinc group by testing mercury in the form of a copper amalgam. This test was the most successful one of all, for after a number of short-circuits on a 1,000-volt alternator, I found the surface of my dischargers had not been disturbed in the slightest degree. It will thus be seen that all available metals in these two groups are non-arcing. In searching for the non-arcing metals each test was made with two air-gaps, and the E. M. F. at the time of the short circuit was, with the exception of the test on magnesium, 1,000 volts.

THE "SECURITY INSULATOR."*

A very decided improvement over the old style insulators is the one illustrated herewith, and called the "Security Insulator."

This insulator is based upon the mechanical principle of the inclined plane, which is relied on to grasp and hold the wire. In operation, the insulator is fastened in position with a wooden screw in



SECURITY INSULATOR.

the same manner as the old style; the wire is laid in the groove, the top-cap given a half turn and the work is completed. The wire will stay fast and uninjured in the insulator until taken out.

By its use the wires are strung parallel and strained perfectly taut, and a neat and workmanlike appearance assured, and again, it helps to guard against danger of fire.

The chief claims of superiority made for it are improved appearance of the installation, perfect binding of wire and saving of time and labor.

THE KNAPP-MILLER AUTOMATIC CURRENT REVERSER.

Messrs. Knapp & Miller, 840 Jessamine st., St. Paul, Minn., have recently designed a new "Automatic Current Reverser," or Polechanger, which embodies some very neat and important features. This machine is designed for use in the telephone service, experimental and testing purposes. It is capable of a wide range of speed and play between contacts. The larger size is built to carry 10 ampères in the external circuit, 50 to 110 volts. The smaller or pocket size, upon which the makers are experimenting, is intended to carry 3 or 4 ampères, and will be of convenient size for the pocket. The local or actuating terminals of both sizes will not require over 8 volts to work them at maximum power and speed. As the current is reversed by means of a vibrating armature having a play of from $\frac{1}{16}$ to $\frac{1}{4}$ of an inch, there is practically no wear, rendering the machine indestructible. Used in connection with properly-made induction coils, a high E. M. F. can be obtained and sufficient current to operate small lamps, gas-lighting, etc. Amateurs and others in search of a cheap and efficient machine for experimental purposes will find this a great success. Low cost and high efficiency are its chief merits. Recent exhaustive tests have met with very flattering results. The makers will in a short time be prepared to furnish these machines to the trade, wound for an actuating E. M. F. of from 10 to 110 volts, and solicit patronage from those interested.

THE BALL ENGINE CO., Erie, Pa., shipped, a few days ago, three 150 H. P. engines to the Westminster & Vancouver Tramway Co., Vancouver, B. C.

* Security Insulator Company, 136 Liberty street, New York.

MORE PAY, OR OUT GOES THE LIGHT.

Erastus Wiman, on behalf of the Richmond Light, Heat and Power Company, Richmond, Staten Island, informed Messrs. Powers, Connoly and Willcox, the New Brighton Trustees Committee on Street Lighting, that unless they agree to an increase in the price of arc lights from $80 to $100, and incandescent lamps from $15 to $17.50 per year, the company would be obliged to cease supplying the village on April 1.

Messrs. Powers and Connoly refused to consent to anything other than a renewal of the present contract. Mr. Willcox favored giving some consideration to Mr. Wiman's proposition.

NEW BOOKS.

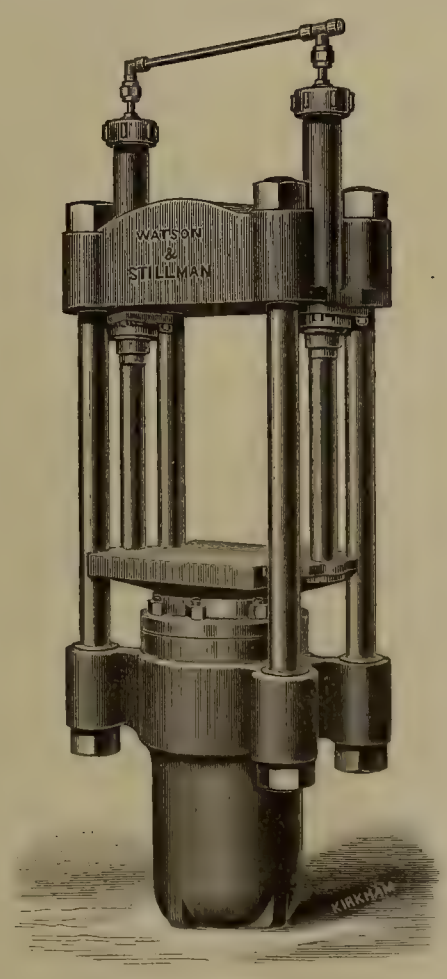
ARMATURE AND FIELD-MAGNET WINDING, by Edward Trevert, 113 pages, with 51 illustrations. Bubier Pub. Co., Lynn, Mass., price $1.50.

The object of this book is to describe in as simple a manner as possible the practical method of armature and field-magnet winding. But little attention has been paid to theoretical subjects, and the book will therefore be found invaluable to beginners and advanced students. It is divided into nine chapters, the subjects of which are as follows: The Armature in Theory; Form of Armature; Drum Windings; Field Winding; Field Formulæ; General Methods of Winding; Field Winding, Concluded; Dynamos; Motors.

The book is for sale by the ELECTRICAL AGE PUBLISHING CO., World Building, New York City.

REINFORCED CYLINDER PRESS.*

Our illustration represents a reinforced cylinder press with automatic reverse-action cylinders used for electrical work. The strain produced by the action of the beam on the cylinder is overcome by reinforcing the body of the cylinder and not by a separate yoke. Owing to the motion being too great to permit the ram being taken out for the purpose of repacking the cylinder without taking the press down, the packing is placed beneath a gland. On each side of the press, small downward-acting cylinders of twelve tons power are placed, by which the ram is



CYLINDER PRESS.

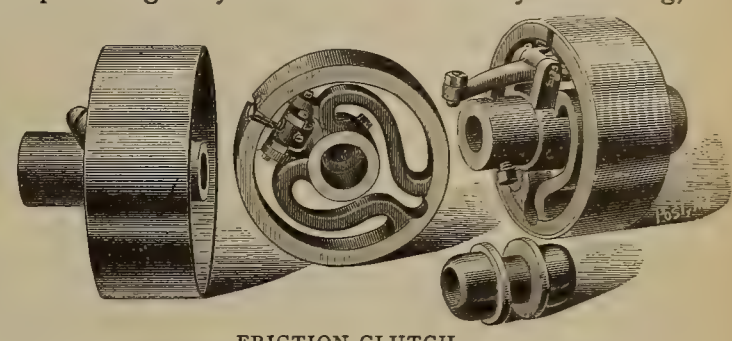
forced back very rapidly and steadily, also clearing the dies which may happen to be in the press if they should stick together. If desired, this cylinder and ram attachment may be placed on any of the presses made by this firm. The press shown in the cut is designed especially for fibre work.

THE 150 H. P. engine, furnished the Kittanning Electric Light, Heat and Power Co., was started a few days ago by F. R. Dravo & Co., Pittsburg agents of the Ball Engine Co., Erie, Pa. The engine gives universal satisfaction.

* Watson & Stillman, 204–210 E. 43d street, New York.

IMPROVED FRICTION-CLUTCH.*

The accompanying illustration represents a new improved friction-clutch, which has been designed especially to meet the requirements of this company's screw-machine and turret lathe work. By reference to the cut it will be seen that the friction proper consists of a spring-ring which is caused to expand by the drawing in of a taper-bolt, this bolt being operated by the usual finger and sliding cone. It will be seen that the friction-ring has no direct connection with the hub, being connected thereto by two curved arms, which extend as far as possible to the opposite side of the hub. The feature in question greatly increases the elasticity of the ring,



FRICTION-CLUTCH.

and allows it to fill in all directions, giving a perfect bearing. Double provision is made for taking up all the wear by means of the usual adjusting screw with set nut on outer end of finger, and also by screwing the taper-bolt into the nut, which is pivoted to the inner end of the finger. This allows of a readjustment, should the clutch wear sufficiently to use the full length of the outer screw, by simply screwing down the taper-bolt and returning outer screw to its original position.

The pulleys are made with long and ample bearings, the inner hub extending inside the friction beyond the face of the pulley, and is provided with an efficient self-oiling device.

These clutches have withstood the most severe usage, and have proved especially serviceable under high speeds and heavy loads, giving a quick and positive reversal with a smooth and easy motion. This latter feature is most important in countershafts, which are constantly reversed. These friction-clutches are made in three sizes.

LIGHTING THE WORLD'S FAIR.

The Chicago *Evening Post*, in its issue of March 16, states that there is good evidence of a combination having been effected between the electric lighting companies with a view to raising prices for the lighting of the World's Fair. It is said that but two bids were received in response to advertisements for the work of lighting the Fair; one from the Western Electric Company and the other from the Thomson-Houston Company. The bid of the former company was subsequently withdrawn, and the figure submitted by the Thomson-Houston Company, viz.: $38.50 per lamp, with a big bill of extras, was twice as high as the figure which Mr. Sunny, the general Western manager, had advised Mr. D. H. Burnham, chief of construction, they would be—$20 per lamp. The bid of the Western Electric Company was $31.25 per lamp.

It is further stated that the notification received from Mr. Sunny, that it would not cost more than $20 per lamp, was made while there was active competition in the field and before the present combination was effected between the Thomson-Houston and Edison General Electric companies. Previously the Thomson-Houston Company had the controlling interest in the Schuyler, Brush and Fort Wayne Companies, all of which were rivals to the Edison Company, which had an agreement with the Sperry Company to manufacture under its patents. We reproduce a statement made by an official of the Fair in connection therewith:

"All the actions of the electric companies in this matter," said an officer of the construction department, "go to prove that they are forming themselves into one big trust. That combination has already been effected, and inquiry about the market will show that electric arc lamps supplies of all kinds have been advanced in price during the last week from 20 to 25 per cent. They have taken advantage of their position to make a big raise on us. The Thomson-Houston Company proposes to furnish light to the Fair at $38.50 a lamp. None of their plant would be used for more than fifteen months, and the greater part of it only six. Under fair competition those lamps can be bought outright for from $41.50 to $45, and it has been done right along.

"The whole tone of their bid shows that they are in a trust and in position to demand whatever they like. They have even inserted in their bid a provision that they be given the sole right to sell lights

* Garvin Machine Co., Laight and Canal streets, New York.

to exhibitors, to renew the carbons and furnish all the other supplies that are required. The exposition officers count on doing that themselves, and will not allow the electric companies the privilege. Nothing was said about it in the specification sent out. The Thomson-Houston people simply wanted that right and demanded it. * * *

"The matter will go before the executive committee to-day and to the grounds and buildings committee to-morrow for settlement. * * * If they persist in trying to hold us up they may succeed in making a good start for Siemens & Halske, the German electricians, who have taken out articles to start a factory in this city. They have patents of their own that have been worked and tested in Germany under which they can manufacture here."

A SUBWAY COMMISSION FOR BROOKLYN.

A bill has been introduced into the New York Legislature by Assemblyman John O'Connor providing for the appointment of a Subway Commission for Brooklyn, N. Y. similar to that of New York City, the object of which is to cut down poles, bury electrical wires and exercise supervision thereof.

The Commission, in accordance with the provision of the bill, is to consist of two "disinterested" persons, each to receive an annual salary of $4,000. They are authorized to employ a sufficient staff of clerical and expert assistants to aid them in accomplishing the work of burying the wires.

NEW PUBLICATIONS.

Science and Commerce is the name of a new bimonthly publication which has just been issued in Paris, France. Its columns will be devoted to chronicling news items and reports of general interest to the electrical fraternity and trade, all technical subjects being avoided. In appearance it is neat and attractive, also well printed. The address of the publication is 24, Boulevard Poissonnière, Paris, France.

OBITUARY.

CHARLES J. VAN DEPOELE.

Mr. Van Depoele, who was well known in the electrical world as an inventor and practical electrician, died in Lynn, Mass., March 18. Mr. Van Depoele was born in Belgium in 1846, and came to this country in 1869, locating in Detroit, Mich. He began the study of electricity when 10 years of age, having access to the batteries and other electrical apparatus on the first telegraph lines between Poperinghe and Bruges.

Mr. Van Depoele is the inventor of the well-known dynamo to which his name is linked. In 1882 he made his first experiment in propelling street cars by electricity, and his first commercial road was equipped in South Bend, Ind., in the same year. In 1888 the company started by him sold its system, patents and business to the Thomson-Houston Company, whose service at the same time Mr. Van Depoele entered.

Mr. Van Depoele has devoted considerable time in recent years to electric mining machinery in addition to other subjects, and he is one of the pioneers in this country in the commercial application of electricity to the propulsion of street cars.

CAUSES FOR A DYNAMO FAILING TO START.

In the failure of a series wound dynamo to excite or yield a current, it may be inferred that the external portion of the circuit presents a very great resistance, which may be attributed to several causes.

If it be found that the armature circuits and insulation are in good condition, then the first place to look for the fault is in the brushes, which may not be properly adjusted to the commutator segments, and which in turn may be short circuited to each other. There is a layer of insulating material placed between the commutator segments which, if of such a substance as to readily absorb copper dust from the commutator, as asbestos, fibre or wood, will in turn become conductive. Such substances should not be used.

In new dynamos mica insulation of the commutators is now used, so that this trouble very rarely occurs in them. In some dynamos, however, they are insulated by air-gaps only, and the spaces between them soon become covered with a paste of copper dust and oil, and a connection thereby established.

The loss of current in a dynamo is presumed by many people to be attributable to dirty contacts or simply oxidized brass contacts of brushes with their brackets at the terminals; such however is seldom or never the case, but it may so happen that, owing to carelessness, the brushes may become coated with a tough film of oil gum, resulting in imperfect contact with their slides.

As the fault of non-starting may be wrongly laid to the dynamo, it is perhaps well to point out that imperfect contacts are likely to happen at fusible safety plugs, fixed for safety near the dynamo. These plugs are very often made of lead wire, pieces of which are placed between pairs of terminals. The use of lead wire is rarely satisfactory, it being almost impossible to secure good contact by its use with an ordinary binding terminal, because if subjected to a pressure it flattens out and is rapidly oxidized, finally burning out at the contact points. Where lead wire is used it should be soldered into brass tubes, so that a hard surface may be afforded for the terminal screw.

Not having been able to locate the fault near the machine, it should be searched for in the external portion of the circuit, beyond switches and cut-outs. It can very readily be determined if the fault actually lies within the machine—that is, within its terminals by short-circuiting it. The safest way of accomplishing this is to secure one end of a few yards of wire in one of the terminals, and bringing the free end against the other for but an instant only. If the machine be excited, a bright flash will mark the breaking of the contact, and sparking will occur at the brushes during contact.

NEW INCORPORATIONS.

Connecticut Pipe Manufacturing Company, Orange, Conn. (P. O. West Haven), was incorporated March 2, with a capital stock of $30,000. Among other things it will purchase, construct and operate electric-light plants. Incorporators: Ed. H. Phipps, New Haven, Conn.; William H. Childs, Manchester, Conn.; George O. Richards, West Haven, Conn.

Fond du Lac Electric Company, Fond du Lac, Wis., was incorporated March 5, with a capital stock of $100,000. Incorporators: F. B. Hoskins, E. A. Cart, William McDermatt, E. Coleman, D. D. Sutherland.

Consolidated Electric Company, Burlington, Vt., has been incorporated with a capital stock of $150,000. Incorporators: A. E. Richardson, U. A. Woodbury, Willard Crane, Edward A. Pope, all of Burlington, Vt.

Peninsular General Electric Company, Grand Rapids, Mich., incorporated March 7, with a capital stock of $30,000. Incorporators: T. C. Harmish, F. M. Champlin, Andrus Bevier, all of Grand Rapids, Mich.

Creede Building and Improvement Company, Amethyst, Col., incorporated March 7, with a capital stock of $10,000. Among other things it will establish and maintain an electric-light plant. Incorporators: George J. Shackelford, George J. Petterson, Alexander C. Foster.

Citizens' Power and Light Company, Ashtabula, O., incorporated March 7, with a capital stock of $5,000. Incorporators: A. J. Beckwith, Ed. S. Henry, R. M. Johnson, J. B. Topky, C. F. Schaffner, John P. Devney, H. M. Kunkle, W. S. McKinnon, E. W. Savage, A. F. Dickinson.

Northern Light Electric Company, St. Paul, Minn., incorporated March 8, with a capital stock of $40,000. Incorporators: H. M. Byllesby, H. C. Levis, William Ely Bramhall, B. F. Meek, Jr., W. P. Johnson, S. P. Wells, Jr., C. K. Stearns, all of St. Paul, Minn.

W. W. McMillan Company, Duluth, Minn, incorporated March 7, with a capital stock of $50,000. Among other things it will manufacture electricity for light, heat and power. Incorporators: W. W. McMillan, W. Horwood, R. Cox, J. T. Boyd, J. J. Burns, J. P. Fairgrieves, D. L. Johnson, all of Duluth, Minn.

Siemens & Halske Electric Company of America, Chicago, Ill., incorporated March 8, with a capital stock of $500,000. Incorporators: C. W. Meysenburg, Edwin F. Bayley, Otic H. Waldo.

Fort Dodge Gas, Electric Light, Heat and Power Company, Fort Dodge, Ia., incorporated March 8, with a capital stock of $50,000. Incorporators: John L. Martin, James S. Cummins, George M. Shearer, J. W. Campbell, L. Brandon, Ft. Wayne, Ind.

Champaign Rapid Transit Company, Chicago, Ill., incorporated March 4, with a capital stock of $50,000. It will operate electric lights and furnish power. Incorporators: John Ahern, S. A. Power, Clint C. Rush.

Helena Water Power Company, Helena, Mont., incorporated February 29, with a capital stock of $2,000,000. to generate electrical currents for manufacturing and other purposes. Incorporators: R. S. Vivian, Kansas City, Mo.; J. H. Lawrence, Ashbum K. Barbour, Helena, Mont.

Lawrence Manufacturing Company, Columbus, O., incorporated March 3, with a capital stock of $30,000. Among other things it will manufacture electrical machinery. Incorporators: William B. Lawrence, E. O. Jones, J. P. Bliss, Edgar W. Wasson, Clarence M. Jones.

Winona Light, Heat and Power Company, Winona, Minn., incorporated March 2, with a capital stock of $150,000, to construct and operate a plant to furnish electricity for light, heat and power. Incorporators: W. E. Bromhall, B. F. Meek, Jr., W. P. Johnson, S. P. Welles, Jr., C. K. Stearns, H. M. Byllesby, of St. Paul, Minn.

Idaho Electric Light and Power Company, Wallace, Idaho, was incorporated March 1, with a capital stock of $500,000 Incorporators: C. W. O'Neil, F. C. Loring, F. E. Lucos.

Pennsylvania Electric Engineering Company, Camden, N. J., incorporated March 2, with a capital stock of $25,000. Incorporators: A. L. Bosley, L. R. Schultz, G. H. Schultz, Philadelphia, Pa.; R. W. Tingley, Germantown, Pa.; C. V. D. Joline, Camden, N. J.

United States Volta Electric Battery Company, Charleston, W. Va., incorporated March 2, with a capital stock of $1,015,000. Incorporators: George F. Jackson, Mineapolis, Minn.; Ellery C. Tankersley, Brooklyn, N. Y.; D. S. Dolbear, New York, N. Y.

Electric Bleaching Company, Jersey City, N. J., was incorporated March 1, with a capital stock of $2,000,000. Incorporators: T. J. Montgomery, Larchmont, N. Y.; C. M. Bowley, Poughkeepsie, N. Y.; R. W. Elliot, Jersey City, N. J.

Puget Sound and Alaska Commercial Company, Seattle, Wash., incorporated February 27, with a capital stock of $25 000. Among other things it will construct and operate electric light and power plants. Incorporators: Lester Turner, Lauron Ingels, E. L. Skog, John Hill, Seattle, Wash.; John C. Boyd, Duluth, Minn.

Nolton and Adams Hardware Company, Port Townsend, Wash., incorporated February 27, with a capital stock of $20,000. Among other things it will deal in electric fixtures. Incorporators: Theron J. Nolton, E. C. Adams, Port Townsend, Wash.; A. H. Adams, Helena, Mont.

Idaho Aluminium Mining and Manufacturing Company, Spokane, Wash., incorporated February 27, with a capital stock of $100,000. Among other things it will construct and operate electric light works. Incorporators: Frank Johnson, J. C. Poetz, N. G. Melmgren, Spokane, Wash.; Henry Melder, Rethdrum, Idaho; D. N. McChesney, Albina, Idaho.

Water and Light Company of Nebraska City, Neb., incorporated March 1, with a capital stock of $300,000. Among other things it will furnish electric power. Incorporators: E. E. Anderson, T. L. Watson, W. S. Downs.

Buffalo, Bellevue and Lancaster Railway Company, Lancaster, N. Y., incorporated March 1, with a capital stock of $90,000, to operate an electric railway. Incorporators: Henry W. Box, John L. Williams, Buffalo, N. Y.

Little Falls Electric Light & Power Company, Little Falls, N. Y., incorporated March 1, with a capital stock of $30,000 Incorporators: James H. Ives, W. F. Lansing, George O. Oppel.

Leonard Avenue Street Railway Company, Columbus, O., incorporated March 9, with a capital stock of $10,000, to construct and operate a street railway to be operated by electric or other power. Incorporators: Theodore Leonard, George E. Roberts, William Shepard, Moses H. Neil, James H. Anderson.

Pennock Battery Electric Light and Power Company, Portland, Me., incorporated March 8, with a capital stock of $1,000,000. Incorporators: George W. Moses, William H. Hunt, Samuel P. Tenney, Chelsea, Mass.

Pennock Electric Company, Los Angeles, Cal., incorporated March 7, with a capital stock of $1,000,000. Incorporators: John P. Culver, W. W. Robinson, Adolph Erdman, A. C. Taylor, R. R. Haines, all of Los Angeles, Cal.

Columbian Launch Company, Chicago, Ill., incorporated March 11, with a capital stock of $200,000, to purchase and operate launches by electricity or otherwise. Incorporators: Thomas B. Marston, Henry N. Tuttle, W. S. Spotton.

Pneumatic Torpedo and Construction Company, New York, N. Y., incorporated March 7, with a capital stock of $250,000, for carrying on any kind of construction, electric or otherwise. Incorporators: William M. Cramp, Philadelphia, Pa.; H. L. Taylor, C. L. Davis, of Brooklyn, N. Y.

Rich Electric Heating Company, Elizabeth, N. J., incorporated March 7, with a capital stock of $250,000. Incorporators: S. M. Weed, Plattsburg, N. Y.; H. N. Bailey, S. H. Gray, J. W. Rich, Mt. Vernon, N. Y.; G. H. Plumb, Elizabeth, N. J.

Shawneetown Electric Company, Shawneetown, Ill., was incorporated March 9, with a capital stock of $20,000. Incorporators: C. C. Travis, W. M. Rikert, Annie J. Travis.

CATALOGUES, ETC.

THE EDISON GENERAL ELECTRIC CO. has just issued a handsome and artistically gotten up little work on Central Station Lighting. It is profusely illustrated and printed on the finest plate paper. Messrs. Geo. W. Walker and R. T. Lozier, of the company, deserve a great deal of credit for this excellent piece of work.

THE STANDARD PAINT CO., 2 Liberty street, New York, has just issued a neat pamphlet containing testimonials from users of the well-known "P. & B." electrical compounds. Telegraph, telephone, electric-light and electric-railway companies are using these compounds with excellent results, as shown by these testimonials. The "P. & B." compounds are perfect insulators, are water, acid and alkali proof, and are constantly growing in favor and demand.

THE CLARK ELECTRIC COMPANY, 192 Broadway, New York, has just issued a neat catalogue descriptive of its system of arc lighting, which it claims to be the cheapest illumination in the world. The advantages claimed for the Clark system are: high efficiency, economical dynamos and perfect automatic regulation. The Clark automatic safety device removes all danger from open circuits. Illustrations of various medals received by the company are also given in the catalogue.

THE PETTINGELL-ANDREWS CO., 192–202 Summer street, Boston, Mass., has issued a circular, directing the attention of its friends and patrons, and the electrical trade generally, to a recent decision of the Patent Commissioners, sustaining its patent of the K.-W. Cut-Out, and notice is given warning every one from selling or manufacturing them. This firm is the sole New England agent for Okonite wires and cables, and sole manufacturer of the "P. A." line and feeder wires, lamps, etc.

MESSRS. F. R. DRAVO & CO., Pittsburg representatives of the Ball Engine Co., Erie, Pa., have made installation of Ball engines in the following office buildings in Pittsburg: Central District Telephone & Telegraph Building, Vandergrift Building, Schmidt Building.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting for the election of officers, the reception of yearly reports and the transaction of business will be held at the headquarters of the Institute in New York City on Tuesday, May 17, followed by a dinner in the evening.

The general meeting for the reading and discussion of professional papers will be held at Chicago on Monday and Tuesday, the 6th and 7th of June. programme of papers is now in preparation, and full particulars will be given out as soon as possible.

NEW YORK ELECTRICAL SOCIETY.

The New York Electrical Society will hold a meeting at Prof. Chandler's lecture room, Columbia College, on Friday, March 25, at 8 P.M.

Prof. F. B.Crocker will lecture on "Electrical Measuring Instruments," and will demonstrate the most important points in the construction and application of the principal electrical measuring instruments now in use.

CANADIAN ELECTRICAL SOCIETY.

This Society will hold its convention at Hamilton, Ont., on the first Tuesday in June next.

SEEING BY ELECTRICITY.

One of the possibilities of the future is the transmission of light rays to a distance by the aid of electricity ; in other words, we may some day be able to see over or through an electric wire. Of course the rays of light themselves cannot be transmitted over a wire, but they can be converted into electric waves by the use of properly constructed apparatus, and these equivalent electric waves, after having traversed the wire, can be reconverted into light rays, thus reproducing the original ones. Selenium will be the essential factor in the accomplishment of this wonderful result.

Selenium is a non-metallic element, and, in some respects, resembles sulphur and tellurium. As used for electrical purposes it is crystalline in structure, brittle and black. Its most remarkable property, however, is the variation of electrical resistance under the influence of light rays. This property of selenium was discovered in 1875 by Willoughby Smith, a prominent English electrician.

Selenium is an extremely poor conductor, its resistance, according to Sylvanus Thomson, being very much greater than that of copper. Under the influence of light, however, its resistance varies directly as the square root of the illumination.

The "selenium cells" constructed by Prof. Alexander Graham Bell and Mr. Sumner Tainter consisted of narrow strips of selenium placed between the edges of broad conducting plates of brass. By this method of construction, a reduction of transverse resistance and a large amount of surface for exposure to the action of light were secured. In the dark this cell had a resistance of 300 ohms, and when exposed to sunlight the resistance fell 50 per cent., or to 150 ohms.

ANSWERS TO INQUIRIES.

Can you tell me to whom the credit of copper refining by the electric method is due? R. H. G., Tivoli, N. Y.

The art of refining copper by electrolysis originated with Elkington, to whom patents on the process were issued in England in 1866.

In electro-plating, what is the object of agitating the plating solution, as I have seen done in some plating establishments? G. E., Rahway, N. J.

The object of agitating the solution is to insure the homogeneousness necessary for any even deposit of the metal. In some establishments this agitation of the liquid is maintained by some mechanical device.

OATS VS. COAL.

It has been suggested that engineers try another method of comparing electric power with horsepower. Electric power is calculated on the basis of a pound of coal—that is, the greatest amount of energy that can be obtained from a pound of coal and converted into mechanical energy. This being so, it is argued, Why not calculate animal horsepower on the basis of oats and hay? How much mechanical energy can be obtained from a pound of oats or hay? That is the question, and what is the relative cost of hay and oats and coal? These are economic questions, and many stockholders of street railroads would like to know the answer.

The electric-light plant of the Martins Ferry Construction Company, Martins Ferry, Ohio, was destroyed by fire on March 11. Damage about $25,000. Insurance, $15,000.

TROLLEY CARS ON THE BROOKLYN BRIDGE.

The Brooklyn Bridge trustees are considering a suggestion, which, if adopted, would be greatly appreciated by the thousands who daily cross from New York to Brooklyn and *vice versa*. The suggestion is to extend the Brooklyn trolley system over the bridge to New York and back along the carriage ways. It is believed that the addition of street-cars on the bridge would not interfere with the usual wagon traffic, and that these cars would relieve the traffic on the bridge cable cars which, at certain times during the morning and evening, are crowded beyond their capacity.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, March 19, 1892.

THE SIMPLEX ELECTRICAL COMPANY, of Boston, which was represented in New York by W. H. Gordon & Co., 115 Broadway, has discontinued the New York agency. Until permanent arrangements can be made the assistant manager of the company, Major Everts, will look after the company's interest in New York City, with headquarters at the Imperial Hotel.

FAR ROCKAWAY, N. Y., is to be lighted by electricity, for which purpose the Citizens' Lighting Company has been granted a franchise. Both arc and incandescent lamps will be supplied, and it is expected that the plant will be in operation by the commencement of summer. The officers of the company are: President, Thomas Henderson; vice-president, James Caffeny; secretary, Benedict P. Smith, and recording secretary, David H. Jennings.

THE PHŒNIX GLASS CO., 42 Murray street, city, has put up a board 8 feet by 7 feet, for exhibiting combination globes. Near the top of this board is the monogram "P. G. Co.," made of 150 one C. P. lamps in variegated colors. On the right and left of this are candelabras of beautiful design. In the centre is placed a handsome cut-glass dish, which is illuminated by 4 ten C. P. lamps; there are also any number of elegant glass shades tastefully distributed, each covering a sixteen C. P. lamp. When lit up entirely it presents a most magnificent sight.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,825,000	100 00	62 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Engineering Co., N. Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J	25,000	100 00	†20 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush ElectricLight Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	30 00
Commercial Cable Co	7,716,000	100 00	155 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	112 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Electric Co	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	81 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	96 75
Edison General Receipts		100 00	97 50
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 50
Erie Telephone	4,800,000	100 00	46 00
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*92
Fidelity Trust Receipts	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co., N. Y	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	51 00
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hickory Electric Co., N. C	12,000	100 00	105 00
Hoboken Land & Imp. 5s	1,000,000		*105
Hunt Engineering Co., N. Y., 6s	30,000	100 00	*90
Hunt Engineering Co., N. Y	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*95
Kansas Elec. Co. 6s, Mo	20,000		*96
Laclede Gas Co	7,500,000	100 00	18 00
Laclede Gas pref	2,500,000	100 00	57 50
Laclede Gas 5s	10,000,000		*81
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	95 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N. Y	50,000	100 00	101 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Elec. Manuf. and Const. Co., N. Y	50,000	100 00	101 00
Nat'l Lead Trust	9,000,000	100 00	19 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	51 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	20 00
Newark L. & P	150,000	100 00	58 00
Newark E. L. & P Co. 6s, Ohio	50.000		*95
North American Railway Co	39,767,200	100 00	15 75
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	37 00
Pennock Baty. E.L.& Impt.Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*96
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*98
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100.000	100 00	105 00
The Ongley Electric Co., N. Y	250.000	100 00	85 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
The Siemens & Halske Co., Ill	500.000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	80
The Wells & French Co., Ill	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	59 00
Thomson-Houston pref	4,000,000	25 00	28 75
T.-H. Electric Co. 5s, Boston	500,000		*100
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100.000	100 00	
Western Union	86,188,852	100 00	87 50
Westinghouse Electric Co	7,000.000	50 00	16 75
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	50 00
West End L., Boston	13,550,000		19 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

All deep-water sailors and some few landsmen have realized the peculiar quiet before the storm, best described as a general desire to go somewhere and do something, accompanied by both mental and physical disability of performance. This is the present condition of the electric telephone stockholders. That a financial change must soon come over the spirit of their dreams is most positive, also that all of the people who use the telephone are dissatisfied with what they feel to be an unjust and exorbitant charge for that which has become a public business necessity. Possible methods of telephoning both long and short distances, and which for years answered the purpose, will soon become public property in the United States. This will reduce the value from proprietary to mercantile property, and may even bring the rates within legislative powers, when, unless the volume of subscribers increases very much, the income must decrease and reduce the current price of the shares on a fair capitalization to an equality with other industries. At present the shares are selling at over 100 % premium, and have ranged in that zone for a long time. Thousands upon thousands are debarred from the luxury of a telephone on their premises by the prohibitive tariff demanded. The present capital, if continued under one general organization, should be increased to something like $75,000,000, and the rates lowered to make it a five to six per cent. security, which can be done within the first year of the new régime. The extra expense requi-

site to accommodate the great influx of new business will not be a heavy tax, while every minute a conductor is idle is a loss. It is proven by actual demonstration that in countries where the telephone is owned or under the control of the State that the greatest portion of the people utilize it. Surely the greatest income to the greatest number of shareholders or investors is the sole, honest intent of financial concentration in the shape of corporations on the one side, and in this country it should be coupled with the people's motto—the greatest good to the general public. That there are scores of schemes ripening and only awaiting the day of deliverance is well known. How the commercial problem of possession will operate alone remains to be seen. Money will certainly be made by some of the experts, and no doubt sufficient competition be stirred up to bring the present shares down to par. The final result will be that like John Bull, Uncle Sam will claim everything that runs on a wire, and its value represented by government four per cent. bonds.

The Superintendent of the Banking Department has presented his report for the fiscal year ending Sept. 30, 1891, showing increased capital amounting to $2,370,000, distributed among twenty new banks. Added to this healthy sum the old houses have increased their capital $1,095,000, aggregating $3,465,000. During the year there was a decrease of $1,294,125, leaving a net increase of $2,170,875. There were also, beside these State banks, nine new national banks started, with a capital of $1,700,000.

The industrial financial issues of the day are assuming a position of such magnitude that investors can, by using a very little judgment, become interested in many of the colossal corporations where their small ventures will have the benefit of the very shrewdest ability coupled with practically unlimited capital. Surprisingly few of them come to grief; one can count them on his fingers. The most notable case lately is, no doubt, the "Hansard Union," a corporation absorbing several large publishing firms, printing among other matter the British Parlimentary Debates, and having as a prominent shareholder and director Sir Henry Isaacs, ex-Lord Mayor of London. A great many people claim to have put their money into this company, from the fact that the lord mayor was its chairman. For once it seems the people were wrong; or, at all events, the matter is to be taken into the courts with the intention of holding the promoters and directors responsible for the losses sustained, estimated at nearly $5,000,000. On the other hand, we have corporations which are winding up their affairs simply because they have grown so large and profitable that their accumulation of wealth under one management is considered by the courts to be inimical to the general good. The Standard Oil Trust management is reported as saying there is but one thing left for them to do, and that is to return the stock in the various companies held by the Trust to the owners. This must of necessity make more work to carry on the business, and either the shareholder or the public must pay for it. The United States and Great Britain differ in one respect in connection with financial matters. In Great Britain, over 600 members of Parliament are directors in public companies; here, I don't believe there are a baker's dozen; certainly there is no corporation in Europe, from the crown down, that has or is liable to accumulate wealth sufficient to cause legislative action, limiting the field beyond which it becomes trespass on the inalienable right of the citizen to support himself and those dependent on him. The great house of Rothschild has never been dictated to by the law, and it is well known that at times they have monopolized production, notably quicksilver, a few years ago, and are more than willing to furnish capital for any exclusive possession if of sufficient magnitude. The Siemens & Halske Company, with its $40,000,000, is sought for instead of repelled. Of its own volition it has crossed the ocean and settled quietly down in Chicago with a few millions to build up a construction and supply business. If the electric industry increases as rapidly as we have every reason to believe it will, before it is ten years old the company may be enjoined, as it will not only have its own capital but unlimited credit at the financial centres of Europe. In an interview with a representative of the company a few days ago, I was told it intended, without any connection with the leading American corporations, to build up a business here competing for all that came within its line, and that it was abundantly supplied with capital and skilled assistants. I shall have more to report relative to its financial influence on the electric and kindred industries after it obtains and fills a few contracts, to show in what ratio it may be able to affect the dividends of the other large companies.

Among the dividends declared and payable in April, is the regular one of the Bell Telephone Co., of $3 per share. Quite a number of the shareholders at the last dividend sent me the $3 received for one share in payment for a year's subscription to the Electrical Age, which accounts for their present happiness and current knowledge of advanced electrical events and improvements. The rest of the shareholders cannot invest their income from one share to better advantage, and keep sober. The directors also voted to issue $2,500,000 new stock in the ratio of one share to each person holding six shares, at par.

WESTERN NOTES.

It is thought that the Siemens & Halske Electric Company will be in operation here by the end of July next. Offices for the company have been rented in the Monadnock Building, and as soon as they are furnished they will be occupied. Mr. O. W. Meysenberg has gone to Berlin on business in connection with the establishment of the new plant.

It is reported that the consolidated Thomson-Houston and Edison General Electric Companies will establish a large manufacturing plant in Riverside, near Chicago. A tract of land 300 acres in extent, owned by Henry Villard, it is said will be purchased by the consolidated companies for that purpose.

It is reported that the National Electric Manufacturing Company, of Eau Claire, Wis., has sold out, and that Mr. G. B. Shaw, the general manager, has resigned. The business of the company, at the present time, is conducted by Mr. Diegh, who signs letters as vice-president of the purchasing company.

The Stewart Heater Co., of Buffalo, has recently received an order for one of its famous heaters for service at the World's Fair, Chicago; also one of the largest size power pumps to run in connection with this heater. The heater weighs 10 tons and has a 14-in. exhaust. Mr. F. Worcester is agent at Chicago for this firm.

PHILADELPHIA NOTES.

W. H. Weston & Co., 830 Filbert street, this city, will soon issue a new price-list of switches and electrical appliances, and report business to be in an excellent condition. They are about to bring out a new snap switch containing many improvements and desirable features. They lately sent out two large slate switchboards, containing over 35 quick-break switches.

Pepper & Register, electrical engineers and contractors, Provident Building, this city, are installing a 1,000 light Westinghouse alternating dynamo at Doylestown, Pa. The steam plant, consisting of one Erie Ball Engine, is being put in by Rufe Bros., of Doylestown. Mr. C. Bragg, Girard Building, Philadelphia, Pa., is agent for the Westinghouse Company in this section.

Leading authors on American steam engineering agree that in connection with the use of steam there is no subject of so much importance as the removing and preventing of scale. Lord's Compound, a chemical preparation, has been successfully used for many years by more than twenty thousand representative establishments throughout the United States and Canada, and is highly recommended for neutralizing the acids in feed waters and also for preventing and removing scaly deposits without in any way injuring the material in the boiler.

BALTIMORE NOTES.

Mr. A. V. Abbott, Blackstone Building, Baltimore, Md., is engineer for the North Avenue Street Railway Company. The lines of this company are operated by the Baxter system.

H. S. Brewington, Baltimore, Md., promoter, Bank of Baltimore Building, is arranging plans for a new company, with a view to purchasing the Wenstrom Company and reorganizing it on a new basis.

Mr. J. L. Blackwell, electrical engineer, 229 East German street, Baltimore, Md., has charge of the engineering for the Central and Curtis Bay and the Richmond and Manchester Street Railways. These companies have just secured franchises for the construction of electrical systems. The Richmond and Manchester Road is to be operated on the Baxter and Edison systems.

J. F. Morrison, formerly president of the Southern Electric Company, while still retaining his large interest in the company, has, with other capitalists, purchased the International Telegraph District and Construction Company, which has for over a year been in the hands of a receiver. No new name has as yet been given to the company. It formerly conducted a large business in arc and incandescent lighting on the Thomson-Houston system. Mr. Morrison is agent in this section for the Fort Wayne system, and the new company, it is understood, will enlarge its plant and introduce the Fort Wayne system.

The Southern Electric Company has enlarged its business to a very considerable extent during the past six months, having added many new lines in electric light, power and railway supplies. It has just completed a large incandescent plant in Ellicott City, Md., installing it with the Edison system. The installation of this plant has been greatly welcomed by the residents of the city as filling a long-needed want. In the salesrooms of this company will be found everything necessary in the electrical line—wire, switches, sockets, cut-outs, fuse-blocks, etc., and many varieties of glass shades. It also deals in the specialties of the Interior Conduit and Insulation Company, and the McCreary Electrical Specialty Company.

WASHINGTON NOTES.

J. U. Burket, 1409 New York avenue, N. W., Washington, D. C., is agent for Perret motors and dynamos, installs complete electric light and motor plants, and carries a full line of electrical supplies.

The Wheless Electric Company is constructing two miles of conduit on its system for the Washington and Arlington Street Railway Company. The work is to be completed within six months. The conduit is to be 16 inches. On the one-half mile section adjoining the power-house in Eckington, of the Eckington and Soldiers' Home Electric Railway, the conduit is nine inches.

Messrs. Royce & Marean, 1408 Pennsylvania avenue, Washington, D. C., are contractors for the installation and wiring of complete central station or isolated electric light plants. This firm recently installed an 800-light plant in the Ordnance Department, using the Thomson-Houston system. They are agents for the Economic Incandescent Lamps, which have given most excellent results, and also carry a full line of household and office electrical supplies and specialties. Mr. Royce, of the firm, is an expert electrician and gives special advice and consultation. He has been the adviser in numerous electrical enterprises in this city.

The Hoosic Tunnel is lighted by 1,250 incandescent lamps. The lamps are arranged in series of 20 each, and are lighted by alternating current.

Commonwealth Iron Co., Commonwealth, Wis., has recently purchased a 35 H. P. Ball Engine from the Ball Engine Co., Erie, Pa.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued March 8 and 15, 1892.

470,419. Electric Oven. John V. Capek, New York-N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Aug. 14, 1891.

The combination of an oven which is bodily movable, a stationary electric heater therein, the walls of the oven extending by the heater, whereby the oven may be moved away from the heater to enlarge the heating-chamber without uncovering the heater.

470,428. Electric Store-Service Apparatus. Midbury W. Hassan, Rochester, N. Y. Filed Feb. 2, 1891.

470,441. Electric-Current Meter. Johan W. T. Olán, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed June 6, 1891.

The combination, in an electric meter, of a vessel containing a liquid, a balanced float in vessel and movable therein, float having a forward movement only while the meter is in use, means for disturbing the balance in accordance with the current measured, so that the float will move, and a recording mechanism operated by movement.

470,455. Magnetic Ore-Separator. Charles T. Thompson and Richard H. Sanders, Philadelphia, Pa. Filed April. 16, 1891.

470,456. Magnetic Ore-Separator. Charles T. Thompson and Richard H. Sanders, Philadelphia, Pa. Filed Dec. 5, 1891.

The combination of a rotating drum, having a substantially non-interfering wall, with a plurality of stationary electro-magnets, a plurality of chutes respectively extending from beneath the upper limits of the several fields to different delivery-points, and means, whereby the energy of the fields of one or more of the magnets may be varied.

470,471. Incandescent Electric Lamp. Augustus C. Carey, Lake Pleasant, Mass. Filed Aug. 3, 1891.

In an electric-light lamp, leading-in or circuit wires, an incandescent filament, and a joint therefor composed of a double tube in which the ends of the filament and leading-in or circuit wires are secured.

470,514. Lightning-Conductor. Harvey Simpson, Kenosha, Wis. Filed Sept. 9, 1891.

In a conductor, the hollow adjacent main sections, a pipe-section surrounding the meeting point of the main sections, and indentations formed in the pipe-section, which extend into the main sections.

470,521. Electric Generator. Charles J. Van Depoele, Chicago, Ill. Filed May 13, 1887.

A system of generating and distributing electric currents,

PATENTS—Continued.

comprising a separately-excited generator of the continuous-current type, the armature of which is connected with the working circuit, an exciting generator, also of the continuous-current type and having primary or main field-magnet coils, and connected directly to, and delivering its entire normal output through the field-magnet coils of the generator, magnetizing the same so as to produce the initial potential in its armature, and additional reinforcing coils upon the field-magnet of the exciter, the coils forming part of the working circuit, and acting to increase or decrease the total output of the exciter, and correspondingly affect the field of force of the main generator in accordance with the consumption of current in the working circuit.

470,552. Galvanic Battery. John H. Davis, Detroit, Mich., assignor to the Electrical Fiber-Carbon Company, same place. Filed April 24, 1891.

In a battery-jar, the combination of the outer flexible vessel, the inner flexible vessel, of less diameter than the outer vessel and rendered impervious to moisture, and a filling located between the adjacent walls of vessels.

470,557. Telegraph-Relay. Charles M. Dyer, Cloverdale, Ind. Filed Sept. 9, 1891.

470,596. Electric-Circuit Closer. George W. Price, Baltimore, Md. Filed Nov. 18, 1889.

In a circuit-closer, the combination, with the base of the coiled spring secured to one of the blocks by a screw, and having a straight extension passing through an opening in the other block and having a loop at its extremity, and the spring contact-piece secured to the other block by a screw, and curved upward at its free end, the curved portion lying in the line of extension of the spring, so that when the same is extended electrical contact will be made with the contact-piece and the circuit closed.

470,608. Electric Dust-Collector. Richard E. Wardhaugh, Jacksonville, Ill., assignor of one-half to William W. Allis, Milwaukee, Wis. Filed Oct. 2, 1889.

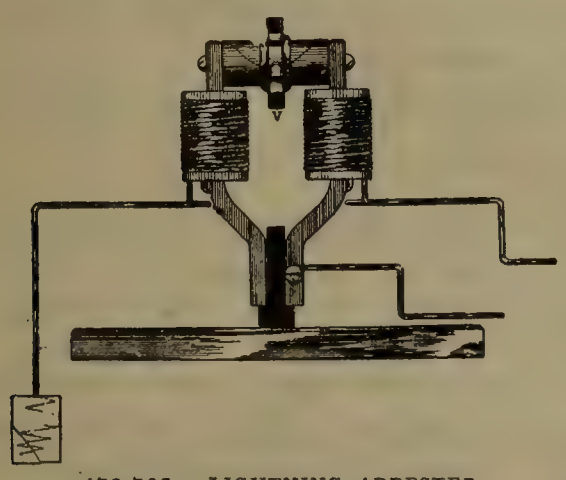
In combination with a dust-collecting chamber, an electric conductor and means for producing a current of electricity through conductor.

470,634. Telephone. William A. West, Bellefontaine, Ohio, assignor of two-thirds to W. H. West and C. G. West, same place. Filed Nov. 12, 1883.

The combination of a continuous main line, transmitting and receiving instruments therein, and a reinforcing device consisting of a local circuit, means controlled by the main and local lines together for varying the current in the local circuit, and an induction-coil having its primary in the local and its secondary in the main circuit.

470,638. Electric Search-Light. Robert S. Dobbie, Brooklyn, N. Y. Filed April 16, 1891.

The combination, in a projector, of an arc lamp having a frame removably held in the projector, a motor in a stationary box or case for feeding the lamp-carbons, and means for adjusting the frame without moving or disconnecting the motor.



470,721.—LIGHTNING ARRESTER.

470,654. Electric Railway. Edward M. Bentley, Boston, Mass. Original application filed Dec. 11, 1885. Divided and this application filed Feb. 25, 1891.

470,656. Motor for Electric Cars. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 4, 1890.

470,657. Contact Device for Electric Railways. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Jan. 26, 1891.

470,666. Police and Fire-Alarm Signalling Apparatus. Leroy B. Firman, Chicago, Ill. Filed April 1, 1889.

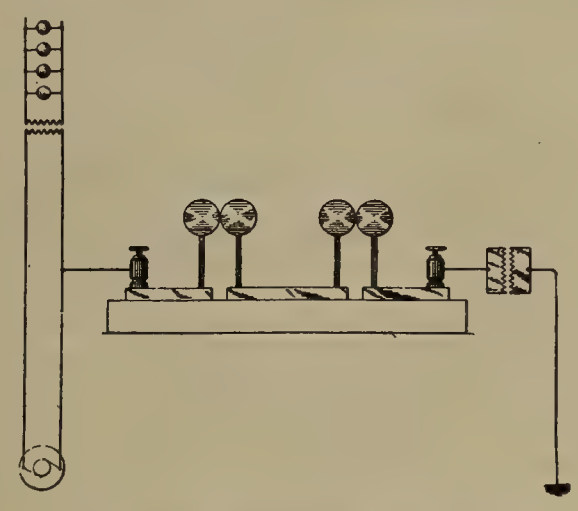
470,667. Combined Police and Fire-Alarm Signal Apparatus. Leroy B. Firman, Chicago, Ill., assignor to the Police Telephone and Signal Company, same place. Filed Nov. 28, 1890.

470,697. Protector for Electrical Apparatus. Charles H. Morse, Cambridge, Mass. Filed Jan. 12, 1892.

470,701. Secondary Battery. George F. Parker and Chas. E. Crapo, Rochester, N. Y., assignor of one-half to Edwin S. Hayward, Jr., same place. Filed April 10, 1891.

The herein-described dome-shaped metallic plate for secondary batteries, provided with tapering recesses for the active material extending through the plate and arranged in the exciting-liquid in the horizontal position with its concavity downward, whereby the gases are retained in the concavity and the liquid is excluded therefrom.

470,721. Lightning-Arrester. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 26, 1889.



470,772.—CIRCUIT INTERRUPTING DEVICE.

The combination, with an arc-rupturing magnet, of the arcing electrodes connected to a circuit supplied from a source of energy sufficient to maintain a continued arc once formed from one to the other and presented to one another on a line parallel to the lines of magnetism or line joining the poles of magnet.

470,722. Tell-tale Device for Electric Circuits. Edgar Tregoning, Malden, Mass., assignor of one-half to Alvin E. Bliss, same place. Filed Oct. 2, 1891.

In a tell-tale device for electric circuits, the combination of the coil, the insulating-tube, the hollow movable core, the guide, the insulating-plug, the contact, the mercury-cup, and an alarm-circuit.

470,736. Lightning-Arrester. George M. Bacon, Scranton, Pa. Filed Aug. 10, 1891.

A lightning-arrester consisting of discharge-points, the former in circuit with the line, the latter with the solenoid, the core, connected with solenoid, the discharge-point, connected with the core, the point connected to the ground, points located within the receptacle, and the receptacle, in combination.

470,748. Electric Switch. Samuel Deacon, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 18, 1889.

The combination, with an electric switch, of an actuating mechanism, a connecting-spring between the switch and actuating mechanism, and a catch or holding device engaging with the switch for holding the same from movement while the spring is being subjected to strain by the actuator.

470,749. Field-Magnet for Dynamos. George E. Dorman, Chicago, Ill., assignor to the Standard Electric Company, of Illinois. Filed Dec. 17, 1890.

470,752. Electrical Hose-Signalling Apparatus. William Fowler, Colorado Springs, Colo. Filed Aug. 24, 1891.

470,766. Arc-Light Hanger. Charles A. Pfluger, Chicago, Ill., assignor by direct and mesne assignments to the Standard Electric Company, of Illinois. Filed May 15, 1891.

470,768. Printing-Telegraph. Edward J. Silkman, Baltimore, Md., assignor of two-thirds to George D. Penniman and Thomas K. Worthington, same place. Filed April 16, 1891.

470,772. Circuit-Interrupting Device. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Nov. 25, 1891.

The combination of two electrodes normally resting in contact with each other and thermostatic supports carrying the respective electrodes.

470,773. Circuit-Interrupting Device. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Dec. 1, 1891.

An arc-rupturing device consisting of two or more electrodes of zinc, antimony, or compounds thereof or other materials having a non-conducting vaporous oxide.

470,774. Apparatus for Protecting Circuits. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Dec. 16, 1891.

The combination, with the circuit of an electric generator, of a rotating discharge device for discharging the respective conductors of circuit to the earth, consisting of a series of contacts connected with their respective conductors and a circuit-closing device connecting the respective contacts with the earth through a relatively high resistance at different times.

470,784. Dynamo. William H. Elkins, Cambridge, Mass. Filed June 29, 1891.

470,785. Dynamo. William H. Elkins, Cambridge, Mass. Filed July 11, 1891.

470,786. Appointment Signal for Telephones. Silas W. Gray, Fort Dodge, Iowa. Filed May 12, 1891.

470,790. Electric Switch. Hugh Moore and Oliver O. Jarrard, Mauch Chunk, Pa. Filed Sept. 4, 1891.

470,792. Galvanic Battery. Francis H. Root, Chicago, Ill. Filed Nov. 5, 1888.

A battery comprising the cell closed at its top and provided with a vent tube, a packing of mineral fibre arranged within the cell, a chloride-of-silver electrode, embedded within the packing, a zinc electrode surrounding the packing, and an excitant consisting of a caustic solution.

470,793. Switch for Electric Signalling Apparatus. Leopold Sellner, Vienna, Austria-Hungary. Filed Oct. 17, 1891. Patented in England, France, Germany, Italy and Austria-Hungary.

470,806. Railroad Circuit-Closer. Frank E. Kinsman, Plainfield, N. J. Filed July 30, 1891.

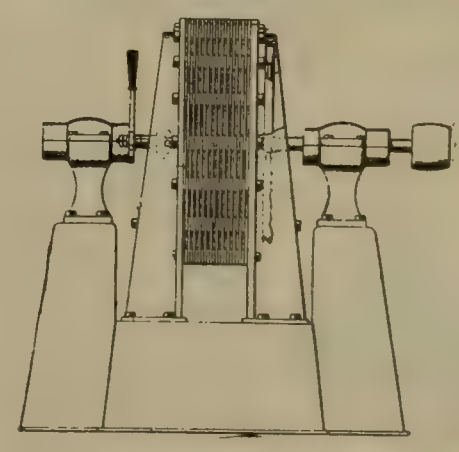
A railway circuit-closer suspended from a vehicle and having its operating portion arranged to travel in line with the wheel-flange.

470,810. Employés Time-Recorder. William Lucas and Thomas A. Garrett, London, England. Filed April 21, 1891.

470,813. Electric Railway-Signal. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed Nov. 9, 1891.

In a block-signalling apparatus, the combination, with a series of normally-closed rail-circuits, of a series of normally open or broken signalling-circuits, each signalling-circuit including a normally open circuit-closer constructed to be closed by the action of the train upon one of the rail-circuits and also including a normally-closed circuit-breaker constructed to be opened by the action of the train upon the next succeeding rail-circuit of the line.

470,817. Electric-Railway Motor. Francis O. Blackwell, New York, N. Y., assignor to the



470,928.—ALTERNATING CURRENT GENERATOR.

Thomson-Houston Electric Company, of Connecticut. Filed Aug. 31, 1889.

470,820. Electric Connector. William H. Garland Chelsea, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 23, 1891.

An electric connecting-plug consisting of a sleeve or tube with its bore eccentric to its axis, leaving a thin and comparatively yielding wall on one side of the tube.

470,831. Annunciator. Archibald H. Brintnell, Toronto, Canada. Filed Apr. 11, 1891.

470,844. Electric-Wire Support. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed June 17, 1889.

A holder supporting an electric-railway supply-wire having lips of malleable metal bent down upon opposite sides of the wire and arranged out of line with one another.

470,865. Transmission of Electrical Energy to a

PATENTS—Continued.

Distance. Marcel Deprez and Jules Carpentier, Paris, France; said Carpentier assignor to said Deprez. Filed Nov. 27, 1888. Patented in France and in England.

470,883. Insulation for Electric Wires. Samuel Vanstone, Providence, R. I., assignor to himself and Frederic A. Fairbrother, Jr., same place. Filed March 21, 1890.

An insulating-covering for electric wires, formed of abutting longitudinally-divided sections of rigid non-conducting material, the abutting ends of which form a socket-joint.

470,922. Manufacture of Filaments for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J. Filed Oct. 10, 1883.

The method of forming blanks or sheets for the purpose mentioned, consisting in treating separately two or more sheets of paper with hydrofluoric acid to form a cementing material and then placing such sheets together.

470,923. Railway-Signalling. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug. 19, 1887.

470,924. Electric Conductor. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 30, 1887.

The combination of a wire, a fabric covering thereon, and an outer covering of a mixture of rubber and infusible material.

470,925. Manufacture of Filaments for Incandescent Electric Lamps. Thomas A. Edison, Llewellyn Park, N. J. Original application filed March 20, 1880. Divided and this application filed July 2, 1888. Patented in England, in Italy, in Canada, in Belgium, in Victoria, in Austria-Hungary, in Queensland, in New Zealand, in Portugal, in New South Wales, in Spain and in France.

A filament for forming the carbon incandescing conductor of an electric lamp, consisting of a number of fine filaments welded together by a carbonizable cementing substance.

470,926. Dynamo-electric Machine or Motor. Thomas A. Edison, Llewellyn Park, N. J. Filed Feb. 24, 1891.

A magnet-pole piece consisting of several distinct layers of iron or steel united for a part of their length into an integral mass.

470,927. Driving Mechanism for Cars. Thomas A. Edison, Llewellyn Park, N. J. Filed March 26, 1891.

The combination of an electric motor, an armature having a driving-shaft, a sprocket-wheel thereon, one or more idle-pulleys supported by the field-magnet of the motor, a sprocket-chain passing around wheel and idle-pulleys, and a driven sprocket-wheel outside of the chain and in engagement therewith.

470,928. Alternating-Current Generator. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug. 25, 1891.

In an electro-magnetic machine, the field-magnet having several poles and consisting of overlapping magnetic plates bolted together so that the plates shall be in contact at the ends, but shall be separated throughout a portion of their length, plates having main bodies and projecting legs, the latter constituting the field-magnet poles.

470,929. Magnetic Separator. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 1, 1891.

The combination of a receptacle adapted to contain fine magnetic ore and to allow escape of the same, a magnet for changing the trajectory of the magnetic particles in the ore, magnet having two poles in position to act on the falling ore, one pole being below the other and formed by a Z-shaped arm having an end bent to form an extended pole substantially parallel with the falling magnetic material.

470,930. Dynamo-Electric Machine. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 10, 1891.

In a multipolar electro-magnetic machine, the combination of the armature core, the armature-coil covering the whole surface of core, a commutator having a number of conducting-blocks, the series of field-magnets forming a succession of alternating like and unlike fields, commutator connections between all portions of the armature-coils situated in corresponding magnetic fields and the same commutator-blocks, whereby a continuous current is produced, and the commutator-brushes taking current from and delivering current to all parts of coil.

470,946. Underground Electric Conduit. James F. Munsie, Jersey City, N. J., assignor to Thomas Leonard Coles, New York, N. Y. Filed Oct. 9, 1889.

An underground electric-conduit system consisting of a through-wire conduit, distributing-ducts extending along conduit and service-ducts leading transversely from the distributing ducts, the through-wire conduit and distributing-ducts being divided up into sections by man-holes spaced at intervals along the line and the service-ducts being provided with man-holes at their ends remote from the main conduit, and devices, whereby the wire may be withdrawn from the main conduit through the service-ducts.

470,994. Contact-Maker. Daniel Draper, Hastings-on-Hudson, N. Y. Filed Sept. 30, 1891.

471,053. Electric-Actuated Vending-Machine. Archie J. Henry, Watertown, N. Y., assignor of five-eighths to Ernest A. E. Meyer, Charles H. Sprague and James B. Wise, same place. Filed Aug. 22. 1891.

471,063. Electric Elevator. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Company, Chicago, Ill. Filed Nov. 11, 1891.

The combination, with a multiple-wire system of electrical distribution, of a shunt-motor and means for changing the connection of motor from one of the wires of the system to another to vary the speed of the motor.

471,064. Electric Elevator. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Company, Chicago, Ill. Filed Nov. 30, 1891.

In an electric elevator, the combination, with the motor and car operated thereby and a switch located on the car, of circuit connections between the field-magnet coils of the motor only and the switch on the car.

BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48-inch double belts and six 25-inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., Street Railway Company, two 24-inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway, of Wheeling, W. Va.

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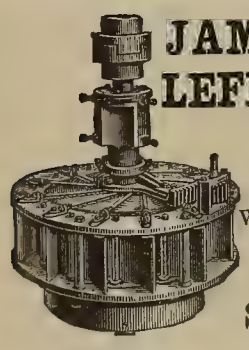
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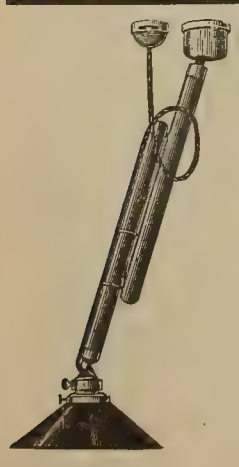
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ELECTRIC FIRES.

In our issue of March 19 we took occasion to refer to an article printed in *The Chronicle*, of this city, in which that journal criticised the figures given by Mr. Allen R. Foote, in his report relative to the fires and injuries caused by electric currents during the year 1890, which was read at the Electric Light Convention at Buffalo last month. *The Chronicle* claims that experienced insurance underwriters believe that electric fires are increasing in frequency, and the language of the article throughout showed that that paper belonged to that class who are skeptical concerning electric light risks.

Reference to fire in the inquiry, which was summarized in Mr. Foote's report, was merely incidental, the object of the investigation being to ascertain the number and extent of injuries to firemen by electric currents while in the performance of their duty. The returns were made by the chiefs of various fire departments and used as they were given, without any effort being made to verify their correctness, and Mr. Foote points out the injustice of *The Chronicle* in using the reference to the number of fire-alarms to sustain its theory that electric fires are increasing in frequency.

The fundamental question is: "Are electric fires increasing in frequency?" From all reports and testimony that we have access to or can command, there can be but one answer, viz.; "No;" on the contrary, they are decreasing in frequency, and very naturally.

IMPROVED TELEGRAPHIC APPARATUS.

The telegraph is an old institution—old compared with the newer electrical industries, such as electric lighting, the telephone and the electric railway—and the public seldom hears of what is going on in the way of improvements in telegraphic apparatus and the methods employed in transmitting signals to distant points. The fact that little is said about such improvements does not indicate that they are few, and that telegraph plants, as they exist to-day, are so perfect that they are susceptible of no further change. Such is not the case, however. Telegraph engineers are not figureheads by any means, and they are just as wide awake in their line of action as their brother electricians are in other departments of electricity. True, no new principles are discovered and few great inventions are made, but the work of improvement in existing apparatus is an endless one. In a general way the instruments now in use are very efficient, and about the only direction in which they can be improved is in simplifying them. Simplicity, of course, means greater efficiency.

We publish on another page a description and an illustration of an automatic repeater for telegraph circuits which, from all accounts, seems to possess decided advantages over the one of which it is a modification, namely, the Milliken.

Ease of handling and manipulation was the object sought in this apparatus, and how far these important points have been accomplished those of our readers who are interested in such matters can judge for themselves by reference to the illustration which accompanies the article.

THE NATURE OF CONDUCTORS AND DIELECTRICS.

What is there in common in certain materials that permits the transference of electric current through their substance with comparative ease, and what is there in common in other materials that resists this action? are questions that are difficult to answer. All substances are conductors of electricity in one sense; that is, they permit the passage of the electric current with more or less facility. Those which resist the electric action the most are termed insulators, and those which resist the least are commonly called conductors. These phenomena are of deep scientific interest, and when they can be explained with certainty we will have reached a degree of knowledge that will afford an explanation to other physical phenomena, the causes of which are yet obscure.

We print on another page an article from the able pen of Mr. Charles P. Steinmetz which throws a good deal of light on this subject, and which will, no doubt, be read with deep interest.

Mr. Steinmetz discusses in a masterly way the electric phenomena as manifested in conductors and dielectrics, and concludes by pointing out the characteristics of these two classes of materials. Conductors, he states, are opaque metallic bodies and decrease in conductivity with increasing temperature, and dielectrics in general, which are called insulators, if in a state where chemical dissociation can occur under electric stress, are able to convey the current by what is called electrolytic conductivity, by means of atomic exchange from electrode to electrode, and when in a condition of great molecular movability, as in rarified gases, transfer electricity by molecular and luminous discharge.

DOES GROUNDING THE NEUTRAL WIRE INCREASE FIRE HAZARDS?

There exists a difference of opinion among electricians as to the advisability of grounding electric light wires. One party contends that such practice increases the fire hazard, while the other argues from the opposite standpoint.

The investigation into this important subject which the New York Board of Fire Underwriters recently undertook, resulted, on March 10, at a special meeting, in the offering of a set of resolutions requiring that electric companies discontinue the practice of intentionally grounding any portion of their equipment, and requiring that all such grounds now existing shall be removed on or before October 1 next.

This action was based upon the report of Prof. Henry Morton in answer to questions propounded by the Committee on Police and Origin of Fires, with reference to fire hazards from the grounding of electric wires, and particularly the middle or "neutral" wire in the Edison system.

Prof. Morton is emphatic in his utterances, and states that in his opinion grounding the middle wire decidedly increases the fire risk. On the other hand, the Edison Electric Illuminating Company, replying to Prof. Morton's report, states that "It is the general opinion of the Edison interest that while absolute insulation, if it can be had, is preferable [to the grounding of the neutral wire], the advantages of grounding the neutral under certain conditions, and particularly on large systems, are such as to make that practice in those cases the best working method, particularly as a precaution against fire risk."

The resolutions will be considered and acted upon at the next meeting of the board, and the result will be awaited with interest, as the interests involved are large and important.

IMPROVED AUTOMATIC TELEGRAPH REPEATER.

BY R. H. WEINY.

The Electrical Age of March 19 contains a very ingenious arrangement for the Milliken-Hicks repeater, but even if, in the operation of the apparatus, it receives the slight benefit claimed for it, that rheumatic old-timer still remains in full possession of all its infirmities, requiring that its extra local adjustments be altered to meet almost every change in the weather, and further demanding that the locals be not only good and strong, but quite constant; in fact, first-class in every particular.

Knowing the weak points of the repeaters now in general use, and the exasperating delays caused by them when in the hands of those not thoroughly familiar with their peculiarities, General Manager W. P. Phillips, of The United Press, had constructed for the wire service of that concern a number of repeaters, so different and so much more satisfactory than the old style, that I thought a diagram and a word or two about them would prove of interest to your readers.

The extra magnet on each relay is a single spool, wound differentially, with an iron cover for a return pole and, as shown in the diagram, is located just above the main-line magnets. Being independent, it remains in the one position regardless of the adjustment of the main-line magnets.

The transmitter is practically the same as those now in use, but its application is different, and as the instrument is built on the sounder plan, it can be used as such; while the switches are so connected that when the repeaters are cut the extra locals are open.

The object of the double-wound extra magnet is to avoid all chances for a "kick" under very heavy adjustments, caused by one magnet discharging quicker than another charges. All the magnets in this case work in the same direction, either charging or discharging, and the result is the repeater will work, and hold without a falter, any line on which it is possible to work a single-line instrument. It will be noticed that when the repeater is cut through, one circuit is constantly through one winding of the extra magnet while the other side is controlled by the front or dead contact point of the transmitter, the current being in the opposite direction. When the transmitter leaves the front contact, one of the extra local circuits is opened, permitting the other side to take hold of the relay armature and hold it to its contact, the main line being opened later. In the reverse motion the main line, of course, closes first and takes hold of the relay armature, but the extra magnet does not release its grip until the transmitter has touched the front contact and the extra magnet is fully charged and balances itself. Thus it will be seen by the action of the magnets that the interval of time between the extra taking hold and the main line letting go, or the main line taking hold and the release by the extra, is of the longest possible duration. As shown in the diagram, the repeater has but one relay adjustment and that is the ordinary single line method. The transmitter points do not have to be *just so*, as the "lapping" of contact-points is not necessary; they practically take care of themselves, and the necessity of giving the armature considerable swing is done away with, permitting a ready response to rapid work. If the extra local on the receiving side should give out (instead of the sender going on his way rejoicing, only to find out later that the receiver had been trying to break for half an hour), the fact becomes known to the sender, and if the extra on the sending side plays out there is no mutilation of signals; the sender can proceed, the trouble manifesting itself when the distant end breaks.

The battery does not have to be in the very pink of condition, as any irregularity balances itself.

The repeater works without a falter and without attention just as long as the locals are in a fairly good condition. The diagram shows the connections of this repeater very clearly, and hardly requires any explanation.

A SPLENDID POWER HOUSE.

The new power-house for the Minneapolis Street Railway Co., Minneapolis, Minn., it is expected will be completed and everything in readiness for operation by the middle of next month. From the outside, the power-house has the appearance of a low brick building covering a large area of ground and surmounted by a tall smoke-stack 165 feet high.

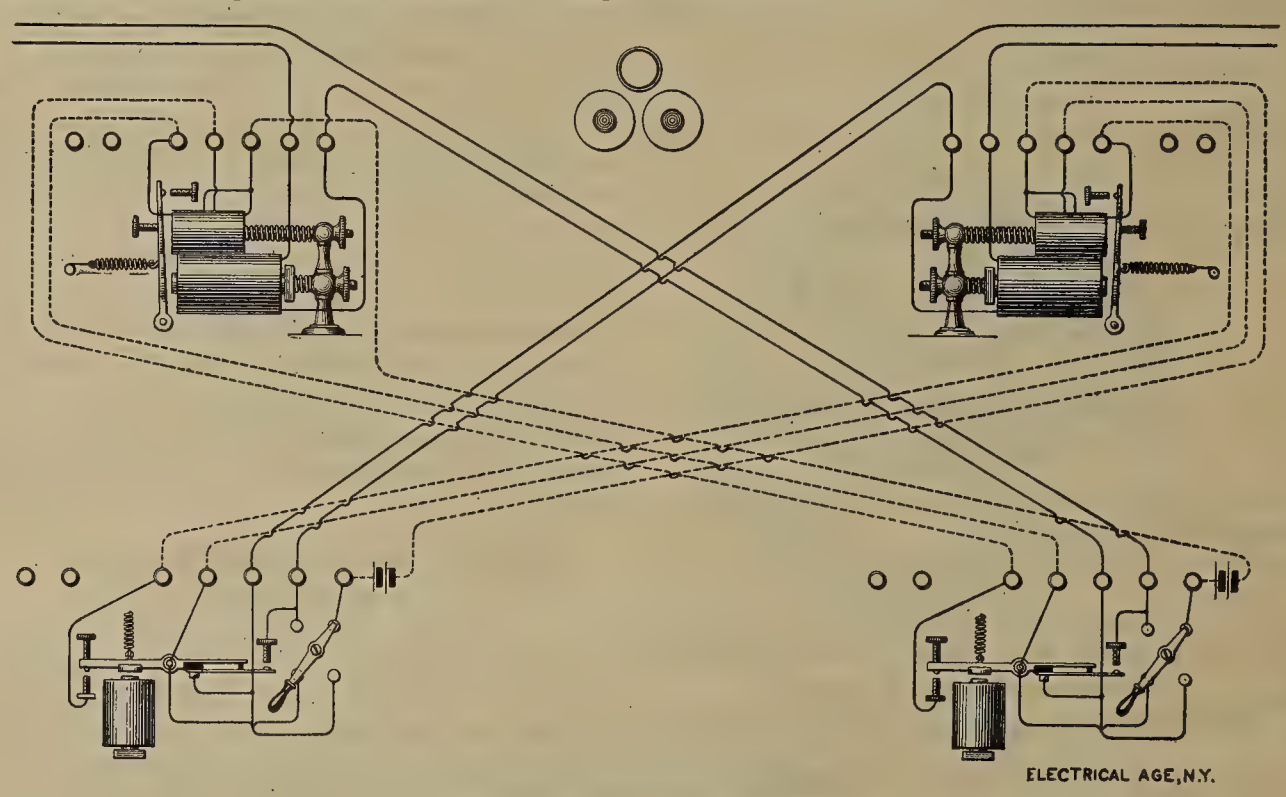
When complete the power-house will have 10 Westinghouse engines of 300 horse-power, which will run 10 Thomson-Houston dynamos of equal power, the engines and the dynamos being rated alike. In the engines 240 horse-power are guaranteed with 140 pounds of steam. With 150 pounds, 300 horse-power will be generated. The engines are compound, with a high-pressure cylinder 16 inches in diameter, and a low-pressure cylinder 27 inches in diameter by 16-inch stroke. The regulation is close, this being required in railroad work. The governor is encased in oil, and all the working parts similarly encased in order to secured the greatest efficiency of the machinery. A steam loop is used for the purpose of bringing back the condensations into the boiler. By this arrangement, it is said, a saving of 20 per cent. in the power is effected.

The ten engines are arranged in two rows, five in each, and facing each engine is a dynamo. These machines are connected by a 24-inch leather belt running around an 82-inch pulley on the engine and a 36-inch pulley on the dynamo.

The advantage of having the power subdivided is that if one machine gets out of order another takes its place, so that there is no interruption. If the power were generated by one huge engine everything would be at a standstill should this break down, until repaired again. When everything is complete, there will be more power generated on the floor of this building than on any space in the country of a similar size. The area of the power-house is 87 by 73, not including the boiler-room.

The boiler-room is nearly as large as the power-room. It will contain seven Stirling high-pressure water-tube boilers when everything is complete. These are of a new pattern and consist of a large number of flues, running between an upper and a lower boiler. By this arrangement a very large surface is presented to the fire, which serves to economize the heat. Each boiler is of 287 horse-power, and rests upon a solid wall which extends eight feet below the floor. The whole will be enclosed by brick walls when finished. The fuel to be used is crude oil, which will be pumped in from two tanks as it is needed. The smoke will be carried to the smoke-stack by means of pipes in the basement. The floor of the boiler-house will be concrete and supported by arches.

The water supply for the plant will be furnished by an artesian well which is now being drilled. A depth of 575 feet has now been reached and the drill is at present working its way through a thick layer of shale.



AUTOMATIC TELEGRAPH REPEATER.

CONDUCTORS AND DIELECTRICS.

BY CHAS. PROTEUS STEINMETZ.

The earliest investigations of electric phenomena made us acquainted with a difference in the behavior of different materials towards this newly discovered force of nature. While some materials, when brought in contact with a source of electricity, became electrified over their whole extension, or, when in contact with the ground did not get electrified at all, but carried the electricity silently off to the ground, other materials became electrified only at the point of contact with the source of electricity. So the distinction between *electric conductors* and *electric insulators* became known. Soon it was discovered also that there exist different degrees in the insulating ability of bodies, and poorer and better insulators were distinguished.

As in the galvanic battery a source of immense quantities of low-pressure electricity was discovered, amongst the conductors differences were noticed also, and good conductors, as metals, and poorer conductors, as solutions of salts, acids, etc., found.

Although we still speak of "conductors" and "insulators," in reality this distinction can not be retained any longer as an essential classification, not because there exists no perfect insulator (even the best insulator has still some conducting quality), but because what were called conductors comprise two or three distinctly different classes of materials, which have nothing whatever in common. If an electric current flows through a copper wire, this is an entirely different phenomenon from that of an electric current flowing, for instance, through dilute sulphuric acid.

In the first case, the current flows through the copper wire in a manner similar to a stream of water flowing through a pipe, that is, it has no effect on its physical or chemical constitution, except that by frictional resistance and a certain amount of pressure—electric-pressure in the one, water-pressure in the other case—is consumed in the conductor, and at the same time a corresponding amount of heat is developed.

Quite different in the second case. A current flowing through dilute sulphuric acid causes therein chemical action directly proportional to the quantity of current flowing, and flows only because it can produce this chemical action; and if we are able to make the chemical action impossible, for instance, by freezing the liquid, it becomes an insulator, and that stops the current.

In the "electrolytic conductors," matter is carried by the current in direct proportion to the quantity of current, so that it seems that the current is not *conducted* through the liquid, but carried by atoms of matter, which travel through the liquid from electrode to electrode. While the first kind of conduction, the "metallic conduction," may be compared with the flow of water through a pipe, this "electrolytic conduction" may be compared with the carrying of water in barrels, and would perhaps, more properly be called "electric convection."

The worst metallic conductors, as bismuth and mercury, are still many thousand times better than the best electrolytic conductors, nitric, sulphuric and hydrochloric acids and caustic potash.

In order to consider more closely the phenomena of electric conduction and insulation, we must strictly distinguish between these quite heterogeneous phenomena, *conduction* and *convection*.

For convenience, we shall call the "metallic conductors" simply *conductors*, and the "electrolytic conductors" *convectors* of electricity.

The *electric conductors are exclusively opaque materials;* they are all *metals*, or *those allotropic modifications which have metallic character*. Their conductivity is a strictly *physical* phenomenon, closely related to their opaqueness, and decreases with rising and increases with decreasing temperature, by such a law, that the resistance—the inverse value of the conductivity—decreases for every degree (absolute) of temperature by the same amount in elementary materials, so that for the absolute zero-point of temperature, — 273° Centigrade, the resistance becomes zero. (For copper, the decrease of resistance by this law has been proved down to below—200°.)

These materials remain opaque and conductive even if their physical condition changes, and they pass from the solid to the liquid state, and inversely.

Quite different is the electric convection or electrolytic conduction. This is a decidedly *chemical*

phenomenon, and the laws of chemistry hold good for it, amongst which the first is: "*corpora non agunt nisi fluida*," which means chemical action takes place only in the fluid state.

Hence electrolytic conduction exists only in liquids, either solutions or melted compounds; and if an electrolytic conductor is solidified it ceases to be conducting and becomes an insulator, a *dielectric*, so called because it lets electro-magnetic oscillations pass through, just as diaphanous materials are pervious to light oscillations; while opaque bodies reflect or absorb the light and heat oscillations and convert them into heat oscillations of the opaque material. So metallic conductors reflect or absorb electro-magnetic oscillations, in the latter case converting them into electric oscillations in the conductor.

Indeed, this law of chemistry does not hold rigidly; even solid substances, especially when near the melting-point, act chemically upon each other, though very much less intensely. So even solid dielectrics sometimes become possessed of slight electrolytic conductivity when nearing their melting-point. Glass, for instance, one of the best insulators, begins to get conducting when heated, and when melted is a good electrolytic conductor.

Hence the electrolytic conductivity is closely allied with chemical action, and for every ampère of electric current passing through the liquid, an exactly determined amount of chemical dissociation takes place, so that this phenomenon is best explained by assuming that the electric potential dissociates the molecules of the compound liquid into their atoms, and by their attraction with the electrodes they travel through the liquid, thereby carrying electric charges from electrode to electrode. We must not think, however, that the atoms of each molecule travel through the whole liquid, but rather that molecule exchanges with molecule its atoms, the electro-positive in the one, the electro-negative atoms in the other direction.

Heat loosens the ties of chemical attraction, hence we find that electrolytic conductivity increases with increasing temperature.

Concerning insulators hardly anything can be added to that what is said of electrolytic conductors, for the difference between electrolytic conductors and insulators is only quantitative, and all the electrolytic conductors become "insulators" when passing into the solid state, while all the insulators have a slight electrolytic conductivity, which increases with increasing temperature, often very rapidly, as in the case of gutta-percha, while indeed very many remain, even in the liquid state, very good insulators, as especially the derivatives of carbon.

We must consider, indeed, that nature knows no classification, and that therefore all these distinctions and classifications, which man is obliged to make for mastering the phenomena of nature, are more or less incomplete. Take, for instance, the metallic modification of carbon, graphite, ranging in its conductivity between metals and electrolytic conductors. It behaves entirely like a metallic conductor, but shows the strange phenomena of an increase of conductivity with increasing temperature, at least for temperatures up to about 700° Centigrade.

Besides the atomic convection of electrolytic conductivity there exists a molecular convection of electricity, especially noticeable in rarefied gases, as luminous discharge, molecular bombardment, etc., which is of less importance for the electrical practice, though scientifically of high interest.

Thus, to summarize, we have *electric conductors* and *dielectrics*. The *conductors* are *opaque metallic bodies* and decrease in conductivity with increasing temperature; the *dielectrics* in general are what we call *insulators*, but, if in a state where chemical dissociation can occur under electric stress, are able to convey the current by what is called *electrolytic conductivity*, by means of atomic exchange from electrode to electrode, and when in a condition of great molecular movability, as in rarefied gases, transfer electricity by *molecular and luminous discharge*.

ELECTRIC LIGHT FOR MAGIC LANTERN.*

PROF. W. C. PECKHAM.

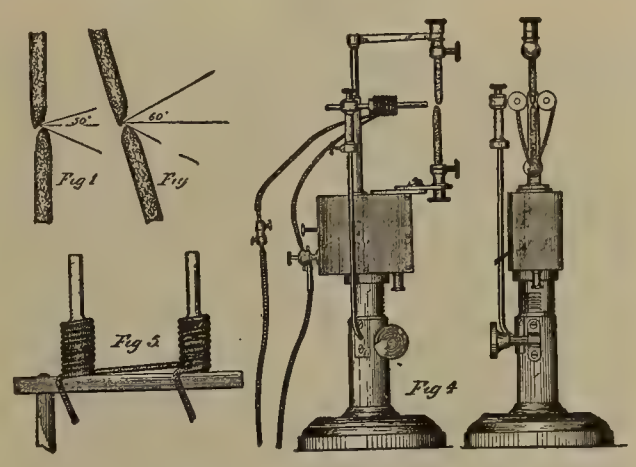
There is great diversity of opinion regarding the candle-power of both the calcium and electric arc lights. Makers and dealers in the calcium light claim as high as 900 candle-power for it as actually used in the lantern. I have made numerous measurements in the laboratory of the Adelphi Academy upon both. The method employed was that of the Bunsen grease spot photometer, with a sight-box by the American Meter Co. The standard of light was the Sugg London Standard Argand gas-burner and a Methven screen, by the same company. These have been compared with standard candles and are correct, or what is called so. The following table is compiled from my notes, each jet being tested three times. 1, A noiseless flame. 2, A medium flame making as much noise as would be allowable in the lantern. 3, A roaring flame, taking all the gas it will use.

CALCIUM LIGHTS.

Jet.	1	2	3	
A	304	304	413	candles.
B	130	205	413	"
C	264	304	491	"
D	264	304	353	"
E	180		304	

Column 3 gives the maximum beyond which these jets cannot be forced and which they cannot long maintain, since the lime would soon crumble away under such a bombardment.

A calcium light which had just been tested with a quiet flame was used as a standard by which to measure the candle-power of the two arc lights for lantern use belonging to the Adelphi Academy, with the results given below.



FIGS. 1, 2, 3, AND 4.

A small lamp made by the United States Electric Lighting Co., requiring about 8 ampères at 110 volts, gave 355 candles. A Clark lamp of full capacity, with a current of about 15 ampères, gave 1,378 candles, and with a full current of 20 ampères on gave 1,758 candles. These figures show that candle-power is much overestimated in all cases. The last lamp measured is what is called a 2,000 candle-power lamp. It gives in the condition in which it would be used 1,300 candles, and this is a magnificent output when compared with the 300 candles of the calcium lights.

In many places current can now be had from lighting and power circuits, while many educational institutions have their own plant, which could easily be employed for this purpose, but as yet no arc lamp of moderate price equal to the work has been put upon the market. Not to mention the old regulators, like the Foucault, with clock-work which requires frequent winding, there are several lamps costing about $100 made for this use, but that price

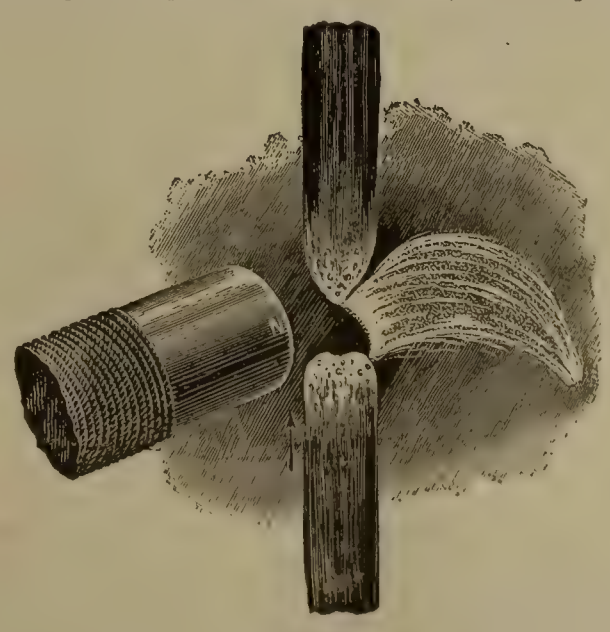


FIG. 3.

for the lamp alone is prohibitory to many. English writers recommend the Brockie-Pell lamp most highly. The Clark lamp, spoken of above, is a favorite here. It, however, is hung down into the lantern, resting on the top of it. Its regulating magnets and mechanism are heavy, rendering the whole somewhat top-heavy. To adjust the light one must reach above the top of the lantern, and if the lamp is to be removed from the lantern a special stand must be provided for it. The lamp I have used for nearly two years was made by the United States Electric Lighting Company. It is simple in construction, rising by a rack and pinion by hand, as the lower carbon is consumed to bring the arc into focus again. Its fault is that it does not "take up" quickly when the current varies through varying resistance in the arc. With a little experience its regulation by hand, to overcome this defeat, is not difficult.

Fig. 4 shows the appearance of the lamp and its interior mechanism, the sides being removed for that purpose when the photograph was made. It stands 20 inches high, with full length of carbons.

It would seem that a focusing lamp might be made for a moderate price which would, with plain, strong and durable workmanship, be as good practically as the highest priced lamp, and that such a lamp would find a good market.

The incandescent lamp has been used in the lantern by some. In its ordinary form with a long loop of filament the light is too widely distributed. A special form has been made for the lantern of 100 candle-power. The carbon filament was coiled into a close spiral of about a half inch in diameter, which is about the size of the white spot on the lime. This lamp is very easy to use, since its resistance would be fitted to the circuit upon which it was to be put, and it would run with the other lamps upon the same circuit and with no more attention. The operator has nothing whatever to do but to turn the key when the light is wanted. Where its light is sufficient nothing better can be desired, nothing cheaper be found. The lamp itself costs very little, and a support for it in the lantern can be made by any one. It is infinitely better than any oil lamp. I have known them to be used in small lecture-rooms in preference to the calcium or the arc light. But it is the arc light alone which can take the place of the calcium light for all uses. It leaves nothing to be desired. I cannot agree with the remark of Mr. Lewis Wright in his recent book on "Optical Projection:" "Such a powerful light is quite useless for exhibitions unless the disc shown exceeds 30 feet in diameter." My experience is that the better lighted a picture is, the less the eyes of the observer are taxed. With the calcium light the deepest darkness is necessary in other parts of the hall to save the picture from indistinctness, and the reading-lamp of the lecturer often blurs one side of it. When the arc light is used the illumination is so abundant that enough lamps, gas or incandescent electric, may be left lighted to enable the audience to see the lecturer and the lecturer to see his audience, so that notes may be taken or a manuscript read, while still the picture can be better seen in all its details than with any other artificial light. The ability to have other lights in the lecture-room is sometimes an important consideration in controlling an audience of students. It is useful always. I often project a slide of a diagram or a machine without wholly darkening the room, and go on with recitation or lecture upon it, while the class attend, copy or take notes as required. In a popular lecture it is far pleasanter. Nothing is more weird for an audience than to sit in deep darkness and listen to a voice coming as from an abyss beyond; nothing more unreal for a speaker than to stand upon a platform and to speak into darkness in which there may be supposed to be interested listeners. With the arc light in the lantern all this is changed, and speaker and hearer may be *en rapport* with each other in a fairly-lighted room.

If the operator is on an arc-light circuit, his lamp is put directly in series with the others on the same circuit, but the high potential used on such circuits makes such an arrangement rather a ticklish one to work with. The low potential generally used with incandescent lights is more safely handled, and there are now many arc lamps used on such circuits. The potential is never above 110–120 volts. At this pressure the wires may be handled as safely as those from a battery. Of course they must not come in contact with each other; for a short circuit will produce a great heat.

If the arc lamp is to be used on an incandescent circuit, additional resistance is required to enable the low-resistance arc lamps to burn in multiple with the high-resistance incandescent lamps. Arc lamps use from 8 to 15 ampères of current at 115 volts. Apply Ohm's law to this, $C = \frac{E}{R}$ or $R = \frac{E}{C}$, and we have $\frac{115}{8} = 15$ nearly, and $\frac{115}{15} = 8$ nearly. So an 8-ampère lamp requires 15 ohms and a 15-ampère lamp 8 ohms approximately of resistance to control the current.

A part of this is offered by the arc itself. The adjusting coils of the lamp furnish something more, differing in different lamps, but not enough to make up the resistance to the amount required to choke off an excessive current through the lamp.

There are two ways of arranging the apparatus:

1. The common way is to place a rheostat in the main circuit whose resistance can be varied at will, and thus more or less current be sent through the lamp. This is the method when the current comes from a central station at a constant pressure.

2. Where there is a separate or isolated plant, as in not a few educational institutions, a coil of No. 12

*Scientific American.

German-silver wire (so that it will carry the required current without heating, with a resistance of three or four ohms) may be put permanently in series with the lamp. The remaining adjustment will be made by the field rheostat of the dynamo. For this purpose the field wires should be brought to the lantern-table, and a field rheostat be connected to them within reach of the operator. By varying the field resistance he can change the voltage of the current and thus adapt it to the lamp.

The only defect of the arc light for lantern use is the "blinking" caused by the change of the position of the bright spot on the positive carbon. This bright spot emits by far the greater part of the light. To see it, place a deep red and a blue glass together and look through both. The bright spot still looks white, but the rest of the carbon looks dark red. This spot is seen frequently to move, sometimes to swing around, sometimes to jump across to the opposite side of the carbon. This motion is attributed to impurities, principally silicon, in the carbon. The best carbons, the Carré French carbons, are not free from this defect.

The blinking does not make much difference for street use. The light flickers and hisses and we endure it, but in the lantern, if the arc goes to the back side of the carbons, the picture is blurred or obliterated entirely. This motion of the arc is fatal to the use of the light for projecting microscopic objects. The light entirely leaves the focus of the objective, and comes back when it gets ready. Several microscopic societies have abandoned the arc light in disgust on this account, though when the arc is in its proper position, the illumination is superb.

The remedy for blinking has been to place the centre of the negative carbon in front of the positive by a distance equal to its radius. This serves two purposes. The distance from the tip of the negative carbon to the front side of the positive carbon is the shortest and easiest path for the arc, and so the arc will remain in front of the carbons, unless something makes it move. A second object which is gained is to form the crater in the positive carbon so that it slopes toward the condenser, as shown in Fig. 1.

In street lamps the axes of the carbons are placed in the same vertical line. The crater tends to be horizontal, and the light is radiated downward and equally all around as it should be. This is just what is not wanted in the lantern. The position shown increases the amount of light sent out toward the condenser and screen. Carrying this idea still further, lamps are made in which the carbons are set on a slope of about 20°, in which position the negative carbon cuts off but little of the light from the crater of the positive carbon, as is seen in Fig. 2. A comparison of Fig. 1 with Fig. 2 shows an angle of opening between the carbons 10° larger in the inclined carbons, although both figures are made from the same negative. The carbons in the focusing lamp used on the tower of the Madison Square Garden are set in this position. It is more convenient for me to tilt my lamp forward and make the lower carbon negative, which answers the same purpose.

According to my observation, this is but a partial remedy for the defect of blinking, and I have devised and constructed a special regulator for holding the arc in its proper position, which so far as I know is new and original, and which has proved successful.

The fact that a magnet strongly repels an electric arc is of course well known. Dr. Samuel Sheldon, now of the Brooklyn Polytechnic Institute, based upon this fact an electric blowpipe shown in Fig. 3.

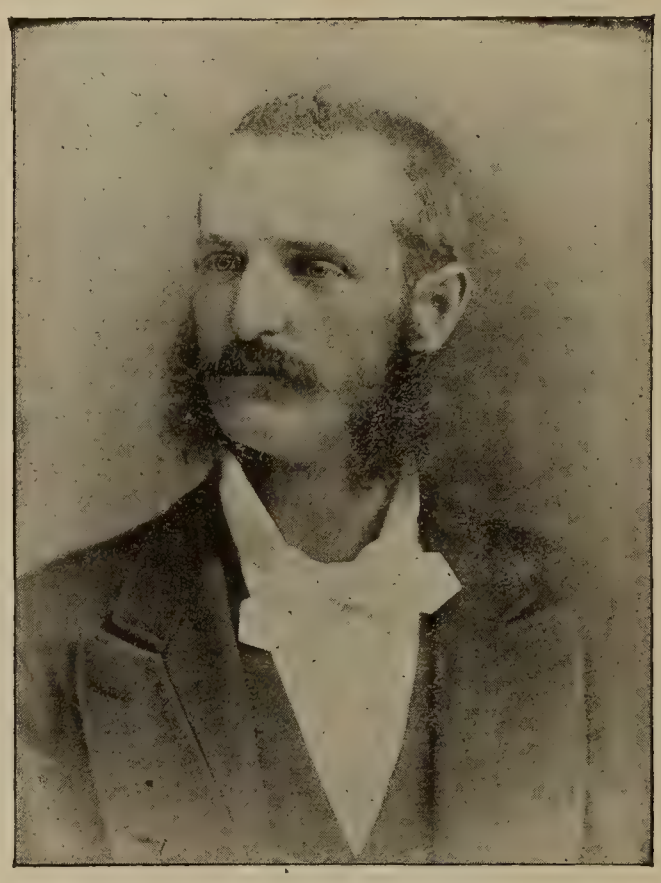
The same force in a less degree will hold the arc on one side of the carbon. At first one pole of the electro-magnet was used. This worked quite well. The apparatus illustrated in Fig. 5 was afterward made, which is an electro-magnet of the ordinary form, except that the soft iron cores extend beyond the coils, so that the coils may be set back far enough that their insulation may not be destroyed by the heat. The cores are of ¼-inch rod, 2½ inches long, and set two inches apart. Eight to twelve turns of No. 12 wire on each core will produce a field strong enough when the poles are set about half an inch behind the carbons. The mode of attachment to the lamp is plain from Fig. 4. It will be seen that the rod which carries the regulator is attached to the base of the lamp and that the magnets can be moved forward and backward. If too near, they drive the arc out with a hissing noise. The regulator is adjusted once for all as high as the focus of the condenser, and as the carbons consume, the rack and pinion brings the arc up to its place again, with reference both to the regulator and the condenser. The regulator is in series with the lamp, and the whole current goes throught it. It might be in parallel, but nothing would be gained by this arrangement.

I have had it in use for more than a year with the best results. Any one can easily make one and test its working. It is confidently expected that it will enable the arc lamp to come into use for lantern projections wherever the heavy current can be had.

BIOGRAPHICAL SKETCHES.

D. HERBERT JEFFERY.

D. Herbert Jeffery, Secretary of the Crocker-Wheeler Electric Company, was born at Corning, N. Y., and though but 38 years of age, his business experience has been a wide and varied one. In the early years of the sewing-machine business he became connected with the Remington and Wheeler & Wilson companies. Later turning his attention to the hardware trade, he accepted an engagement with the large house of Sargent & Co., of New York and New Haven. Mr. Jeffery subsequently assisted in the organization of the New York Live Stock Express Company, and was for four years its secretary. This was the first company to build and run cattle-cars through from Chicago to New York, in which cattle could be fed, watered and rested without unloading. It was also the first concern to build and run palace horse cars. Mr. Jeffery was also one of the three originators of the large corporation known



D. HERBERT JEFFERY.

as the Domestic Spring Bed Company, of Jersey City, N. J. He afterward withdrew, and with his brother started, four years ago, the concern known as Jeffery & Co., of Jersey City, manufacturers of wire springs. Mr. Jeffery, seeing the great future in the electrical business, subsequently sold out his spring business to accept his present post with the Crocker-Wheeler Electric Company, as secretary and office manager. Mr. Jeffery is a man of considerable executive ability, an A 1 salesman, and well known to the electrical fraternity, doing the principal part of the buying for the concern with which he is connected.

Electricity offers great possibilities to one of an inventive turn of mind, and Mr. Jeffery's well-known faculty for improving and inventing will, we take it, be turned to good account in his present field of labor.

FIRES AND INJURIES CAUSED BY ELECTRIC CURRENTS.

BY ALLEN R. FOOTE.

1. The difficulty of giving accurate and useful statistical information without asking a great many questions is aptly illustrated by the use made by *The Chronicle* in its issues of March 10 and 17, respecting statistics furnished by myself regarding "fires and injuries to firemen caused by electric currents."

2. The inquiries by means of which these statistics were obtained were originally drawn to include statistics regarding property losses by fires caused by electric currents. But on account of the tremendous pressure continually being brought to bear upon the Census Office *to cut down the scope of its inquiries*, it was decided to omit all reference to property losses in this connection and confine the inquiries strictly to personal injuries to firemen. This course was taken in consideration of two facts. While insurance associations and journals could be relied upon to keep the interested reasonably well informed as to property losses, there was no apparent source of information regarding personal injuries to firemen from electric currents.

3. It must be conceded that the conditions under which firemen work among wires carrying electric currents are more hazardous than any under which the employés of electrical companies or the public have any occasion to come in contact with such wires. The statistics were gathered from 425 cities, each having 8,000 or more population and an abundance of wires carrying electric currents for every form of commercial use. To show the experience of firemen in facing the dangers supposed to be lurking in such wires, it was necessary to show the number of men at risk, the number of times they were at risk, the number of times the risks were alleged to have been caused by electric currents, the number of injuries received, the number received at fires alleged to have been caused by electric currents, the number of injuries alleged to have been caused by electric currents, and the number of fatal injuries. Here are seven inquiries necessary to establish one fact. This was not sufficient, however. Stating that 31 injuries were caused by electric currents does not convey full information. It is important to know whether any or all of the injuries were serious or merely trifling. To ascertain this fact several more inquiries were addressed to each chief of a fire department, who reported an injury, to obtain information fully showing the character of the injury reported. The letters received in reply to these inquiries, covering every case of reported injury, are attached to the statistical information. The showing made by them is instructive. As a result of these inquiries it is shown that in 425 cities, covering about 76 per cent. of the total urban population of the United States, 56,498 firemen are enrolled on the regular and volunteer force. That there were during the year 1890 39,847 fire-alarms for which the whole or a considerable portion of the force was called out. Of this number 518 alarms are alleged to have been for fires caused by electric currents; 1,719 injuries to firemen, received in the line of duty, are reported, 60 of which were fatal; 31 injuries are said to have been caused by electric currents. But the special reports received, covering each of these cases, show conclusively that *not one of these injuries was fatal*, and with two or three exceptions they were so trifling that they were not worthy of being dignified by being called injuries; yet they gave occasion for lurid articles in the public press portraying the "dangers of the deadly wires." It was to remove the prejudice thus so unjustly created against the electrical industries that this investigation was made. This purpose it has accomplished most admirably.

Let it be borne in mind that all reference to fires in this inquiry is merely incidental; that the returns were made by the chiefs of the fire departments, and used as given without any effort to secure verification, and it will be very apparent how wholly unjust the attempt of *The Chronicle* is to use the reference to the number of fire-alarms to sustain its theory "that electric fires are increasing in frequency." If *The Chronicle* had stopped when it had written: "Most of Mr. Foote's 518 fires probably caused trivial losses, being in fact mere alarms. In the same year *The Chronicle* received reports of 121 fires caused by electric currents, in which the property losses and insurance losses were nominal. By our reports the proportion of electric fires in 1890, siza ble fires, was only .54 of one per cent., or about one-half of Mr. Foote's percentage," it would have made a perfectly fair statement to which no charge of prejudice could attach.

The dangers of property losses by electric fires cannot be settled in this way. Insurance companies are eminently practical and conservative in their management. Their business depends upon the fact that fires do occur, and their profits depend upon premiums calculated in the first instance upon the theory that they occur more frequently and are more destructive than the actual results show, and in the second place that any particular agent used on the premises is a factor of increased hazard. These two factors are depended upon in insurance calculations to keep the premiums abnormally high. Every per cent. unnecessarily added to the premium by this process is a direct addition to their profits. A new agent like electricity, coming into the field, about which there has been so much popular superstition and so little actual information, has offered an unusual opportunity for this particular method of figuring, and insurance men have not been slow to reap the harvest while they may. The day has come, however, when electricity shall benefit by the opposition it has encountered and overcome.

The interests of those engaged in the electrical industries are the direct opposite of the insurance companies. Risk of loss by fire is not the reason for their existence. They can make no profit out of the difference between the amount collected as premiums and the amount paid for losses. It is to their interest to prevent every fire they possibly can, and so to establish the reputation for *safety* for electric services, that the public, whose interest is identical with their own, will count such feature one of the de-

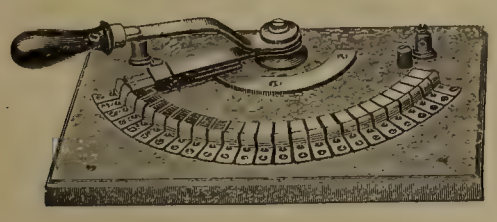
termining factors in adopting the use of electricity for every service that can be rendered by it. The adoption of "*Rules for safe-wiring*," by the National Electric Light Association, is in the interest of the public as well as of those engaged in supplying electrical services. They furnish a guide for this class of work prepared by those who know when wiring is safe, and whose interest it is that it shall be safe. Let these rules be broadly distributed. Let the users of electrical services be fully supplied and posted regarding them, so that they will demand a certificate that the wiring of their premises has been done in conformity with these rules before they pay their wiring bills. They can then show such certificate when wishing to place their insurance, or to renew or change their policies. This is the way to watch electricity as a cause of fire. Such watching no one can object to, and the more thoroughly it is done on these lines the better it will be for electricity. When this is done there will be no trouble whatever in procuring ample insurance from the strongest companies, and their premiums will soon settle down to the basis of legitimate profit on risks *wired as required by the rules of the National Electric Light Association.*

STAGE-REGULATING SWITCH.

The adoption of electric illumination in theatres and the consequent enhancement of the beauty of the scenic effects obtainable has become very general in this country. At first the effects were crude and inartistic, owing to the inefficient apparatus used for controlling the lights. A beautiful sunset effect would be spoiled by the dwindling of the rosy light by jerks, too perceptible to the audience not to cause laughable comment, and the opposite result occurred when the increasing light was supposed to represent a sunrise.

To obviate these objectionable features, the Edison General Electric Company has brought out a new stage-regulator switch by means of which graduations of light are obtained fine enough to satisfy even the most fastidious of stage managers. This switch, mounted on a slate base, consists of fifty clips arranged in a circle in four divided quadrants, with a four-armed contact passing over them, and engaging in a clip every quarter width of the clip.

Contact over the entire fifty clips is made by a movement of the switch-handle through an angle of 45° only, instead of through 120° as in all other stage regulators yet devised, and thus the speed of the operation is considerably increased. These switches are either directly mounted on the sides or the top of the fire-proof stage regulators, or are mounted separately upon a switchboard and connected with the regulators by means of regular fire-proof cables made up of the strands of the connecting wires. They can also be arranged in a special frame in such a manner that the handles can be worked separately, or connected together be all operated as one unit.



ORIGINAL STAGE-REGULATING SWITCH.

We show in the cuts the original type of stage-regulator switch with the semicircular row of clips, and for purposes of comparison, the improved switch with the circle of clips divided into four quadrants.

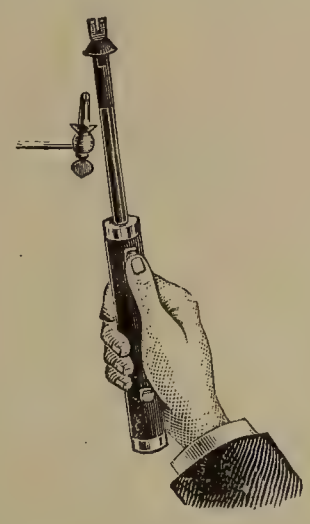
ELECTRICAL GAS LIGHTER.*

An electrical gas-lighter which is at once convenient, easily handled and reliable is a valuable piece of apparatus to have in the house or office, or in any other place where gas is used. The device illustrated herewith embodies all of these qualities, and is, besides, meritorious on account of the ingenuity of its construction and its small size.

This electrical gas-lighter has two cells of capsule battery and a spark coil within the handle. The spark coil is of peculiar construction and is designed expressly for use in this apparatus. In size it is 4¼ inches long by ¾ inch in diameter, and is claimed to be one of the smallest sizes ever made.

The capsule batteries made by this company are well-known for their small size and large current. They are of the "dry" class and they never polarize. Each cell has an E. M. F. of one volt, and delivers a current of 2.20 ampères.

This gas-lighter differs from the old gas-lighting apparatus in that it can be used in all kinds of weather, and its operation is not dependent upon the dryness of the atmosphere. In operating it the button is pushed forward, and this produces an instantaneous spark which ignites the gas in the usual manner. The lighter can be held in any position,



GAS-LIGHTER.

since it has a hood at the top of the extension-tube for the purpose of collecting escaping gas, so as to insure its ignition by the spark.

* The Nassau Electrical Company, 112 White street, New York.

NOTES ON ELECTRO-MAGNETIC MACHINERY.*

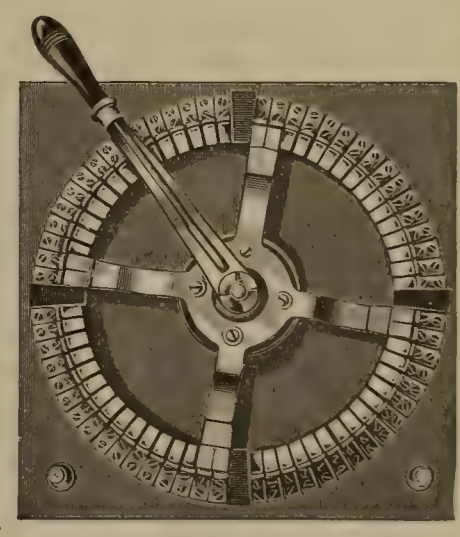
BY WM. S. ALDRICH, M.E.

The terms Machinery, Machines, Mechanisms are scarcely synonymous, though often so used. Early writers on the subject, among which the names of Monge, Carnot and Lanz are prominent, speak of mechanisms as means for altering or changing the direction of motion; such as the conversion of motion from continuous circular to reciprocating rectilinear motion. Ampère defined those mechanisms to be pure which consisted entirely of rigid bodies, limiting, as it were, the definition to the means by which the motion was produced or transferred; and he defines a machine to be "an instrument by the help of which the direction and velocity of a given motion can be altered." Willis, in his "Principles of Mechanism," follows closely, at first with a classification based on comparative motion, subordinating the means and modes of communication by which these motions were obtained; but, later, making the mode of communication primary and the comparative motion secondary in his classification of the elementary combinations of pure mechanism. Rankine, in his "Machinery and Millwork," adheres to Willis' later classification, but includes hydraulic connection as having a legitimate place among the means for the communication of motion in mechanisms. This marks a definite advance, for the means employed to communicate or transmit motion may be quite different, but the kinematic question remains the same—which is that of pure motion.

The Idea of the Kinematic Chain was brought out by Reuleaux, in his work on the "Kinematics of Machinery," as the next step in the development of the science of machinery. He thus defines a mechanism to be "a closed kinematic chain, which is compound or simple, and consists of pairs of elements; these carry the envelopes for the motion which the parts in contact must be given, and by these envelopes all other motions are prevented." The constrainment of motion now becomes a fundamental condition for every mechanism, and subordinates the mere question of directional-relation or of velocity-ratio, as determined by the comparative motion of any two points of the mechanism. A machine is a mechanism so operated as to do work, and is stated by Reuleaux to be "a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work, accompanied by certain definite motions."

The Electro-Magnetic Connection of Moving Parts, in a mechanism or a machine followed naturally upon the inclusion of hydraulic and pneumatic modes of communicating motion. For development in any line becomes apparent when a general identity is to be seen through many special varieties. And, however varied may be the mechanical movements of any machinery, or however simple the relative motions amidst the complicated mechanism, the ultimate analysis shows simple, well-known motions, obtained by well-known pairs of elements and kinematic chains, whether such chains are composed entirely of rigid connecting elements, or of hydraulic, pneumatic or electro-magnetic connection. Seeing, therefore, that the time was ripe for another mode of connection in mechanism, and which should include the electro-magnetic forces of nature as "among the mechanical forces of nature [that] can be compelled to do work, accompanied by certain definite motions," Sylvanus P. Thompson has given us the term "Electro-Magnetic Mechanisms," and considered them somewhat at length in connection with his work on "The Electro-Magnet." It is my purpose in these papers to speak of these mechanisms when put to do work, as electro-magnetic machines; and the general term, electro-magnetic machinery, will include such mechanisms as may be more or less useful in the conversion of motion under constrainment, and such machines as may be useful in the direct transmission of energy—by electro-magnetic means.

The Medium for the Transmission of Energy may likewise serve, as it often does, as the means for communicating motion; and, when energy is transmitted along with the conversion or transfer of motion in any mechanism, that mechanism becomes a machine. Any medium, therefore, which is of such a nature as to admit of its being made a part or link in the mechanism of the energy cycle, will serve, in almost all cases, equally well for the transmission of energy or of motion; provided, that notwithstanding the deformations to which it may be subjected, the medium is capable of returning to its original condition. Some mediums or links are practically incompressible and inextensible, within the usual limits of the transmitted energy; such as iron rods, retaining their form throughout; and a water connection, which retains its volume while altering its volume-form. Other mediums admit of practical extension, but are of little use in compression; such as belts, wire ropes and like flectional elements used as wrapping connectors in mechanism. Compressed air, springs and like flectional elements admit of practical extension and compression, and are of more or less value in the transmission of energy; but of little use as elements or links of a kinematic chain for constrained motion. In all of these energy is transferred by and through matter in some one of its many forms—matter which follows the laws of the continuity of matter and of space, while entering as a medium in the continuity of energy.



NEW QUADRANT SWITCH.

Systems for the Transmission of Energy have therefore become quite definitely established, for long or short distances, and have taken the following broad lines of development:

(1) Mechanical transmission, by belts, wire ropes and other wrapping connectors for long or short distances; and by gear-wheels, links, screws, cams, ratchets and like forms, for more immediate and direct transmission.

(2) Hydraulic transmission, with pumps, accumulators, connections, motors and presses, more or less varied in form for utilizing water-pressure.

(3) Pneumatic transmission, with the compressors and apparatus especially adapted to that medium.

(4) Electric transmission, with dynamos, line connections, regulators and motors, and chiefly used in long-distance transmission.

It is proposed to add:

(5) Electro-magnetic transmission* in which the dynamo and motor, as generator and receiver, or as driver and follower, shall be in the same magnetic circuit; or in which the magnetic circuit shall be used for direct and immediate distribution of energy for very short-distance transmission, in much the same way as the electric circuit is even now used for long-distance transmission.

The Ether as the Medium for the Transfer of Energy, by electric or electro-magnetic means, has

* Read at the meeting of the Electrical Section, Franklin Institute, Philadelphia, held December 1, 1891.

* Paper read before the Electric Club of the Johns Hopkins University, November 9, 1891, on "Notes on Electro-Magnetic Transmission of Energy."

been found to possess many striking analogies to other and better-known mediums. By the modern theory of electricity, the electric energy is supposed to be concentrated in the ether surrounding the conductor, or other core of disturbance, and that a transfer of the ether energy takes place whenever electric energy is being transmitted from point to point. However great may be the contrast between the mechanical, hydraulic and pneumatic transmission of energy and the *etheric* transmission, it remains a fact that energy may be transmitted by all of these means, with varying degrees of efficiency, and accompanied, if desired, by definite conversion of motion. The former three require some material connecting-link between driver and follower—some kind of contact of elements, or some paring of surfaces—while the etheric transmission requires no such material contact or paring; indeed, such contact may kinematically lock the whole mechanism, as an armature, in contact with its core in some special forms of this type of electro-magnetic mechanisms. The ether medium allows of the transmission of constant or varying forces, as now transmitted by more material modes of connection; and with the peculiarities of comparative and constrained motion accompanying such energy transmission. By the displacement theory, electricity seems to act as an incompressible fluid. By the researches of Hertz, the ether appears to be possessed of some peculiar mechanical properties, such as inertia, and stress and strain manifestations. We have even come to conceive of the mechanism of the ether medium and to picture some of the peculiar manifestations of the ether mechanism as analogous to gear-wheel mechanism.

CORRESPONDENCE.

PRIMARY BATTERIES.

Editor Electrical Age:

In my former communications to the Electrical Age upon the subject of primary batteries of strong and constant current, I endeavored to point out some prevailing errors in their construction and the necessity of using mechanical means in part to depolarize the battery in order that the cost of maintenance should not be too great to admit of their use in fields where they are much needed, such as operating motors for the propulsion of various kinds of light machinery. I wish in this article to describe a battery that can be adapted to operating sewing-machines and ventilating fans. In the first place a sewing-machine battery should be contained in a case not exceeding 12 x 7 x 9 inches, containing three cells of high E. M. F. and perfectly depolarized by means that would make the service cost not to exceed 10 cents per day for ordinary continuous work. For usual family work two cells will do the work well.

In this statement I have in view motors like the Perret, the "C. & C." and others like them, wound for from 4 to 10 volts.

For so compact a form the cells would, of course, need to be rectangular which, for many other reasons, is the preferable form. The battery should be free from local or wasteful action when standing on open circuit even for long periods, at least for weeks, and not lose its energy, but be ready for work at all times.

I am aware that many persons are ready to affirm that a primary battery of the kind under consideration is impossible—a battery of high E. M. F., as it must needs be, to do the work with the number of cells named above. I will here call the attention to an opinion extensively entertained even now by many who should have learned better by this time; it is this, that a porous cup on a battery, if its porosity be reduced to such a degree as to be efficient for the work for which it is designed, will so largely increase the internal resistance of the battery that only a small delivery of current can be obtained, and they are thus rendered useless for the propulsion of motors and other work requiring large current. Here is certainly a very strange error and most obstinately adhered to and announced oracularly, and with such assurance as would frighten an ordinary mortal from stating the contrary. Niaudet states the result of several experiments upon this subject and notices the ordinary opinion concerning the same which has now become antiquated. This is what he says: "All this would lead to the belief that the choice of porous jars had great influence upon the intensity of the current by changing the internal resistance of the cell." The results of several experiments show, however, that jars of different states of porosity can change *but slightly* the resistance of the cells.

It is a fact that the battery that to-day in this city is capable of delivering the greatest current continuously is a porous-cell battery, dimensions being equal. Very low internal resistance is attained, and so slight is the porosity that there is no mingling of the liquids while on open circuit that causes any waste of zinc.

Whether a porous-cell battery "is entirely worthless for work on external circuits of low resistance, such as motors," let practical results decide. Three cells of dimensions as follows will operate a sewing-machine well, $3\frac{3}{4}$ x 7 x 7 inches deep, weight when charged, 12 pounds.

The battery without porous cell, for which high claims are made, requires *ten cells* to do the same work, as is stated in the illustrated catalogue of the manufacturers. Of the comparative *expense* of maintaining, I will say and will prove (if desired) the odds are *very largely* in favor of the said porous-cell battery, as well as the work of caring for it.

We repeat here what we said in a former paper, that very low E. M. F. is a fatal defect in a battery for operating motors, it necessitating the great increase in the number of cells it is rendered *too costly*. It is not likely, Mr. Editor, that I shall have occasion to ask any further use of your columns to discuss the subject that has been our pleasure to offer a few thoughts upon on several occasions. My object has been to make known some things in regard to primary batteries which I had learned by long study and work in improving their usefulness. I have carefully avoided misleading your readers in any statements that I should make.

I have worked *years* in this department of electric improvement; have studied every battery patented in this country and Europe with a view to accomplishing what all authorities agreed were possibilities; and the lines upon which improvement must come are happily indicated by the following passage from Niaudet and Prof. Crocker. Niaudet remarks as follows: "The most important improvements in batteries are those which have had in view the diminution or suppression of polarization. * * *

The principal aim and efforts of inventors worthy of that name has been to depolarize the electrode." Prof. Crocker says, in reference to the whole matter of battery electricity: "The fault is in the apparatus." To improve the "apparatus" and to suppress polarization has been my whole aim and effort.

After working now five full years without giving a thought or an effort to anything else as an occupation, I am more than satisfied with results achieved.

I have not forced myself upon the attention of the public; have steadily refused to do so until all that I thought possible had been accomplished in this department of electric work, so that some persons may be measurably excused for not knowing what has been accomplished but not published. D. N. K.

New York, March 25, 1892.

SINGLE MOTORS FOR CARS.*

BY E. A. SPERRY.

I have been deeply interested in the consideration of car equipment where a single motor has been employed. It has seemed to me from the earliest that a single motor was by all means the best; that it was by far better to employ a single motor where possible, and dispense with the complications involved in using two. There is certainly no trouble in obtaining power enough in one, but inasmuch as it has been suggested by some one that the car equipments had been designed in some instances by the so-called electricians rather than by the mechanical engineer, the mechanical difficulties encountered in transmitting the power after it has been generated, and distributing it to the traction-wheels of the car, have stood in the way of employing one motor rather than two. Not only have I believed in the employment of a single motor for car equipment, but I have undertaken to put my ideas into practical form. For instance, I have employed a single motor for two wheels upon a car, four wheels, six wheels and eight wheels; and these not on models but upon full-grown, full-sized car equipments. Some eight-wheel car equipments which I have been engaged upon have weighed as high as 12 tons, and have been employed on very heavy grades. These equipments have required different powers of motors. For instance, on an equipment of this class—that is, single-motor car equipments—I have installed motors as high as 125 horse-power, in those cases running eight wheels. This principle in operation has been very satisfactory—very much so indeed. These equipments have been used on tracks with heavy grades and in severe service in the way of railway crossings and numerous frogs, and in the heavier motors have been used on extremely sharp curves—that is, curves of low radius; and where employed as locomotives, they have been attached to very heavy trains and have succeeded in doing the work for which they were assigned; in most instances they have been enabled to do a great deal more work than it was at first supposed they were capable.

I am a firm believer in the single source of power and a system of distribution for that power to the various wheels of the car.

The points I will consider in connection with this matter may be stated briefly as follows: A single motor for car equipment is the better, or the best form, from the fact that it is simpler, less expensive, it has a lighter weight, has a higher efficiency, and it has higher efficiency of transmission after the power is generated; it is more economical of current in other ways, as we will see; more economical of repairs; it can be made to give us more traction, and a single motor permits of more elaborate construction to adapt the motor and gearing to the requirements of service.

As to the first point, that it is simpler. One motor is simpler than two, having one armature, which is

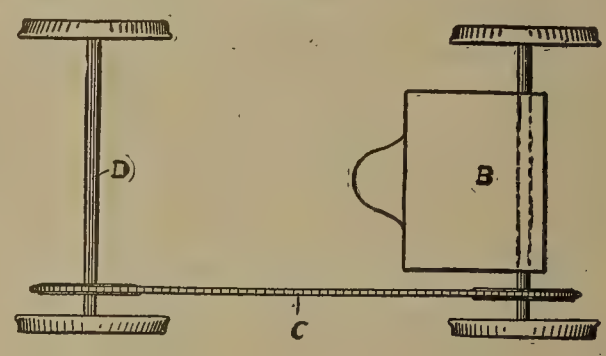


FIG. 1.

the bane of a great many electrical railroads; employing but one set of commutator-brushes, and where the motor is geared to the tractive elements of the combination by a single-reduction gearing, there are less journals, less parts, and taken from every standpoint the equipment is simpler.

The point of its being less expensive is one which needs no elaboration. It will readily be understood that for a given potential a larger motor has less windings upon it and is of quite a little less weight for a given capacity. The windings, for instance, in a 50 horse-power motor need only be about half what it is in a 20 horse-power motor, and we all know that the element of time, especially where expert workmen are employed in the construction of any device, is the feature that very largely controls in the computation of the total cost of the articles, and where fewer convolutions and parts are required for the same power, of course considerable can be saved in the equipment.

That the equipment is lighter in weight I have had ample opportunity to observe from the fact that I have seen equipments operated side by side, and have investigated as to the weight of single-reduction and double-reduction equipment, where one motor

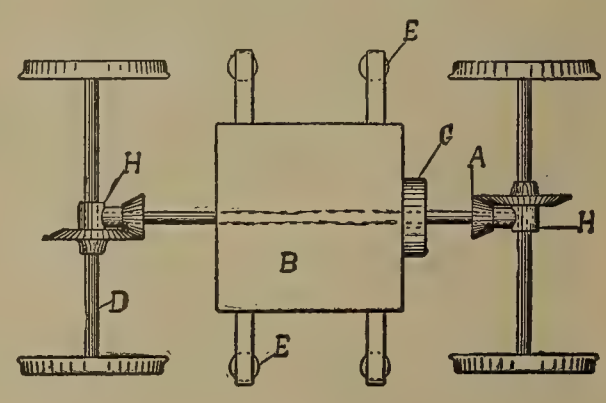


FIG. 2.

and where two are employed, and know that the saving where single-motor equipment was employed is between 1,800 and 2,200 pounds.

This factor is one of importance, inasmuch as it has to deal with the wear and tear upon the road-bed and the total amount of power required by the equipment, especially the total amount of dead weight to be pulled about for a certain carrying capacity in live load. For instance, take an extreme case like the Pike's Peak Railroad. There they have an equipment which weighs about 37 tons. The total capacity of that equipment in live load is somewhere between three and four tons weight—that is, the paying load is between three or four tons for hauling 37 tons. In electric street-car service, especially where the roads are comparatively level, the

* Abstract of paper read before the Chicago Electric Club, March 21, 1892.

paying weight can be greatly increased as compared with the total weight of equipment. This can be accomplished to the greatest extent where a single light-motor may be employed to develop the traction. It may be stated that in the distribution of this weight (suppose we consider a single motor for car equipment as compared with two motors, each hung upon the axle), where two motors are employed, it is usually customary to hang them directly upon the axle, and the consequence is that in some instances it springs the axle. I came across an instance of this kind recently, and there are numerous instances of the sort. I enquired the size of the axle. I said: "Your axle must be extremely small if the weight of the motor is sufficient to spring it." The means of its measurement not being at hand, we, however, found a wheel that had come off of the axle, and measured the bore, and it was a standard $3\frac{1}{4}''$ steel axle that had been sprung by the hammering action of the motor mounted upon it. The axles are much more readily crystallized when carrying this weight, and, as is well known, the road-bed suffers materially, which is a question of great importance—the one that is being talked of and investigated very extensively at the present moment. It is a question that has seemed to dawn on the street-railway people all over the country almost within the last six months, and extreme measures are now being employed to obviate it. They are trying to overcome this bad effect in a number of ways, some of which seem to promise good results.

Now there are two methods in which a single motor may be employed. Let us consider B the motor in Fig. 1, in this case mounted directly upon the axle, its end being supported in any of the usual ways, elastic or otherwise. In that case the power from a single motor may be transmitted by gearing or by a sprocket-chain C to the other axle, letting the dotted line indicate the sprocket-chain. That method was one of the first used by Mr. Van Depoele—the sad news of whose decease has just reached us—and we are all affected with the same feeling of sorrow that so prominent an engineer has passed away. This form of transmission was used at a very early date by Mr. Van Depoele. He placed the motor on the front platform of the car and then transmitted the power back through counter-shafting, first using gearing and then transmitting to one axle by a chain. In numerous instances in Ohio chains were used between two axles, so as to transmit the power to all the axles, thus getting the benefit of all the adhesion. This idea of using a sprocket-chain, while it was one of the first used, has never proven successful, from the fact that wherever in engineering a sprocket-chain is used it requires that the centres shall be adjustable. The distance between the axles in all cases should be capable of adjustment. Of course it is possible in some instances to use a sprocket-chain with an idler, but in that instance it must be a "face-wheel" in almost every case. But in the case here our wheels are small as compared to the distance; the idler brings the chains too near together, and the greatest adjustment possible is very small, and has never been found available. The idea of making both, or one of the axles adjustable with reference to the other, was thought at first not to be good engineering. The proof of this, of course, would be in equipping a car in this manner and watch the operation. I have done this and can report, after some months of use, that there seems to be no trouble at all in allowing one axle of a truck to be adjustable. The main difficulty encountered at first was the fact that sometimes one end would be adjusted further than the other. I found that a very simple expedient to remedy that was to provide a small scale attached to the stationary part of the truck, with a little pointer fastened to the movable pedestal box, and whenever it was adjusted, the pointer would move along the scale, indicating whether the two sides were alike, so that the two axles would not be at an angle.

The other system may be diagrammatically illustrated as in Fig. 2. Suppose B to be a motor, a bevel-pinion shaft connected therewith, and a bevel gear to be attached to each axle as shown. The bevel gear on one axle should be in the opposite position to that on the other, so that all the wheels will move in the same direction. It has been thought by some that the use of bevel gearing is objectionable. It has been thought that a bevel gear will not run on pitch lines. A bevel gear I have found by actual tests to be more delicate than a spur gear. A spur gear is one where the teeth are parallel to the axis of the rotation. I find, however, this fact: that when the pinion in any bevel-gear combination is held so that its lines can be maintained, and maintained in an extremely rigid manner, so that "against all comers" these lines are made to meet exactly at a point of coincidence of the pitch lines and cones, there is no friction of the bevel, even though it is a rough casting, no more than there is in spur gearing under similar conditions.

ELECTRICAL EXHIBITS AT THE WORLD'S FAIR.

The Department of Electricity of the World's Columbian Exposition, of which Mr. John P. Barrett is chief, is mailing to prospective exhibitors a pamphlet containing classification, rules and regulations and other information concerning the intentions of the department. Mr. Barrett has decided to immediately begin the assignment of space, and those who have not already made application should do so at once.

The scope of the department, as set forth in the pamphlet, probably will be of interest to our readers at this time. It is as follows:

"The primary object of the Electrical Department is the demonstration in actual operation of the commercial and economic applications of electricity. It is desired moreover to make exhaustive tests of electrical apparatus in all possible directions with a view to establish the actual efficiency of the same in comparison with other and older methods of accomplishment.

"In addition to these practical features, it is contemplated to present object lessons of interest and instruction, showing the development of the science from its formative or initiatory state to the present time. The accomplishment of this object will take the form of an historical exhibit embodying models, drawings and crude machinery made and used by pioneers in the science. It is the earnest desire of the department to make a full and connected showing in this direction, and the co-operation of all who are interested in the work of the department is solicited.

"Reverting for a brief space to the practical features of the exhibition, a few of the more pressing applications of electricity may be mentioned, in which directions special facilities will be required, and in which an endeavor will be made to meet the requirement.

ELECTRIC LIGHTING.

"The buildings and grounds of the Exposition will be lighted by electricity. It has been estimated that about 8,000 arc lamps of 2,000 candle-power and about 130,000 incandescent lamps of sixteen candle-power will be required. Besides this, from 3,000 to 3,500 horse-power will be required for the operation of the machinery of exhibitors. To furnish and transmit this 24,000 horse-power, the Exposition Company will construct a plant which, though a complete station in itself, will be composed of a number of smaller complete plants installed by those who contract to furnish certain parts of the service. These plants will be primarily for the service of the Exposition, but are not for that reason prohibited from becoming competitive exhibits as well, provided the usual course is taken by their owners of making the proper application as exhibitors, through the office of the Director-General.

ELECTRIC RAILWAYS.

"An intermural railway of five miles in extent, for transporting passengers about the grounds, will be arranged for as part of the service of the Exposition, and, though the question has not been definitely settled, it is expected that electric power will be the operating force.

"In addition to this road, it is contemplated to make provision for the exhibition of electric-motor cars in operation. The necessary space for this purpose has not been located as yet, but exhibitors may feel assured their interests in this behalf are fully appreciated, and will be given proper consideration in ample time to allow all necessary arrangements.

MINING AND MILLING WORK.

"Preparations are being made for the exhibition of motors and other electric machinery, to fully illustrate the possibilities of the science in the direction of mining and milling, the long-distance transmission of power for mining operations and the various applications of the power at the point of usefulness.

METAL-WORK.

"Reducing, refining, separating, welding and shaping metals and all kinds of electro-metal work will be the features of the exibition of this department, and all possible facilities will be furnished exhibitors in this field.

ARTISTIC EFFECTS.

"Art in electricity is becoming popular, and an endeavor will be made to show the newest and most approved fixtures for lighting, as well as the many systems of stage and auditorium lighting, the lighting of art-galleries, etc. Small chambers, illustrating various effects promise to be popular with exhibitors, and all proper aid will be extended by the department looking to the best possible result as well as to the exhibit generally as to the individual exhibitor.

INSULATION WORK.

"Wiring, underground and overhead systems of construction, interior insulation, conduit construction, etc., promise to be greatly benefited by carefully-installed exhibits, showing development in these directions, and exhibitors will be given opportunity for thorough tests of their apparatus."

The chief of the department will be glad to furnish special information to those interested and invites correspondence.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

At the meeting of the New York Electrical Society in Prof. Chandler's room, Columbia College, Forty-ninth street, on March 25, a good-sized audience was present.

Prof. F. B. Crocker gave a lecture on electrical measuring instruments, and on the counter before him was an example of almost every class of instruments of this character used. He could not go into details concerning every instrument, there were so many things involved. The Weston instruments alone were well worthy the study of months and even of years. There were, however, general characteristics and facts about electrical instruments which would receive his attention.

Prof. Crocker referred briefly to the fundamental and derived electrical units, and also to Ohm's law. While on the subject of units he referred to the error made by the British Association in determining the value of the unit of resistance—the ohm. The B. A. unit, he said, was equal to .9866 the absolute unit, the error amounting to $1\frac{1}{3}$ per cent.

For accuracy he thought the Weston instruments superior, and preferred them or the Thomson balance to the tangent galvanometer for measuring.

Referring to the results of Tesla's experiments, Prof. Crocker stated that the real effect was electrodynamic in its nature, not electrostatic.

The speaker then briefly described the various instruments and the principles upon which they were constructed, and pointed out their advantages and disadvantages.

The lecture throughout was exceedingly interesting, and was listened to very attentively by the audience. Prof. Crocker handled the subject in a way that showed his complete familiarity with the principles and practice of electrical measurements.

GROUNDING ELECTRIC WIRES.

At a special meeting of the New York Board of Fire Underwriters, held March 10, the chairman of the committee on police and origin of fires, after verbally reporting the results of the committee in reference to their investigations into the dangers from grounding electric wires, offered the following resolutions for adoption:

"*Resolved*, That the committee on police and origin of fires be and they are hereby directed to require all electric companies furnishing current for power and lights (to parties that have received certificates of approval of electric equipments from this board), to make regular weekly reports of the tests of their currents, as called for in the requirements of this board, and in the event of failure on the part of the electric companies so to do, then the superintendent of the survey department is hereby directed to decline to grant certificates, or make inspections of equipments supplied with current by said delinquent companies, and further

"*Resolved*, That said committee give notice to all electric companies receiving certificates from this board, that the intentional grounding of any portion of the equipments is a violation of the rules of this board, and such practice must be discontinued. This board will refuse certificates of approval to all companies who do not comply with this rule, and further

"*Resolved*, That the committee require of electric companies that all grounds now existing on electric circuits shall be removed on or before Oct. 1, 1892."

Action will be taken on these resolutions at the next meeting of the board.

THE CHOICE OF A DYNAMO.*

TRANSLATED FOR THE "ELECTRICAL AGE" BY N. B. G.

Before construction every electrical plant, in order to act regularly and economically, should be studied attentively in all the details of the material employed.

In view of these facts it is necessary that the electrician in charge be familiar with all practical details.

As a necessary preliminary in the judicious choice of a dynamo, one of the most important points to be considered is the work which it will be required to do. We find in an article by Prof. E. P. Roberts, published in a late issue of the *Journal of the Association of Engineering Societies*, several statements which should guide the electrician in the choice of a dynamo. We will give here a summary of the numerous practical hints embraced in his work, as to certain points, and the article in full as to others.

It is indispensable in the critical examination of any dynamo that each of the parts be examined as well from a mechanical as an electrical point of view.

MECHANICAL PART.

From a mechanical point of view, the manner of construction, bearings and rotary portion should be successively examined.

Framework Construction. — The construction should be sufficiently rigid and of a form to allow free access to the commutator and brushes either for the purposes of cleaning or adjusting. It should be placed on a solid foundation and in such a manner as to reduce the centre of gravity of the movable parts (the inducer or inductor according to the type of dynamo). It is equally necessary that it permit of easy and quick repairs of all the parts exposed to constant usage or considerable mechanical effort.

Bearings.—The bearings should be of sufficient surface, easily replaced and lubricated; they should also be placed in such a manner as to prevent the lubricant from running along the shaft or dropping upon parts other than those for which it is intended, and thereby preventing a collection of dirt which would be detrimental to the machine, and further, it would cause metallic dust to enter into the joints of the machine and cause electrical derangements. The waste oil can be filtered in machines specially made or mixed with fresh oil and used again profitably.

Rotary Part.—The rotary part of the dynamo (inducer or inductor) should be solidly affixed to the shaft, and preferably keyed. The shaft should be light, strong and perfectly true, as otherwise it would result in augmenting the friction, and perhaps cause heating, thereby producing a strain on the machine. The pulley of the dynamo should be of a diameter in proportion to the mean linear speed at which the belt is to be run. It is also necessary that the movable part should be perfectly round and the centre of gravity on the axis of the shaft, otherwise vibrations are inevitable.

The disposition of the mechanical parts of the dynamo should be such as to insure the necessary rigidity of all the parts that the electrical currents be given out with regularity; for example, where the inducer is run at a high speed it is indispensable that the wires should be solidly wound and the connections firmly made, otherwise there will be danger of distension on account of the tangential force produced by the fields.

ELECTRICAL PART.

Commercial Value.—The commercial value of a dynamo is fixed by the relation existing between the electrical energy furnished and the mechanical energy absorbed.

The mechanical energy absorbed is easily determined with a dynamometer of transmission placed between the motor and the dynamo. To measure the electrical energy produced it is sufficient to determine, first, the difference of the potential in the exterior circuit with the aid of a voltmeter; second, the amount of current in the same circuit with the aid of an ampèremeter. The two values thus obtained, multiplied by each other, give the value of the electrical energy furnished, in watts, the product thus obtained, divided by 745, gives the same energy in horse-power, since 1 horse-power equals 745 watts. Given on the one hand the electrical energy produced and on the other hand the mechanical energy absorbed, the result will be the commercial value of the dynamo. It is equally necessary to have a dynamo that gives a high yield, whether going at a full or fractional rate of speed.

Practical Yield.—The practical yield can be ascertained by the relation which exists between the electrical energy furnished and the purchase price of the dynamo, cost of the motive force and all other expenses for improvements—in other words the yield in watts per dollar expended.

In the expense for improvements, those relating to the maintenance and repair of the dynamo should be included. It is difficult to determine these expenses precisely, but inasmuch as the dynamo will be kept in good condition and cut-outs placed where necessary to prevent accidents, or in case of aërial lines protection to the line by the use of good lightning-arresters, the repairs will be unimportant and will not amount to more than 2 % of the purchase price, otherwise the figures may be much larger, even reaching to the extent of replacing the dynamo in a short time.

The yield in watts by total kilogrammes of weight, by square meters of surface occupied, and, in certain special cases, as on board ship for example, by cubic meters of space, is generally of secondary importance although it may sometimes be necessary to keep an account of it.

It is well known that a large dynamo costs less and occupies less space per watt furnished than the equivalent in small ones.

Heating.—It is indispensable to take an account of the augmentation of temperature produced by action of the dynamo. When the parts are considerably heated the insulation might become carbonized, rendering the wires very weak and the insulation defective. After running at full speed for some time the temperature should not rise to more than 70° in the inducer and from 50° to 60° in the inductor. These limits are often passed, but it is not prudent.*

When the winding is of a considerable thickness the outside layers are always cooler than the internal ones.

We should not lose sight of the fact that the outside layers of an armature will always be cooler during the time it is in motion than immediately after stopping, because the cooling is less rapid when it is stopped than during the time it is revolving, for the reason that the cool air is not renewed as quickly, nor should we be astonished that the temperature of the outside layers rises gradually to the same degree of heat as the inner layers as soon as the machine is stopped.

The temperature of an inducer can be ascertained with sufficient practical precision by placing on it a thermometer as soon as it is stopped and covering it up with a woollen cloth.

Sparks from the Brushes.—The manner in which the commutator and brushes act is an important point in determining the electrical action of a dynamo. When the dynamo is of the open-coil type—that is to say, when an elementary coil may, during certain times, be out of circuit and which should give a current of feeble intensity and great electro-motive force—sparks will be produced sufficient to damage the commutator.

On the contrary, when the coils of a dynamo are closed and also those which are intended to produce a current of great intensity it is necessary that the production of sparks be minimized.

Brushes and Commutator.—Following the conditions of action found in the dynamo, we will know if it is necessary to modify frequently the wedging of the brushes to conform to the variations of the charge.

In cases where frequent adjustment is necessary it is advisable to learn whether it is more advantageous to adjust by hand or automatically.

In important stations it is preferable to adjust automatically to minimize complications and prevent loss of energy, so that the advantages obtained will be more in accord with the expense incurred, and the necessary complications might at times be causes of troublesome derangements and require the presence of a skilled mechanic.

The commutator should present a smooth and uniform surface.

The peripheral speed should be sufficiently moderated to prevent too great heating due to friction, and the pressure of the brushes should not be too great for the same reason.

The brushes should at the same time be sufficiently tight to insure perfect contact with the commutator and to remain always perfectly flat on the fixed conductor, for that reason it is necessary that the brushes be connected with substances of great conductivity and that the brush-holders be as near the commutator as possible. Brushes and brush-holders should always be in a certain degree elastic.

In some dynamos the brushes rest tangentially on the commutator, but more often they are applied obliquely. When the brushes are well fixed in the brush-holders we should see that they rest uniformly on the commutator and that they are maintained solidly so as not to suffer from a change of position. The brush-holders should be sufficiently accurate and elastic to insure perfect contact with a minimum amount of friction. We should insist on this point.

In machines intended to give currents of great intensity, it is preferable that there should be on each side two or several brushes instead of a single one. In effect, the electrical resistance finds itself sufficiently reduced, owing to the augmentation of the surface of contact between the brushes and the commutator, and imperfect action of the dynamo is to be attributed more to bad adjustment of the brushes than to the speed of the dynamo. When there are several brushes used we should see to it that all of them are suitably fixed side by side so as to be placed on the commutator, as one brush, evenly. Sometimes it is preferable to have the brushes one in front of the other.

Carbon brushes are at times more desirable than copper ones, because they require less attention than the latter. They present also the advantage of suppressing sparks due to the short circuits in the armature when the brushes touch two contiguous segments of the commutator.

The same brush-holders can be used for carbon brushes as are used for copper ones, but special brush-holders should be used.

Isolation of the Dynamo.—It is indispensably necessary that the circuit be well insulated from the metallic portion of the dynamo. During the action of the machine it can be roughly ascertained if the insulation is bad. For this purpose it is sufficient to touch with moistened hands a part of the pedestal not covered with paint and well cleaned and one of the binding posts, when no appreciable shock will be felt. The operation can also be repeated with a copper wire by uniting the binding post to the frame which should produce no spark. The isolation of a machine should generally not be less than 100 ohms per volt developed at the posts when the dynamo is at normal speed in a dry place.

Verificatian of the Dynamo in Point of View of the Usage to which it is to be Put.—The best way to ascertain if a given dynamo comes up to the demands of the service intended is to run it at a normal speed indicated by the constructor, and at full charge. Then running at different speeds, increase in each case the difference between the potential and the volume of the current, the electrical energy developed being absorbed by appropriate resistances. We will then have the elements of the known curves under the name of "characteristics," which are to the dynamo what diagram indicators are to steam-engines. In these trials it is well to verify the effect produced by a slight displacement of the brushes.

* J. A. Montpelier in *L'Electricien.*

* A machine attains the temperature mentioned when the quantity of heat it loses by radiation has become equal to the quantity of heat developed in the parts mentioned.

THE VACUUM IN LAMP BULBS.

BY THOMAS R. TALTAVALL.

One of the most interesting stages in the progress of the manufacture of incandescent lamps is the exhaustion of air from the bulbs, and the life of the lamp depends more upon the success of this part of the work than anything else.

Human beings cannot live without air, but electric-lamp filaments cannot live with air—the oxygen in the air which is so essential to the support of animal life is fatal to the life of an incandescent lamp filament. The carbon of the filament oxidizes very readily when heated in the air, and for this reason it is necessary to confine it within a bulb from which the air has been exhausted.

The exhaustion of air from lamp bulbs is accomplished by means of vacuum pumps, and it must be conducted with great care, as it is at this stage of lamp-making where the greatest difficulties are met. Mercurial pumps are used for the exhaustion of air, among the best known of which are the Sprengel and Geissler. Mechanical pumps are usually employed to hasten the process in its first stages, mercurial pumps being afterwards used to complete the work. The mechanical pump cannot produce as high a vacuum as is necessary for lamps, while the mercurial pump can produce a higher one than needed.

A word about the mercurial pumps will be of interest.

The Geissler mercurial pump is a modification of the apparatus used by Torricelli in his experiments which led to the invention of the barometer, the space between the top of the column of mercury in the barometer tube and the top of the tube itself being called a Torricellian vacuum. The Sprengel pump is somewhat simpler than the one just referred to, and is thought by many of those who have used both to be capable of producing a more refined vacuum.

To give a general description of the action of these pumps in practical operation, it may be said that the bulbs to be exhausted of air are connected with that portion of the tube containing the mercury where the vacuum exists, and then in creating the vacuum the air contained in the bulb is carried off with that in the tube. When the proper degree of exhaustion has been attained the bulb is melted off

at the neck by a glass-blower and the lamp is then ready to be finished.

The process of exhausting the air from lamp bulbs is similar to driving a swarm of flies out of a room. It is a comparatively easy matter to get a large number of them out, but when few remain the hard work begins. So it is with the air in the bulbs. It is easy enough to get most of it out; the hard labor comes when we get to the last of it.

After the air has been sufficiently exhausted from a bulb there remains less than one-millionth part of the original quantity.

RAPID TRANSIT.

LESSONS FROM THE CENSUS.*

BY CARROLL D. WRIGHT, A.M.

It is to be hoped that the complete statistics relating to rapid transit in cities will enable the public to determine, with reasonable accuracy, the relative economy of the different powers used. This is a question which is vital to the interest of city and suburban communities, and which leads to the ethical consideration of the problem of rapid transit. That power must eventually be used by which passengers can be transported from their homes to their places of business and return at the least possible expense and the greatest possible safety commensurate with high speed.

The necessity of living in sanitary localities, in moral and well-regulated communities, where children can have all the advantages of church and school, of light and air, becomes more and more evident as municipal governments undertake to solve the problems that are pressing upon them. If it be desirable to distribute the population of congested districts through country districts, means must be provided for safe, rapid and cheap transit to the country districts; or inversely, if it be desirable to build up the suburban areas, the people must be supplied with cheap and convenient means of reaching the localities within which they earn their living.

The reduction of fares, through improved means of rapid transit, however desirable, is really a minor question. It is probably true that by a slight reduction from a five-cent fare the head of a family engaged in mechanical labor, earning perhaps five or six hundred dollars per annum, might save enough to pay taxes, or to offset church and society assessments, or to furnish his family with boots and shoes, in any event extending his power *pro tanto* for the elevation of his family; but he does more than this when speed is taken into consideration. By the old methods of transit from suburbs to the heart of a city, a workingman going into the city of Boston was practically obliged, while working ten hours at his usual occupation, to spend an hour on the horse railway, when now, on one line, by the use of the electric car, he can go to and return from his place of work in half that time, thereby actually adding to his own time half an hour each day, practically reducing his working time from eleven hours to ten and a half hours without reduction of wages and without increased expense for transportation. The question of rapid transit, therefore, as seen by this simple illustration, becomes an ethical consideration; for if there is anything to be gained by adding to the time which men have at their disposal for their own purposes, for intercourse with their families, for social improvement, for everything for which leisure is supposed to be used, then the question of rapid transit is one of far greater importance than that of saving money either to the man who uses transportation or to the company that secures dividends upon its stock. I believe, therefore, that all efforts that are being made to secure convenient and cheap rapid transit in great cities are those which should bring to their support the help of all men who are seeking the improvement of the condition of the masses.

ANOTHER ELECTRICAL EXECUTION.

Jeremiah Cotto, an Italian murderer, was executed by electricity at Sing-Sing prison, on Monday, March 28.

SHORT RAILWAY EQUIPMENT.

The Short Electric Railway Company announces for February business, orders for original equipment or for additional apparatus from: Beatrice Rapid Transit & Power Company, Beatrice, Neb.; Janesville Street Railway Company, Janesville, Wis.; The Spokane and Montrose Motor Railroad Company, Spokane Falls, Wash.; The Bloomington City Electric Railway Company, Bloomington, Ill.; The East Liverpool & Wellsville Street Railroad Company, East Liverpool, Ohio; The Braddock Electric Railway Company, Braddock, Pa.; The Georgetown and Tenallytown Railway Company, Washington, D. C.; The West End Street Railway Company, Rockford, Ill.; The Jamestown Street Railway Company, Jamestown, N. Y.; The South Covington and Cincinnati Street Railway Company, Cincinnati, Ohio; The Lincoln Street Railway Company, Lincoln, Neb.

The Short Electric Railway Co. announce recent sales to The Braddock Electric Railway Co., Braddock, Pa.; The Union Passenger Railway Co., Chester, Pa.; The Ft. Wayne Electric Railway Co., Ft. Wayne, Ind.; The Schuylkill Electric Railway Co., Pottsville, Pa.

*Abstract from *Popular Science Monthly*, April, 1892.

NEW BOOKS.

The bound volume of the *Transactions of the American Institute of Electrical Engineers* for the year 1891, a copy of which we have just received, is a work of great value. The papers read during the year were of extraordinary high character, and the discussions of each developed much additional and valuable information, all of which this book contains.

The volume is gotten up with great taste; the type is clear, the paper of excellent quality and the bindery neat and substantial. An excellent steel engraving of Prof. Elihu Thomson composes the frontispiece.

KILLED BY BANDITS.

Information has been received from Massowah, the Italian colony on the African coast of the Red Sea, that Captain Bettini, an Italian officer, was killed by bandits while returning to Fort Azjohannes. Captain Bettini was a brother of Lieut. Gianni Bettini, the inventor of the micro-phonograph, which instrument was described and illustrated in last week's ELECTRICAL AGE.

REPORTER'S OUTFIT.

This consists of a box small enough to place in one's inside coat-pocket, containing 4 capsule batteries; a silk cord is attached thereto and connects with a reflector worn as a watch charm. Inside this reflector is a ½ C. P. lamp which can be lighted by turning on a small switch attached to the battery-box. This outfit can be utilized to great advantage by a reporter in writing notes in situations where there is an absence of light, such as in dark streets at night, etc.

These outfits are made by the Nassau Electrical Company, White and Centre streets, New York City.

NEW INCANDESCENT LAMP.

E. W. Applegate, of the Western Union Telegraph Company, Omaha, Neb., has invented a new and valuable incandescent lamp. In this lamp the use of platinum is entirely done away with, and any metal may be used as leading-in wires; the removable head can be lifted out and a broken or burned-out filament replaced and no part of the lamp destroyed. The lamp has no metal in its construction other than the leading-in wires, and the material used is indestructible with the exception of the glass bulb. An advantageous and novel method is employed in exhausting the air from the bulb. Mr. Applegate has also a filament which will soon be ready for the market. This filament is strong and durable, giving more candle-power on a less voltage, and t is claimed the length of life will be double that of any now in use. It is understood that a company will be formed for the introduction of Mr. Applegate's inventions.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, March 26, 1892.

MR. F. S. HASTINGS, late treasurer of the Edison General Electric Co., has retired and Mr. S. D. Greene appointed in his place.

MR. C. AUGUST HARSCH, electrician of the Edison Illuminating Co., Lancaster, Pa., is in town looking up new specialties for his company.

MR. C. A. THELLER, secretary and treasurer of the Hailey Electric Light Co., Hailey, Idaho, was in town last week and gave this office a pleasant call.

HENRY ALEXANDER, the treasurer of Alexander, Barney & Chapin, has tendered his resignation and will sever his connection with the company April 1.

MR. J. S. SPEER, of the Partridge Carbon Co., Sandusky, O., gave the *Electrical Age* a call last week. This company is making a specialty of carbon brushes for motors which are claimed to be superior to all other makes.

MR. BAYARD WHITEHORNE has resigned his position with Truex & Vail, and accepted an appointment with the Newark Electric Light Co. We wish him every success in his new field, and congratulate the Electric Light Company on having secured so valuable an assistant.

IN our issue of March 5, we erroneously noted the death of Mr. George L. Wright, the former president of the River and Rail Electric Company, now the Union Electric Company, of this city. Dr. Randolph, the former treasurer, was the gentleman who died on the date referred to.

THE FORREST SILVER BRONZE PACKING CO., 115 Liberty street, this city, has just issued a very unique descriptive pamphlet of the silver bronze rod packing manufactured by it, and which is particularly adapted to steam engines of every description, marine, locomotive or stationary.

H. G. MADDEN, manufacturers' agent, 18 Cortlandt street, this city, is out with a new adhesive rubber tape, called "Yale tape," which is claimed to be a very superior article. Mr. Madden's business is rapidly assuming large proportions, his New Haven insulated wires and cables are holding their own and he reports large orders ahead. Crown sockets are also in excellent demand.

THE NEW YORK CARBON WORKS, 18 Cortlandt street, this city, have issued a notice informing manufacturers, dealers and users of carbon cylinder batteries that they have secured from Mr. Chas. W. Holtzer the sole and exclusive right to manufacture carbon cylinders or cups under his patent, No. 327,825, dated October 6, 1885. All cylinders will bear date of patent, also their trade mark, thereby protecting all users of same from infringement.

THE INTERIOR CONDUIT & INSULATION CO., 42-44 Broad street, this city, has issued a cautionary notice to architects, builders, owners and others. It is gotten up in pamphlet form and sets forth that the company is sole owner of a system of interior conduit or tubes, and it is the intention of the company to resort to legal remedies for any infringement of same. The pamphlet contains a synopsis of its patents, and also copy of proceedings brought by it in the Circuit Court of the United States for the District of Massachusetts against the Holtzer-Cabot Electric Company.

W. H. GORDON & CO., 115 Broadway, this city, wish it distinctly understood that they have not gone out of the wire business. A recent notice in one of the trade papers, mentioning the severance of one of their connections, might create a wrong impression. They wish their friends to bear in mind that they have even greater facilities than heretofore for furnishing them any grade or kind of wire they may need. It should be borne in mind that on bare and insulated wire, line material lamps, and several other specialties, Messrs. W. H. Gordon & Co. are manufacturers' agents, and are selling at factory prices.

THE stockholders of the Engineering Equipment Co., 143 Liberty street, this city, recently held their annual meeting in Jersey City (the company being incorporated under the laws of New Jersey), and elected the following Board of Directors: F. H. Underwood, C. A. Tinker, E. L. Harriott, F. A. Magee and A. L. Tinker. Mr. A. L. Tinker was re-elected secretary and treasurer, Mr. F. A. Magee, general manager *pro tem.*, and Mr. F. D. Crane was appointed manager of the street railway department. The business of the company shows a very healthy increase, and its progressive policy will be continued by the new management. A full line of electrical and street-railway supplies, including cotton leather belting and fibre conduits, G. & W. line materials, etc., are constantly kept on hand.

TRUEX & VAIL have moved their offices to a suite of rooms on the fourth floor of the Electrical Exchange Building, 136 Liberty street, this city, and have also established a laboratory, where, among other things, the Walker ammeter will be calibrated by an expert of long experieuce in such work. The Walker ammeter is highly endorsed by all who have used them, and are warranted to be correct to within 2 per cent. They are sold at a price which will commend them to all, and we have seen many testimonials from responsible parties, among whom are several professors of physics in leading universities and colleges. Their Swinging Ball Lightning Arrester is having a big sale. A large shipment has been made to the Electric Appliance Co., of Chicago, which is to be agent in the West.

C. H. W. COPELAND, 136 Liberty street, this city, is agent for the John T. Noye Manufacturing Co., Buffalo, N. Y., manufacturer of the Rice Automatic Cut-Off Engine. The requirements of an electric light-engine demand close yet stable regulation, a high speed durability during long runs and the best possible steam economy. All of these points the Rice Automatic possesses to as near perfection as any engine built. Since they have been building these engines a very large number have been sold, varying in capacity from seven to five hundred horse-power. They have been distributed all over the United States and show a clear record for general satisfaction. This company also makes tandem compound engines in pairs and a large variety of steam specialties. Mr. Copeland recently rested a five-cent nickel piece on the back cylinder of a Rice Compound Engine in the Thomson-Houston electric light-station at Yonkers, N. Y., and it remained in that position without falling, showing that the engine ran without jarring. Mr. Copeland is installing a twenty-five horse-power Rice Automatic Cut-Off Engine to run an Excelsior dynamo at the Bloomfield factory of the New York Aristotype Company; also putting in boilers, pumps, heaters, etc. The company has received testimonials from all over the country as to the efficiency of and the general satisfaction which its engines give.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.....	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.....	3,825,000	100 00	62 00
Am. Elec. Exercise Mach. Co., N.Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Engineering Co., N.Y..	1,000,000	100 00	60 00
American Telegraph and Cable...	14,000,000	100 00	82 00
American Telephone Co., D. C....	100,000		*101
Ashley Engineering Co.....	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J.....	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00

Barr Electric Mfg. Co., N. Y.....	50,000	100 00	100 00
Bay Electric Co. 6s, Mich.....	25,000		*101
Bell Telephone.....	15,000,000	100 00	205 50
Bell Telephone 7s.....	2,000,000		*113
Boston Electric Light Co.....	1,500,000	100 00	108 00
Brooklyn Edison Electric Light..	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light.	500,000	100 00	140 00
Brooklyn Municipal Light.....	500,000	10 00	14 50
Brunswick Elec. L. & P., Me.....	50,000	100 00	100 00
Brush ElectricLight Co., Balto..	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto..	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s....	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y.....	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.....	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.....	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me.....	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s...	20,000		*95
Circleville, O., L. & P. Co.....	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	30 00
Commercial Cable Co.....	7,716,000	100 00	157 00
Complete Elec. Con. Co., N. Y...	50,000	100 00	175 00
Cons. Electric Light Co., N. Y...	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y....	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.....	35,430,000	100 00	112 25
Cons. Gas & E. Co., Batavia, 6s..	80,000		*95
Cons. Subway Co., N. Y.....	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.....	15,000		*99
Desant Elec. and Sig. Co., N. Y..	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.....	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s.....	300,000		*101
Detroit Electrical Works.....	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd.....	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co.....	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.....	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.....	100,000	100 00	100 00
Edison Electric Co.....	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.....	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa....	80,000	10 00	13 75
Edison Illuminating, N. Y.....	4,500,000	100 00	81 00
Edison Electric Light Co., Phila..	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	96 75
Edison General Receipts.....		100 00	97 50
Elec. Sup. & Con. Co., N. Y.....	120,000	15 00	16 00
Elizabeth E. L. Co., N. J.....	100,000	10 00	4 50
Elmira Municip. Imp. Co., 5s....	1,800,000		par
Erie Telephone.....	4,800,000	100 00	46 00
Excelsior Electric Co. 6s, N. Y...	300,000		par
Fargo Gas & Elec. Co. 6s, Dak...	100,000		*92
Fidelity Trust Receipts.....	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*98
Fort Wayne Elec. Co.....	4,000,000	25 00	13 00
Franklin Electric Co., N. Y.....	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co.,O	95,000	100 00	102 50
G. T. Woods Mfg. Co., Ky.....	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co.....	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guarantee Identification Co., N.Y.	50,000	50 00	51 00
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co.....	250,000	100 00	20 00
Hickory Electric Co., N. C.....	12,000	100 00	105 00
Hoboken Land & Imp. 5s.....	1,000,000		*100
Hunt Engineering Co., N.Y., 6s..	30,000	100 00	*95
Hunt Engineering Co., N. Y.....	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill....	50,000		*95
Kansas Elec. Co. 6s, Mo.....	20,000		*96
Laclede Gas Co.....	7,500,000	100 00	18 00
Laclede Gas pref.....	2,500,000	100 00	57 50
Laclede Gas 5s.....	10,000,000		*81
Law Telephone.....	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s....	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light.....	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa..	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph.....	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y..	3,500,000	100 00	100 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver..	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s..	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N.Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N.Y.....	500,000	100 00	101 00
Nat'l Aut. Fire Alarm, L. I.....	150,000	100 00	100 00
Nat'l Elec. Manuf. and Const. Co., N. Y.....	50,000	100 00	101 00
Nat'l Lead Trust.....	9,000,000	100 00	19 50
New England Butt Co.....	100,000	1,000 00	1,000 00
New England Phonograph Co....	12,500	100 00	†20 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	51 50
N. Y. and N. J. Tel. and Tel. 5s..	1,500.000		*90
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co.....	20,000	100 00	20 00
Newark L. & P.....	150,000	100 00	58 00
Newark E. L. & P Co. 6s, Ohio..	50,000		*98
North American Railway Co....	39,767,200	100 00	14 25
North New York Lighting	150,000	100 00	10 50
Northwest Elec. Co. 6s, Manitoba.	50,000		*95
Postal Telegraph.....	10,000,000	100 00	37 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light.....	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn.....	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Richmond L. H. & P., S. I.....	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light.....	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston.....	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich..	50,000		*95
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co.....	16,000	100 00	†80 00
Swan Incandescent.....	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y..	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.....	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y..	100,000	100 00	105 00
The Ongley Electric Co., N. Y...	250.000	100 00	85 00
The Railway Impt. Co., N. Y.....	10,000,000	100 00	100 00
The Siemens & Halske Co., Ill....	500,000	100 00	par
The WashingtonWat. Pow., Wash.	1,500 000	100 00	80
The Wells & French Co., Ill..	600,000	100 00	par
Thomson-Houston Electric Co....	6,000,000	25 00	58 50
Thomson-Houston pref.....	4,000,000	25 00	28 75
T.-H. Electric Co. 5s, Boston.....	500,000		*100
T.-H. E. L. Co., Yonkers, 6s.....	100,000		*99
T.-H.L.H. &P.Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y....	50,000	100 00	100 00
United Elec. Light and Power....	3,000,000	100 00	40 00
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co.....	100.000	100 00	
Western Union.....	86,188.852	100 00	87 50
Westinghouse Elec. & Manf. Co..	7,000.000	50 00	30 50
Westinghouse Elec. Co. pref. 7s..	4,000,000	50 00	45 00
Westinghouse Ass. Rects.....		50 00	18 00
West Point W. Lt. & P. Co., Va..	25,000	100 00	100 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

"To be, or not to be, that is the question," whether 'twere better to remain simple New York or to absorb all the outlying territory which the capital of many who, not desiring to remain within New York, reclaimed from the wilderness and divided with people suited to their fancy. The question is purely a financial one; thousands have expressed their opinions, and in every case I have seen they are based on the expense present and future. The great city could without doubt carry on the government with one-half of the present corps of servants, if we leave out the school-teachers, firemen and policemen, and the competition being greater, a closer watch by the outs on the ins would certainly produce more satisfactory results. The pull or influence would be so stretched that it would become invisible and useless. The aldermen and their constituents' interests would be so far separated that the public would be well served. Harlem and Port Richmond, Yonkers and Jamaica, or even Flatbush and the present Eighth Ward could have no more excuse for aiding each other than Maine and Arkansas or Alaska and Florida through their representatives in Washington. More pure justice would prevail. The Mayor might order electric conductors underground on the Bowery, but to do it on the Parkway he would have to study up his city and find out where it lay. I think it would settle the electric question in more ways than one. The great city would of necessity be cut up among the various companies, but the annual bid for light would act as a check against overcharge or poor service. The 16 C. P. gas-burner, which was for so many years accepted without question, and paid for, until the competition of the incandescent lamp caused a measurement conducted by experts to be made, when I believe it was proven that no practical amount of force could produce a 16 C. P. gas-light with a four-foot burner. As a financial problem the 2,000 C. P. arc has been given up long ago by the Common Council who pass the bill and order it paid. The electric railroads within the greater city will also, by competition and expert explanations to the public, produce the desirable *quid pro quo*, by public education and demand. It is, perhaps, early to discuss these financial incidents, but history is moulding itself very fast just at present. The two new bridges across the East river and one across the Hudson are certainties; it is also a foregone conclusion that all of them will be crossed by electric cars, and in a very few years a speculator can, if he finds fortune against him at Guttenburg, step into the car and within the hour step out at Gravesend, Sheepshead or the Coney Island Exchanges and continue his dealings, all for a five-cent fare. There is not a single feature in connection with the consolidation that is not financial. The great mass of those who oppose it do so from pecuniary motives, direct or indirect, and the question will be discussed for yet a little while and then be answered in the affirmative.

The air is full of rumors of rich auriferous discoveries from Alaska to Mexico, and on both sides of the mountains. It is scarcely possible that the great West could have settled up so fast without the excitement caused by the gold mines which were the points to which all were bound, who, for various reasons surveyed and reported back their convictions, or themselves settled down to the life, first of a pioneer, next a farmer, and then a full-fledged city constructor. The millions produced in California have been multiplied many thousand-fold in the values which they practically created. Just at present the rush has changed from Oklahoma's broad acre boom to Colorado's gold and silver deposits. First, when all was quiet, came the rich find at Creede, which aroused the country for scores of miles around, and in a short time started miners and speculators, both from the Atlantic and Pacific coasts. The lone blacksmith shop was joined by the saloon, gambling house, school, church, and before a slow mind could realize it a city was built with its electric-light plant, waterworks, street railway and most of the modern luxuries. Next came the discoveries at Cripple Creek, and a second new city is being built, then as always is the case, mining experts, running over the ground, find other rich mines. One lot half way between Creede and Cripple Creek, named the Empress Josephine and Boss Mammoth, are fine six-foot true fissure veins in porphyry, the whole mass of ore carrying some $30 per ton, which by the new electric processes, are concentrated to some three times that value, with numberless bonanzas of high grade ore worth from $30,000 to $50,000 per ton. New York and Washington capital secured an option on this, and it is offered to-day in this market, some two-thirds being already subscribed. Report has it that no less a personage than Gen. Rosecrans has accepted the presidency. He is a miner by his West Point education, and for many years actively engaged in personally developing the mines of Nevada. He is too old a miner to invest in anything but a mine of merit. There has been a larger percentage of medium fortunes made in mines than any other industry. One should not invest more than he can afford to lose, but the chance of a large quick fortune, and that in actual gold and silver, is an incentive few can withstand. This is followed by despatches from Boulder, near by, announcing still another startling discovery of a three-foot vein in old workings in the old Sunshine property, averaging some $15,000 per ton. These discoveries will, if they have no other effect, settle up the country, and we must not forget that electricity is required wherever any number of people congregate, or that the object of this column is to seek for and point out the place and the circumstances under which money can be earned by the supply of electricity in all its various forms.

NEW INCORPORATIONS.

Edgerton Electric Light Company, Edgerton, Wis., incorporated March 11, with a capital stock of $6,400. Incorporators: F. W. Coon, M. Peltin, W. T. Pomeroy.

Robinson & Moore, Everett, Wash., incorporated March 8, with a capital stock of $5,000. Among other things they will construct and operate electric-light works. Incorporators: Samuel Robinson, Charles P. Moore, Everett, Wash.

Seattle and Everett Railroad Company, Seattle, Wash., incorporated March 8, with a capital stock of $500,000, to build and operate railroads, steamboats and other transportation lines, electric light, telephone and telegraph lines. Incorporators: R. Hilton, John P. Fay, Herman Chapin, Seattle, Wash.

San Francisco and West Shore Railway Company, San Francisco, Cal., incorporated March 9, with a capital stock of $1,000,000, to build and operate street and other railways by steam, animals, wire cables, electricity or otherwise. Incorporators: Henry W. Westphal, C. O. Swanberg, Louis F. Dunand, J. W. Ellis, J. O. Jephson, all of San Francisco, Cal.

Leavenworth Electric Railway Company, Leavenworth, Kan., incorporated March 11, with a capital stock of $300,000. Incorporators: George A. Baker, J. C. Lysle, George Burrows, William Dill, all of Leavenworth, Kan.

Central Construction Company, Baltimore, Md., was incorporated March 11. Among other things it will construct and equip electric, cable and other railways.

Railway Times Publishing Company, Chicago, Ill., incorporated March 12, with a capital stock of $25,000, to publish a journal devoted to the interest of steam and street railway equipment and electrical supplies. Incorporators: William C. Mulvey, Dana A. Patten, Cassius C. Clark.

Philadelphia Rapid Transit Company, Philadelphia, Pa., incorporated March 14, with a capital stock of $300,000, to construct and operate motors, cables and other machinery for supplying motive-power to street railways. Incorporators: Alfred Parrish, John P. Ilsley, W. G. Harding.

Escanaba Electric Street Railway Company, Escanaba, Mich., incorporated March 15, with a capital stock of $50,000. Incorporators: James Lillie, Kankakee, Ill.; John K. Stack, James B. Moran, of Escanaba, Mich.

St. Kanawha Falls Water Power Electrical Manufacturing Company, Charleston, W. Va., incorporated March 14, with a capital stock of $1,000,000. Incorporators: M. Levi, J. C. Alderson, Levi Welch, Charleston, W. Va.

Standard Battery Company, Chicago, Ill., incorporated March 15, with a capital stock of $1,000,000. Incorporators: Fred M. Bailey, Charles A. Haslett, Sterling L. Bailey.

The Pneumatic Fire Alarm Telegraph Company, Philadelphia, Pa., incorporated March 11, with a capital stock of $250,000. Among other things it will manufacture electrical appliances and devices. Incorporators: J. M. Harlan, Franklin H. Hearst, H. N. Day, all of Philadelphia, Pa.

The Ridgway Electric Light Company, Ridgway, Pa., incorporated March 11, with a capital stock of $10,000. Incorporators: C. M. Jackle, Fred H. Ely, E. C. Ross, all of Ridgway, Pa.

Bayonne City Electric Light and Power Company, Bayonne City, N. J., incorporated March 12, with a capital stock of $50,000. Incorporators: W. H. Peddle, Roseville, N. J.; L. Stewart, E. A. Dugan, Jersey City, N. J.; J. T. Olhausen, Elizabeth, N. J.

Electric Launch and Navigation Company, Camden, N. J., incorporated March 14, with a capital stock of $300,000. Incorporators: J. Parker, R. Gihon, Philadelphia, Pa.; J. H. Holloway, Camden, N. J.

Wolverine Electric Light Company, Holland, Mich., incorporated March 16, with a capital stock of $25,000. Incorporators: E. W. Richmond, James Huntley, John E. McKane, all of Holland, Mich.

Greencastle Gas and Electric Company, Greencastle, Ind., was incorporated March 17, with a capital stock of $50,000. Incorporators: James Green, Charles D. McClure, Lewis M. Ramsey, all of St. Louis, Mo.

Electric Construction and Supply Company, Jersey City, N. J., incorporated March 16, with a capital stock of $225,000. Incorporators: F. A Kinsman, Arlington, N. J.; B. B. Ward, T. T. Grover, New York City, N. Y.

Electric Railway Construction Company, Jersey City, N. J., incorporated March 16, with a capital stock of $50,000. Incorporators: G. L. Wiley, Arlington, N. J.; R. C. Carhart, W. H. Browne, Brooklyn, N. Y.

Tower Electric Light and Telephone Company, Duluth, Minn., incorporated March 19, with a capital stock of $60,000. Incorporators: G. H. Claypool, A. C. Batchelor, E. C. Jones, all of Duluth, Minn.

The Elmira Municipal Improvement Company, Passaic, N. J., incorporated March 18, with a capital stock of $1,000,000, to construct and equip electric-light plants, etc. Incorporators: F. H. Mollenhauser, Jersey City, N. J.; H. S. Roll, Hoboken, N. J.; H. P. Doremus, Passaic, N. J.; D. C. Robinson, C. H. Baldwin, G. Brand, Elmira, N. Y.; J. B. Woodward, New York, N. Y.

Spring Garden Mining Company, San Francisco, Cal., incorporated March 16, with a capital stock of $1,000,000. Among other things it will develop and operate electric power. Incorporators: J. W. Shanklin, E. S. Shanklin, Oakland, Cal.; J. D. Widber, A. C. Widber, San Francisco, Cal.; C. R. Thompson, Quincy, Cal.

The Fremont Electric Light and Power Company, Manitou, Col., incorporated March 18, with a capital stock of $50,000. Incorporators: Edward P. Creighton, M. A. Leddy, Colorado Springs; H. H. Brown, Denver, Col.

The Omro Electric Light and Power Company, Omro, Wis., incorporated March 19, with a capital stock of $5,000. Incorporators: C. S. Douty, W. W. Race, H. C. Scott, M. Phillips, F. Dennis.

Western Investment Company, Seattle, Wash., incorporated March 16, with a capital stock of $300,000. Among other things it will operate electric-light works, telegraph and telephone lines. Incorporators: R. C. Elliott, Frank Shelberg, Seattle, Wash.; John D. Boyd, West Duluth, Minn.

BUSINESS NOTE.

UNLIKE other dealers in typewriters, the Typewriter Exchange, 10 Barclay street, New York City, of which Mr. George A. Hill is manager, does not indulge in those oft-repeated announcements: "to reduce stock, etc;" "owing to removal, etc.," but continues on the even tenor of a legitimate business way, and sells all makes of machines at one-half the manufacturers' prices.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued March 22, 1892.

471,100. Electrically-Controlled Elevator. Andrew M. Coyle, Washington, D. C., assignor to Nelson Hiss, Baltimore, Md. Filed May 23, 1891.

In a system for controlling elevators electrically, the combination, with a starting and stopping mechanism, of a main electric circuit controlling the starting and stopping mechanism, a series of main-circuit closers for the several floors or landings, and a series of magnets in branches of an auxiliary circuit for operating the circuit-closers.

471,130. Thermostatic Instrument. Morris Martin, Malden, Mass. Filed June 3, 1891.

In a thermostatic instrument, the combination, with an active member adapted to form part of an electric circuit, of one or more independent hollow terminals to form part of the electric circuit and a fusible connection joining hollow terminal to the active member to complete the electric circuit.

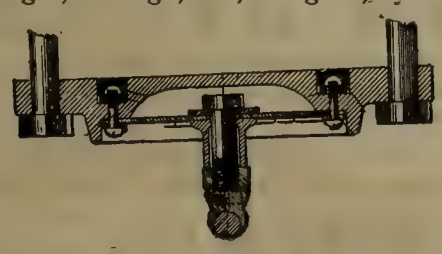
471,151. Trolley-Wire Support. Elmer A. Sperry, Chicago, Ill. Filed July 9, 1891.

In an integral device for supporting a trolley-wire, a wire-clamp, a portion designed to be secured to the supporting medium, and an elastic or yielding portion connecting the two.

471,155. Alternating-Current Motor. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 17, 1891.

An alternating-current motor comprising an armature and field-coils inductively acting on armature and connected to a single supply-circuit and a condenser shunting some of such field-coils, whereby they are caused to lag behind the other coils in magnetic changes.

471,190. Carbon-Holder for Arc-Lamps. Charles A. Pfluger, Chicago, Ill., assignor, by direct and



471,151.—TROLLEY-WIRE SUPPORT.

mesne assignments, to the Standard Electric Company, of Illinois. Filed Oct. 17, 1890.

In an arc-lamp, the combination of a single carbon at one electrode with two or more distinct carbons rigidly secured to one and the same holder, so as to travel together at the other electrode, and means for keeping the points of such distinct carbons always substantially in contact with each other during the period of burning.

471,206. Trolley-Pole Catcher. Montraville M. Wood, Chicago, Ill. Filed June 4, 1891.

In a trolley-catcher, the combination of a trolley normally upwardly held against the trolley-wire, a rope whereby the same may be drawn down, means for winding the rope to bring the trolley down, ordinarily disconnected from the motor mechanism of the car, and a catch to throw such winding-apparatus into operation, the catch adapted to be operated by the tightening of the rope.

471,210. Electric Striking Mechanism for Clocks. Silas C. Dickinson, Corning, Iowa. Filed Sept. 17, 1891.

In an electric striking device, the combination of the main circuit including the magnet, a source of electric energy, and a circuit-closer controlled by a clock mechanism, a branch circuit including the electric motor, circuit-closers controlled by the main circuit, a second branch circuit including the same motor, and means controlled by such motor for closing the second branch circuit and determining the length of time it shall remain closed.

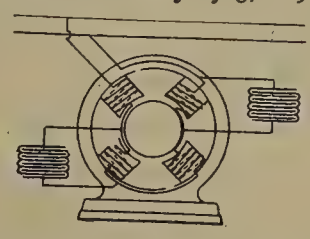
471,230. Electric Railway-Signal. Edgar C. Wiley, Bristol, Tenn., assignor of two-thirds to James A. Dickey and Napoleon B. Ainsworth, same place. Filed June 18, 1891.

The combination, with the base-plate, of the two leaf-springs secured thereto at their inner ends, and a double-inclined depressible bar, supported at its outer end upon the ends of the leaf-springs.

471,234. Electric Arc-Lamp. Hector Dewar, Boston, Mass., assignor to Albert W. Rounds, same place. Filed Sept. 15, 1891.

In an electric arc-lamp, the combination of a non-magnetic floor, magnets secured thereon, an insulating strip between the magnets and the floor, having a depending block and adjusting screw mounted in the floor, and passing through the depending block.

471,237. Vibrating Electric Switch. Jacob S. Gibbs, Hartford, Conn. Filed July 3, 1891.



471,155.—ALTERNATING-CURRENT MOTOR.

In an electric switch, a contact-lever with an angular hub and a reciprocating rod carrying spring-devices, which pass over the angle in the hub and press against the inclines on either side thereof for raising and lowering the outer end of the contact-lever.

471,242. Electrically Welding Metals. Auguste de Méritens, Paris, France, assignor, by mesne assignments, to the Thomson Electric Welding Company, Boston, Mass. Filed Nov. 8, 1887. Patented in France.

The herein-described art or process of joining two pieces of metal together by a welding or soldering operation, consisting in forming an electric arc at those points only of the metal which are to be joined, the heating-current being adjusted at point to the required welding or soldering temperature.

471,271. Electric Switch. Amandus Metzger, New York, N. Y. Filed June 6, 1891.

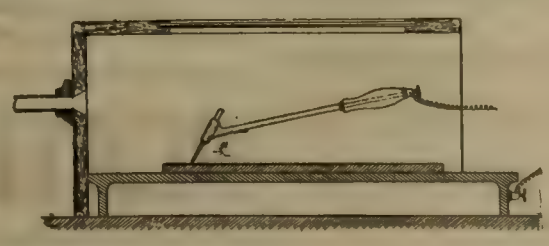
The combination, with an insulating switch-base, of a circuit terminal consisting of a single piece of sheet metal having two arms extending from the base, and having an arm embedded in the base, a second terminal, and a switch-arm adapted to connect the terminals.

471,296. Electric Signal for Railways. Eugene T. Turney, Chicago, Ill. Filed Nov. 10, 1890.

In an electric signalling apparatus for railways, a contact-post, in combination with a switch-lever arranged near the former, both connected up, a battery mounted on the engine, an insulated contact plate or bar also mounted on the engine, connected with battery, and adapted to make contact with the post, an alarm arranged on the engine and set in operation when a circuit is closed by contact between the post and plate, and a suitable device arranged on one of the cars of the train and adapted to set the switch-lever in passing the latter.

471,302. Safety Device for Electrical Conductors. Julius Marx, Nauheim, Germany. Filed July 6, 1891. Patented in England, in Germany, in Switzerland, in Austria-Hungary, in Belgium, in Italy and in France.

The combination of a receptacle, electrical terminals in-



471,242.—ELECTRICALLY WELDING METALS

cluded therein at a distance from each other, and a compound in the receptacle of low resistance, which becomes less conductive or non-conductive upon increase of temperature, and which connects terminals.

471,310. Long-Distance-Telephone System. Eugene Gwosdeff, St. Petersburg, Russia. Filed Feb. 15, 1889.

The telephone system for great distances, characterized by the following arrangements: the microphones and telephones connected with the line by means of the separated condensers and connected with a return-line by means of condensers the electric capacity of which corresponds with the respective resistances of the two lines.

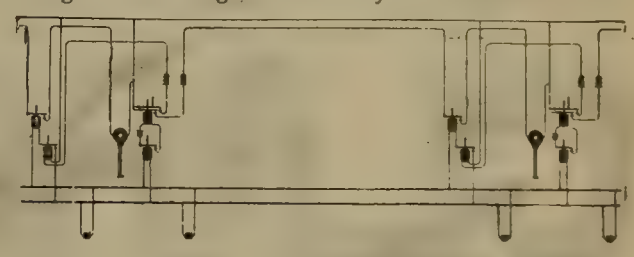
471,352. Telephone System. Anthony B. Ferdinand, Oshkosh, Wis. Filed June 29, 1891.

471,375. Conduit for Electric Railways. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 8, 1890.

The combination, in an electric-railway conduit, of the slot-rails and transverse yoke placed at intervals, overhanging at their upper ends the air space in the conduit, and having an opening in overhanging portion, with the insulators for the supply conductor removable from the conduit through openings.

471,409. Apparatus for Electric Railway Signalling. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed May 23, 1891.

The combination of a series of two or more secondary signalling-circuits, one for each block or section, for actuating or controlling a signal or signals for such block or section, a series of four or more primary signalling-circuits, two for each block or section, adapted to be actuated successively by a train while traversing the blocks or sections, the first primary circuit of each block actuating or controlling the second primary circuit of that block and also actuating or controlling the secondary circuit of the preceding block and the second primary circuit of each block actuating or controlling the secondary circuit of that block.



471,409.—APPARATUS FOR ELECTRIC RAILWAY SIGNALLING.

471,410. Electric Railway Signalling Apparatus. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed June 15, 1891.

In an electric railway signalling system, a series of home-signals, and a series of primary signalling-circuits respectively operating or controlling home-signals and themselves operated successively by the train in passing over the road, in combination with a series of distance-signals, electrically and mechanically independent of the home-signals, and a series of secondary signalling-circuits respectively operating distance-signals, each of secondary signalling-circuits having a circuit-breaker adapted to be operated by one of primary signalling-circuits at a distance and having, also, a short circuit shunting the distance-signal itself and adapted to be operated by the next adjacent primary home signalling-circuit.

471,447. Charging-Table for Electric Railways. Edward P. Usher, Grafton, Mass. Filed Aug. 31, 1891.

The described charging-table, comprising permanent supports adjacent to the car-track and a top adapted to receive the batteries, such top being hinged at one edge and provided with means for adjusting the opposite edge of the table-top vertically to correspond with the battery-recess of the car.

471,454. Process of and Apparatus for Bleaching by Electrolysis. Albert E. Woolf, New York, N. Y., assignor, by mesne assignments, to Rosamond Woolf and Thomas J. Montgomery, same place. Filed Dec. 8, 1891. Patented in England.

In the art of bleaching, the process set forth, which consists in submitting sea-water to electrolysis, forcing atmospheric air into the electrolyte, discharging the same between the electrodes, and submitting the materials to be bleached to the action of the products of electrolysis in the same vat or tank.

471,491. Trolley-Wire Hanger. Thomas J. McTighe, New York, N. Y. Filed July 11, 1891.

A clip for trolley-wire hangers, comprising a metal plate adapted to be folded up around the wire and having at its meeting portions one or more registering tongues and slots forming a key-way, in combination with a suitable key.

471,525. Automatic Electric Block System. Joseph A. Carlton and Henry L. Johnston, Atlanta, Ga. Filed June 16, 1891.

In a device of the class specified, a light circuit cut in two places, one brake held normally closed by a spring-terminal and the other held normally open, but adapted to be closed by contacts carried by a lever set alongside the track and adapted to be operated by a train and carrying an armature and an electro-magnet in circuit, so set as to attract armature on the completion of the circuit by the proper movement of the lever and hold it until the circuit shall be broken by the disruption of the spring-terminals by the passage of the train.

471,526. Disk Carbon for Arc Lamps. Hosea W. Libbey, Boston, Mass. Filed Oct. 17, 1890.

A disk carbon the perimeter of which is of spiral form.

471,527. Machine for Casting Grids for Secondary Batteries. Albert F. Madden, Newark, N. J., assignor, by direct and mesne assignments, to John M. Pendleton, New Brighton, N. Y. Filed Feb. 16, 1889. Renewed July 24, 1890.

In a machine of the character described, the combination, with the crucible, of the chamber communicating with the crucible, the mould at the top of the chamber and adapted to be moved across the latter, and the grate-bars arranged at the upper end of the chamber and having their upper faces contiguous to the bottom face of the mould-plate.

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BUSINESS NOTES.

The Bodifield Belting Company, of Cleveland, O., have just issued a book that will be of interest to users of electrical appliances. The object of the book is to introduce a new kind of leather belting this company has recently perfected, and to explain its merits. This company claims that belting as it has been made in the past is not properly made for electrical work, especially in places where it is hot, dry, or on machines where oil gets on the belts. It is a well-known fact that many belts have been ruined by machinery oil getting on them.

The belt this company has introduced is called "Carbon," and an extract from their book will practically tell what they claim for it. They say:

THE DEMAND OF THE DAY

Is for oil-dressed leather belting; but the oil-dressed belts that have been and are being sold are simply hard, dry leather made into belting, and then drawn through some grease or oil. While this is slightly beneficial for a short time, it does not accomplish the result desired. Why? Because this treatment only gives the belt a surface coating: it fails to make the leather that has been made hard and solid by machine pressure pliable; it fails to soften the grain that has been made as smooth and hard almost as glass. Should enough soft oil be used to produce the result aimed at, a "stretchy" belt would be made, as well as one that would soon become rotten, especially at the laps, excessive oil always having a bad effect on cement.

Three years ago we commenced making, under a process known only to ourselves, a belt that has under the severest tests made for itself, wherever used, a name above any other belt known. This is a filled belt, we forcing into the leather during the currying process a large amount of hard grease; this makes our leather firm and solid, yet perfectly pliable. By this process we escape the bad effects of soft oils. We make our leather almost as pliable as the rawhide, yet have the body and weight of regular oak-tanned belts. We use no machinery to make our leather solid (our filling does that), therefore the grain of the leather is in its natural state, soft and pliable as calfskin. This leather when made into belting will drive fully twenty per cent. more than any of the hard, dry belts will.

While belting made from our filled leather has proved itself the best on the market, there was still room for improvement: many places demanded a waterproof belt; an oil-proof belt was desired on dynamos, etc. Belt oils or dressings were not wanted; a perfect belt for high speed and small pulleys was a necessity. All this led us into experimenting, and the result is our "Carbon" belt, which is the combination of all that can be desired in a belt. About one year after commencing our experiments we perfected our "Carbon" filling, and one year ago we put "Carbon" belting to the most severe tests, so that now, after a year's trial, we offer it to the public as the only perfect belt made.

The compound is made of a carboniferous product held in solution: this material is absolutely oil and water-proof. To this solution we add an extract that is a leather preservative. This combination makes a filling that is not an oil; it has all the good effects of oil, without any of its injurious qualities.

For making our "Carbon" belt, we use our regular filled leather, and add to it the "Carbon" filling. One of the greatest advantages of the "Carbon" belt is its weight: leather that will weigh 16 ounces to the square foot will, when filled with "Carbon" filling, weigh 20 ounces, gaining 25 per cent. This added weight, in connection with our process of currying, makes our "Carbon" belt capable of driving fully one-third more than any hard, dry belt can. The "Carbon" belt is made of heavy, pure oak-tanned leather, cut strictly short lap and from the centre of the hide. Our object is to make belting so good that when good belting is wanted there will be no question regarding where to place orders.

It would be well for those having trouble with oil, etc., to try this company's belting. They are a reliable and gentlemanly house to do business with, and they would not offer anything for sale in which they did not have the utmost faith.

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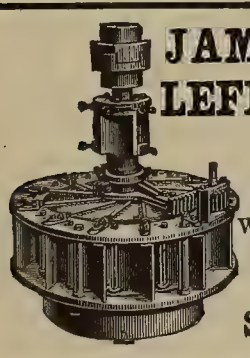


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NEW YORK, APRIL 9, 1892.

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UNDERGROUND TELEGRAPH LINES.

It is said that the House Military Committee, Washington, D. C., will report favorably a bill providing that any telegraph company may construct one or more underground or submarine telegraph lines from Washington, through Baltimore, Wilmington, Philadelphia and New York and intermediate places, connecting with all arsenals and other military posts adjacent to cities through which it runs, and with military posts in New York Harbor and the western extremity of Long Island Sound, the work of construction to be under the supervision of the Government. One wire is to be rented by the Government, and in case of war one must be furnished to it free of charge.

TO CONTROL ELECTRIC WIRES.

A State Electrical Subway and Control Commission has been created in New Jersey for the purpose of regulating matters pertaining to electric wires. It will have all the powers necessary to deal with the subject in every phase, and its decisions will be final.

The new law requires that no electric wires shall hereafter be constructed along, across or above any street or avenue in the State unless approved of by the Board of Commissioners, except wires owned by the State or used for fire or police purposes.

We think the State should set the example for the corporations by burying its own wires, and compelling the fire and police wires to go underground as well. There is an inconsistency here.

ELECTRICAL CHIMES.

On Easter Sunday (April 17) the air around Grace Church, New York, will reverberate with the sweet notes of the silvery chimes which will be rung by the aid of electric power. Mr. George T. Atwood has been at work for some time on the problem of ringing bells by electricity, and has so far succeeded in his efforts that he promises on Easter Sunday to give the New Yorkers an idea of what he has accomplished. He claims to be able to put musical expression into the ringing, which is something unattainable by the old method.

If Mr. Atwood succeeds in what he has undertaken to do his invention will find a very large field for application. There are many chimes of bells located in different parts of the country which, if musical expression can be added to their silvery notes, will acquire a sweetness of tone and effect by the new method that cannot be obtained in any other manner.

PROSPERITY IN THE STREET-RAILWAY SUPPLY BUSINESS.

The street railway man's time has come at last, and his heart jumpeth with glee at the prospects of a golden harvest. The reason for this exuberance of spirits is plain. When large cities, such as Brooklyn, Boston, etc., adopt the trolley system by the wholesale it means work for somebody. Some one must supply the electrical equipment, the cars, the trucks, the rails, etc., and the concerns manufacturing the various parts of an electric railway plant are the ones enjoying the boom these days.

Trade is said to be exceedingly dull in most all other lines of business, but the electric railway apparatus manufacturing industry is an exception, and those who are interested in such concerns are fortunate, and have good reason to feel joyful and buoyant in spirits. The Brooklyn contracts alone are of unusual dimensions, and it is likely that ere long many others will follow. Philadelphia may before long require a large electric railway equipment, and there is a possibility that Baltimore and Chicago will fall in line in the near future.

THE TELEPHONE INDUSTRY.

The vast proportions of the telephone industry in this country may be faintly judged by reference to some of the figures given in the report read at the annual meeting of the Bell Telephone Company, in Boston, on the 29th of March last.

There are, according to this report, 512,407 telephones in use in the United States, requiring 266,456 miles of wire, which on the average allows a trifle over half a mile of wire to each instrument. This length of wire would circle the earth ten and a half times if stretched out in a continuous length, and dividing it by the number of years the telephone has been in operation (sixteen) would give 16,656 as the average number of miles of wire stretched each year.

The most interesting part of the report to the stockholders is that relating to the revenue. The figures show an increase of over a quarter of a million of dollars in the net earnings over the previous year.

It was decided to increase the capital stock $2,500,000, making the total $17,500,000, and the present stockholders will be given the opportunity to subscribe for the new stock in the proportion of one new share to six of their present holdings, at par.

The next few years will no doubt see some important developments in the telephone service in this country, and it will be extremely interesting to watch the effect upon the existing corporation after the expiration of the Receiver patent next year.

UNDERGROUND WIRES AND CABLES.

In the report of the Committee on Underground Conduits and Wires, which was read at the Buffalo Convention of the National Electric Light Association last February, some very important and interesting facts were set forth, but which on account of being involved with other questions are liable to be lost sight of. Take for instance the statement that, with very few exceptions, the system and plans heretofore adopted in laying wires and cables underground in this country have proved failures.

This assertion, no doubt, was a surprise to many, and the question naturally arises, "Why have they proved failures?" The reasons therefor are numerous, but can be summed up in a few words, viz.: too much economy in the matter of insulation, and carelessness in handling.

The committee found in their investigations that in some cases there was insufficient insulation used, and in many others carelessness in laying the conduit or drawing in the cables and wires caused much of the trouble. They call attention to the fact that it is absolutely necessary that all work and materials in connection with underground wires should be first-class, and that it is poor economy to use any but the best.

More intelligence should be used by the workmen in drawing the cables in and out of the ducts, and working in the manholes. Much of the damage, the committee states, is done at these times.

We give on another page an abstract of this report, which refers particularly to these and kindred subjects, and which is well worth the very careful consideration of every one interested in underground work.

BAILEY CURRENT CONTROLLER.*

A current controller is a very necessary adjunct in galvanic work, and is oftentimes found quite useful in Faradic work. By its use a current may be turned off and on steadily and gradually, and consequently preventing disagreeable and injurious shocks where such should be avoided.

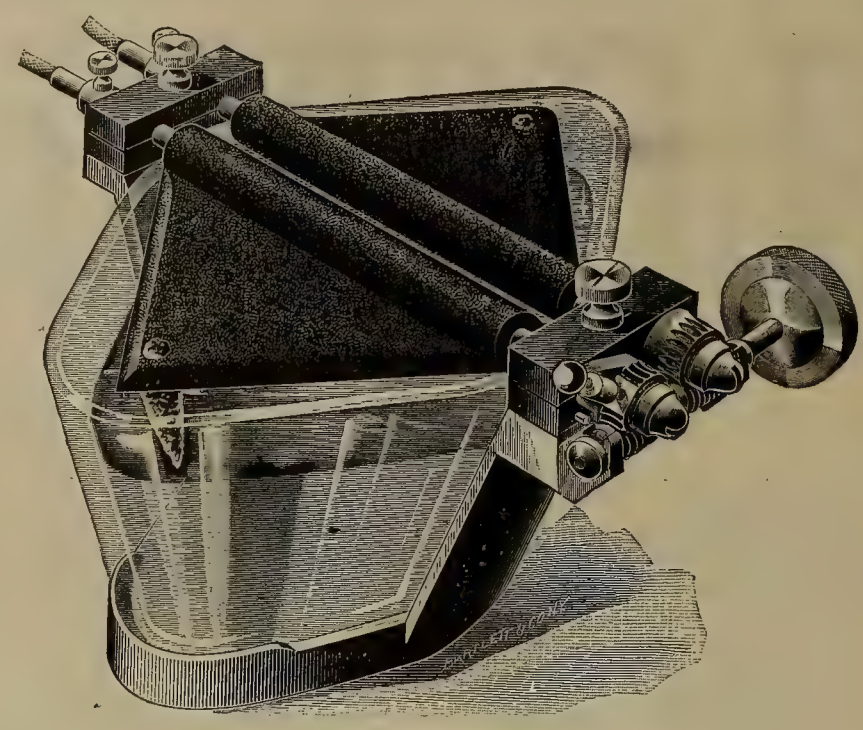
The controller illustrated herewith is known as the "New Bailey Current Controller," and is an improvement on the old Bailey Controller, all the faults in the latter having been eliminated in the new instrument. It consists of two triangular-shaped carbon plates, each carrying a bit of sponge at one of its angles, and so mounted over a small glass cup of water that by means of a worm-gear operated by a hand-wheel, the sponge tips are gradually moved down into the water and toward each other until the plates touch at their lower points. Or, by turning a thumb-screw the left-hand plate may be unlocked from the gear and moved as far into the water as desired, and then the other plate gradually turned toward it. By the latter method a still more gradual increase of current is assured. Each shaft passes through the centre of a hole running the entire length of the longest edge of the plate and is moulded in with pure tin, the tin completely filling the space between the shaft and carbon from end to end. An electrical connection is thus had having an abundance of conductivity, and one which is non-corrodible beyond any question. Each plate is $3\frac{1}{2}$ x $3\frac{1}{2}$ x 4 inches; the whole apparatus is over all 7 x 7 x $4\frac{1}{2}$ inches, and weighs two pounds. The carbons are handsomely moulded and the mountings highly finished and perfectly fitted. This current controller, or rheostat, will give a current at the outset more feeble than any instrument of its kind or character can give, and will increase the current without variation or fluctuation, which has never before been done, and finally will give the full strength of the battery actually without shock, which is also for the first time accomplished. It is the only instrument in which each electrode moves toward the other. At the start they are six inches apart, and at the finish actually in hard contact without having given the least shock. This is attributable to the gradual coming together in water of the two large flat surfaces of carbon. As there is no cover over the plates, and when out of water they are separated by fully $\frac{3}{16}$ of an inch, there is no danger of escape of current by means of water adhering between them, or by moisture of condensation. In construction, no wax or cement is used and no frail parts or connections. As this controller is specially adapted to the use of medical apparatus, we feel sure that its great merits will commend it to the medical fraternity and also for home use.

ALLIED INTERESTS.

The remarkable success which has attended the introduction of electricity into traction, said Mr. Erastus Wiman before the National Electric Light Association in Buffalo last February, should in a large degree be attributed to electric lighting experience. It is clear that much of the perfection in machinery, both electrical and steam, which enables electric roads to start off on a career of abundant success, would have been impossible had not the field been already explored by the light organizations. Hence it is natural there should follow in many localities a union between the two interests, that of electric railways and electric lighting, and in this prospect there is a hope for the future of promise and profit. In the reconstruction of central stations, therefore, the wants of street lines of travel as well as of street lines of light are to be contemplated, making existing properties often more valuable, and bringing into constant use all the facilities, permanent fixtures, fixed charges, expenses of administration, and other expenditures now directly chargeable only to electric lighting. The construction of electric railways into new localities hitherto inaccessible, and the profit possible by the enhancement of value in real estate is a tempting field for the electric light proprietor. The advantage of affording along these new lines a supply of power into every house, equally with a supply of light, begets an attractiveness for these new neighborhoods thus created second only to the advantage which is imparted by the rapidity, the cleanliness, the frequency and economy of the electric railway systems now so universally approved.

The momentous revolution in values as the result of highly improved means of street communication by the aid of electricity, is one of the economic features of the hour. In no department of business activity within the past three years, has there greater profit been made, has there greater good been done. The growth of wealth in numerous cities, of which Boston is one of the best examples, has been very great from this means, while communities have been knit together, the outlying and inaccessible parts brought within easy hail, and solidity, strength, and rapidity of movement made possible, with all that follows in its train.

* Law Telephone Co., 85 John street, New York.



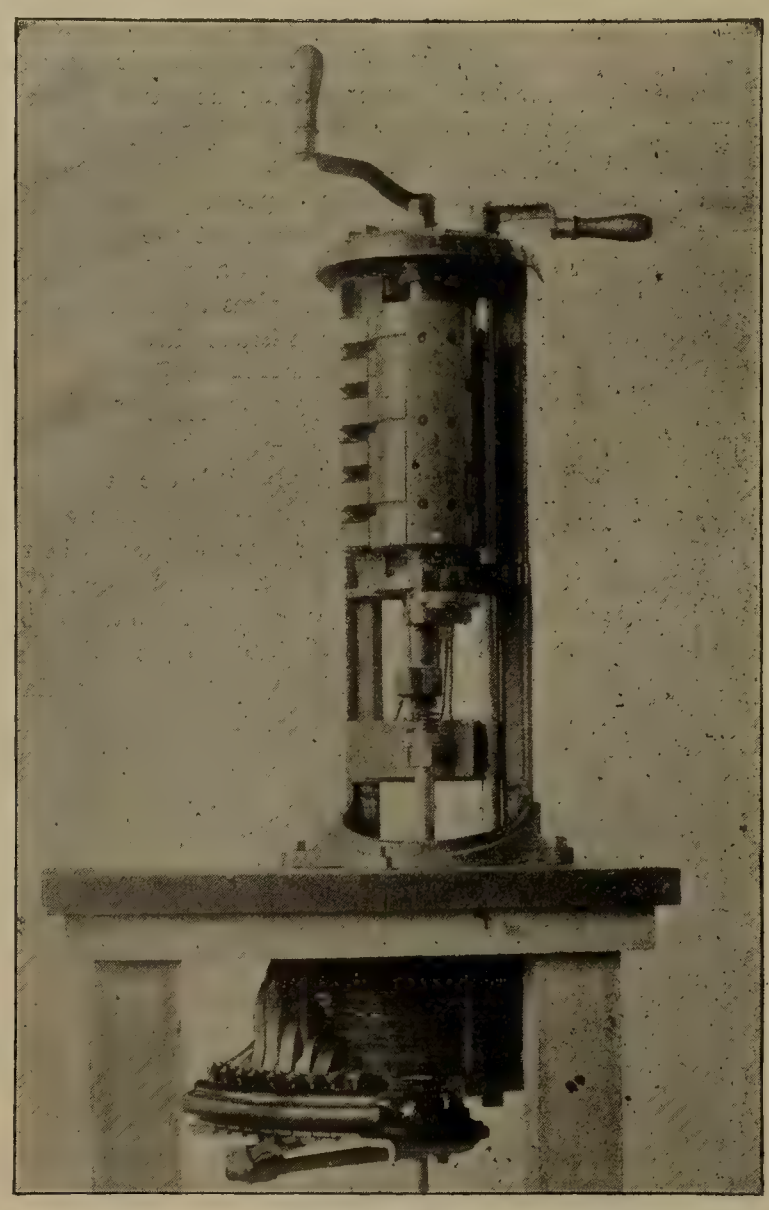
CURRENT CONTROLLER.

CONTROLLING-SWITCH FOR STREET CARS.*

The accompanying illustration shows a new type of street-car controlling-switch recently devised, intended to take the place of the present platform-switch for equipments of large motors of 25 H. P. and upwards.

In starting the car the switch-handle is turned from the position marked "off" with a "counter-clockwise" movement; this has the effect of carrying the arm of the rheostat placed under the switch around on its contact segments and the resistance is gradually cut out of circuit. After this arm has been carried around and all the resistance cut out, it is released from the cylinder shaft and left locked in this position. Further movement of the handle then affects only the cylinder and commutates the field-magnet coils of the motor from series to parallel in the usual way.

In stopping, the field-coils are turned from parallel to series, the resistance-coil is then again put in circuit, and finally the circuit is broken by the contact-lever on the last segment of the resistance-coil, and not, as formerly, upon the cylinder contacts.



CONTROLLING SWITCH FOR STREET CARS.

The only caution to be observed in stopping is to see that the switch-handle is turned to the position marked "off." As the motors are reversed by means of a separate lever operating a reversing-switch placed under the cars, the reversing-lever is connected to a shaft separated from the cylinder shaft, but interlocking with the cylinder shaft in such a manner that it is impossible to reverse the motors until the cylinder shaft is in an "off" position. The cylinder plates and contacts are made of thick iron stampings, as experience has shown that iron is a better material to use than brass, hitherto employed. Sparking does not burn the iron as much as the brass, and greater certainty of good contact is insured. The rheostat is of the regular circular pattern resistance-coil, which has been in use for some months past as the standard slow starting device. This rheostat is protected by a galvanized iron case, made to suit different car constructions. When fitting the switch a sheet of iron and a layer of asbestos should be placed between the rheostat and the car floor. This will prevent any danger from fire either from heating or sparking in case of accident to the rheostat.

The current from the trolley-wire first goes through the field-coils and switch cylinder for commutation, then through the armature and reversing switch, and thence through the switch contact-lever and resistance-coil to ground.

Only six wires are run to the platform switch; these are the field-magnet wires. The three wires running to the reversing-switch are of the same size as the regular armature wires, as is the wire between the metal terminal of the reversing switch and the contact-lever of the rheostat. When fitting switches to cars already wired, the cables can be utilized, but the terminals of the wires left idle should be well insulated.

* Edison General Electric Co., New York.

CHIME RINGING BY ELECTRICITY.

G. F. Atwood, who was for three years foreman at Edison's laboratory at Orange, N. J., has invented an appliance for the ringing of chimes by electricity, which is to be tried at Grace Church, New York, on Easter Sunday morning (April 17). The most prominent feature of his invention lies in the fact that not only does he propose to ring the bells by electricity, but also to put musical expression into the ringing. In operation, each bell is to have pendant from its centre two clappers, both of which are to be held near opposite sides of the bell by a firm iron rod fastened to the striking ends of each. One clapper is to do the striking, and the other to dampen the tone.

The chimes will be rung from a small keyboard, which will be placed near the organ and worked by the organist. Each key will connect and disconnect the current for one bell, and will be cut in and out

through different degrees of resistance by foot pedals. Through the agency of such a keyboard, chords may be struck and tunes played which were impossible to accomplish by the use of the old system of levers.

NOTES ON ELECTRO-MAGNETIC MACHINERY.*

BY WM. S. ALDRICH, M.E.

(*Continued from page* 165.)

The Kinematic Conception of the Ether Mechanism, in combination with the peculiar mechanical properties apparently possessed by the ether medium—however far from being a true conception, may serve the passing moment till a better working hypothesis is presented. We know that the ether energy of the electric current and of the magnetic circuit moves at right angles (normal) to the direction of the current or the axis of the magnet; also while the instantaneous direction of motion of a point in the pitch circle of a gear-wheel is tangential to its path, the energy is transmitted radially or normal. These peculiar gear-wheel properties of the kinematics of the ether mechanism, like all good illustrations, leave us in doubt as to many points; especially, as to whether the ether gear-wheels are more or less flexibly mounted, as on springs, but with apparently limited or even fixed distances between centres. Perhaps Oliver J. Lodge may yet point out to us whether these gear-wheels, as elements in the ether kinematic chain of mechanism (speaking in the phraseology of Reuleaux), are pair-closed, force-closed or chain-closed. That is, whether they mesh with each other by reason of some peculiarity of their paired connection or characteristic conformation of their toothed outline, or are by some force kept in geared connection, akin, perhaps, to the manifest tendency of the magnetic circuit to complete or perfect itself—to enclose the greatest possible number of lines of force in following the path of least resistance, and yet to remain as undeformed as possible in the presence of opposing magnetic forces—a kind of electro-magnetic force-closure; or, perhaps, these ether gear-wheels may have their centres connected by a link or chain device, not yet made clear. And the time may come when the kinematics of this hypothetical mechanism of the ether may be as definitely studied as its mechanics, and the paths of its moving elements as clearly laid down as now in the case of link-work, cams, gearing, etc. The ether medium has already been made to yield some of its many possibilities in the applications of electricity and magnetism; and its peculiar characteristics show it to be capable of the widest range of usefulness in the transmission of energy and of motion, for a long or short distance, and by immediate and direct, or by indirect means. And the beautiful electro-magnetic induction experiments of Elihu Thomson, the high frequency alternating-current effects obtained by Tesla, and the researches of Crookes in high vacua—give grounds for hoping that the day is near at hand when these invisible forces will be clearly seen and understood by the things that are made.

* Read at the meeting of the Electrical Section, Franklin Institute, Philadelphia, held December 1, 1891.

Electric Transmission of Energy is shown in simple ideal form. In Fig. 1 for long distances; in Fig. 2 for short distances. In either case, but especially the latter, we may suppose the axes of the two armatures to be placed parallel, or in any given oblique position to each other, being then similar to transmission by belts and wire ropes. The speeds of the two shafts may be maintained constant under changes of load, or varied at will; and the rotations may be in the same or opposite directions, and reversible at will. The current used may be direct or alternating. Power applied to drive one as a dynamo will drive the other as a motor, while if power be applied to both, the output will be current in the external circuit, as given by the two dynamos coupled for any given output. Current supplied to drive one as a motor will serve to drive the other as a dynamo, giving an electric-motor-driven dynamo as a transformer, if the two shafts are in any way coupled or geared; while, if current be supplied to both, the output is power from each machine acting as a motor. More than two machines are often used, and sometimes one dynamo operates several motors in the same electric circuit, but with individual magnetic circuits. In the figures from 1 to 12, inclusive, *P Q R* represent armatures and armatured shafts, and *A B C* fields and field coils.

Electro-magnetic Transmission of Energy is understood to mean that combination for the transmission of energy, in which all the armatures are in the same magnetic circuit. (*a*) One or more of these armatures, as dynamos, may be utilized to generate current, which may be supplied to the remaining armatures, as motors, in the same magnetic circuit; or, (*b*) all the armatures may be run as motors by an external source of supply of current; or, (*c*) all the armatures may be run as dynamos by an external source of power. Figs. 3, 4, 5, 6, 7 and 8 show such combinations of two armatures in the same magnetic circuit, or branches of the same. (*a*) If armature *P* is driven by power, as a dynamo, the current supplied to armature *Q* will drive it as a motor; or, (*b*) if current is supplied to both armatures *P* and *Q*, they will run as motors; or, (*c*) if power is applied to both armatures, current will be generated in the external circuit. This last combination is similar to a separate-circuit self-exciting dynamo (type of Fig. 4), brought out by Ladd, March 14, 1867, which had two shuttle-wound armatures—a small one to excite the common field magnet and a large one to supply currents for electric lighting. We may also arrange any one of the forms shown (Fig. 2, for instance), as a dynamo-transformer, by supplying current to armature *P*, acting then as a motor, and gearing or otherwise coupling the shafts *P* and *Q*, so that armature *Q* acts as a dynamo, giving a transformed current within any given range.

Dynamotors for Electro-magnetic Transmission of Energy are combinations of armatures in the same magnetic circuit, as illustrated in Figs. 3, 4, 5, 6, 7 and 8, which show two armatures in the same magnetic circuit, as dynamo and motor. A dynamo-motor combination, in the same electric circuit, but with *individual* magnetic circuits, as Fig. 2, is really a transformer of mechanical energy; while a motor-dynamo combination, similarly arranged, is a transformer of electrical energy. The dynamotor is also a dynamo-motor combination, in the same electric and the *same* magnetic circuits, Figs. 3, 4, 5, 6, 7 and 8, and as such is also a transformer of mechanical energy; but it may also be used as a transformer of electrical energy. These dynamotors allow of a constant or variable velocity-ratio being electro-magnetically transmitted between two shafts arranged in any way within close proximity, for the immediate and direct transmission of energy. The direction of rotation as well as the velocity-ratio may be varied at will. Direct or alternating currents may be used, but preferably the latter, and very probably some form of the so-called rotary current. The dynamotor may be an independent machine, with no external circuit connections, or it may be more or less dependent upon some external source of current supply, either for regulation of velocity-ratio, or of its operations as an energy transformer.

Mechanical Equivalents of Dynamotors are those mechanical means for the transmission of energy and motion, equivalent, from the standpoint of kinematics, to the electro-magnetic means employed in the dynamotor. Thus Figs. 3 and 4 show dynamotors for parallel shafts, in ordinary proximity, and have their mechanical equivalents in belts, spur gearing and like means for the transfer of circular motion between parallel shafts. Figs. 5 and 6 show dynamotor forms for parallel shafts very close together, as in Oldham's coupling. Shafts intersecting at an angle, such as in bevel gearing, universal joints, Hooke's joint, etc., are mechanically equivalent to the form of Fig. 7. Screw wheels, worm wheels and skew-bevel wheels are mechanically equivalent to the form of Fig. 8 for transmission between non-intersecting axes.

Magnetic circuits in parallel and in series admit of a variety of ways of grouping two or more armatures in electro-magnetic machinery. Fig. 9 shows the simple ideal grouping in parallel or magnetic shunt with one energizing coil. The ends of the field at armature *R* may be closed around, and another coil put in, acting in conjunction with the coil *C*. And with or without this additional coil, separate auxiliary energizing coils, acting in the way of feeders, may be placed between armatures *P* and *Q*, and Q and R. The simple magnetic shunts, to which Sylvanus P. Thompson refers,* may develop into useful industrial applications, such as multiple drills, operated by spindles on armatures arranged in parallel magnetic circuit. Other forms of branch magnetic circuits are shown in Figs. 3 and 5. The simple ideal grouping of armatures in series in the magnetic circuit is shown in Fig. 10, with one energizing coil. As before, auxiliary energizing coils may be placed at the other end, or between the armature *P* and *Q*, and *R* and *S*, but these coils do not here act as feeders as they did before in the parallel arrangement, but rather as separated parts of one large coil controlling the one magnetic circuit. This may be clearly seen by referring to the field coils in Figs. 4, 6, 7 and 8, which shows the arrangement of two coils in series for one magnetic circuit.

The Electro-magnetic Kinematic Chain may be developed by reference to Figs. 11 and 12. Multi-

* "On a Property of Magnetic Shunts," communicated to the Physical Society, April 17, 1891. See *The Electrician* (London), Vol. xxvi., April 24, 1891, p. 764.

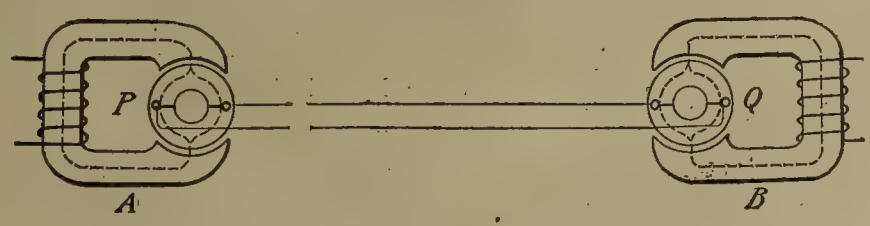


FIG. 1.

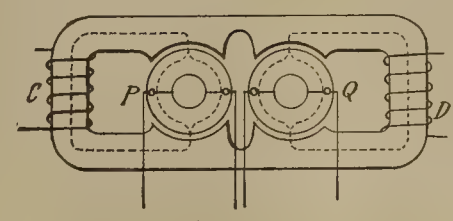


FIG. 5.

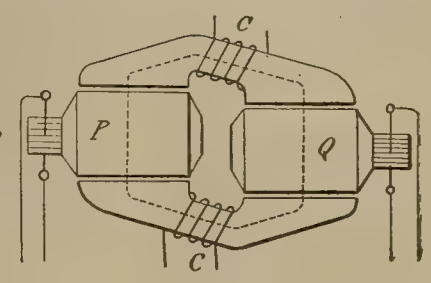


FIG. 6.

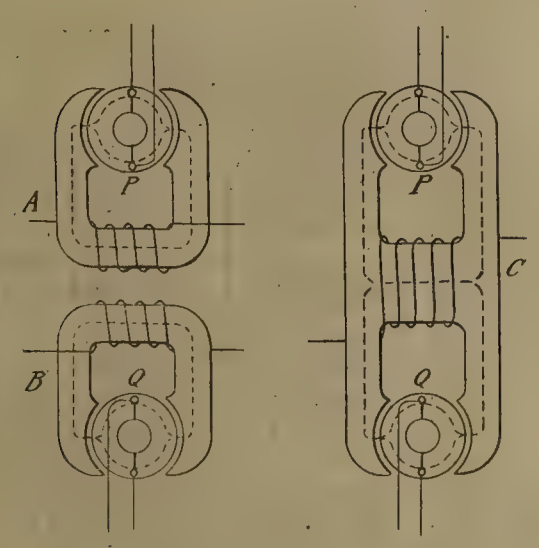


FIG. 2.

FIG 3

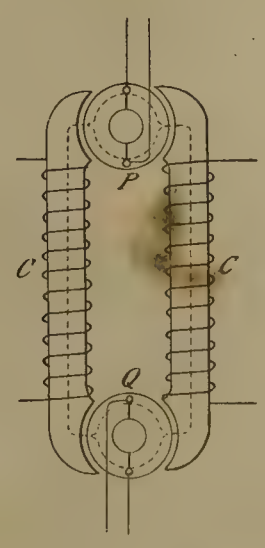


FIG. 4.

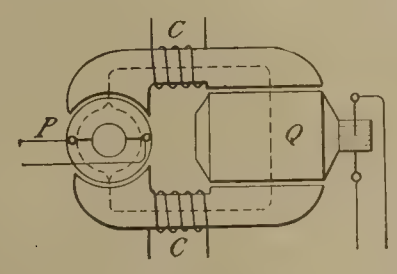


FIG. 7.

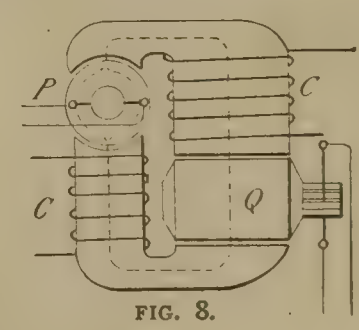


FIG. 8.

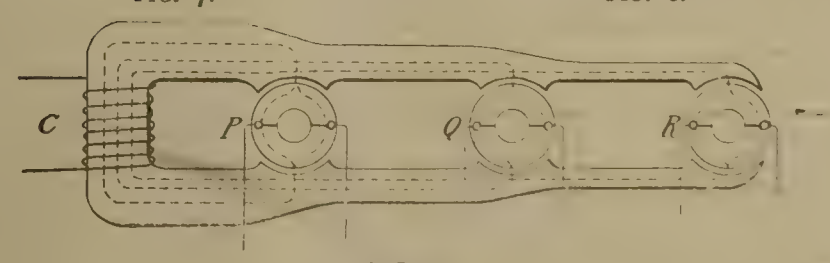


FIG. 9.

polar types are preferably here used. If the arm L, connecting the two fields in Fig. 11, be *fixed*, the combination may be used as a dynamotor. And by driving armature Q as a dynamo, by power, or by a motor secured to the arm L, armature P will operate as a motor, turning at a certain definite and predetermined speed with respect to Q. Should the armature P be slowed down by a *fixed* brake or clutching device, and the armature Q rotated as before, there will be a rotation given to the field C_1 of P, in the *opposite* direction to which the armature P is turning, in order that the lines of force across P may continue to be cut at the same rate as before; that is, when the field was fixed and the armature was free to revolve. If armature P be wholly stopped, its field C_1 will turn around, carrying the arm L and its appurtenances at the same speed at which the armature was formerly turning, but in the opposite direction. If on the other hand, the speed

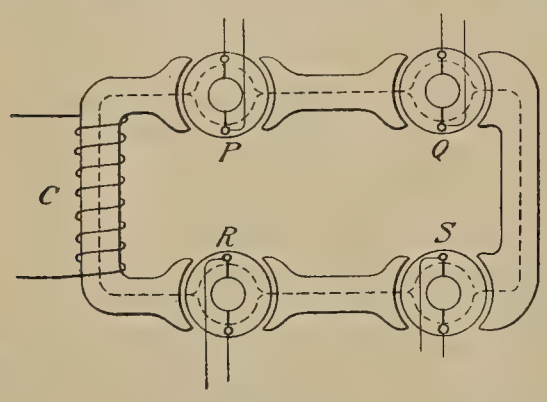


FIG. 10.

of the armature P be increased, by applying external power, then, to cut the lines of force at the designed rate, the field C_1 of P, and so the arm L, will have to turn around in the *same* direction as the armature P. The armature and its field form an electro-magnetic turning pair of elements; in the first case above, acting as a motor-turning pair, and in the second case as a dynamo-turning pair of electro-magnetic elements. The placing of two armatures, P and Q, in the same magnetic circuit makes it an electro-magnetic connecting link between them; while, if placed simply in the same electric circuit, they form a combination of elements electrically linked. The electro-magnetic chain is then built up of electro-magnetic links, which connect electro-magnetic pairs of elements. Two or more armatures may therefore be electro-magnetically arranged in series or in parallel, or any of the usual modifications and combinations of these groupings. And, from the kinematic standpoint, two or more armatures, with their fields, may be kinematically arranged as an electro-magnetic kinematic chain; the mechanical equivalents of this combination may be seen in belt kinematic chains, wheel-kinematic chains, and crank (linkage) kinematic chains. In general, then, an electro-magnetic kinematic chain may be considered as a combination of electro-magnetic connecting links, so connecting pairs of electro-magnetic elements, that all parts of the chain have determinate motions; such motions being determined by the form of the elements carried by the links, and independent of the application of external force when considered merely as a change in position. Fig. 12 shows a simple ideal electro-magnetic chain of three links. Whether the armature P is held fixed,

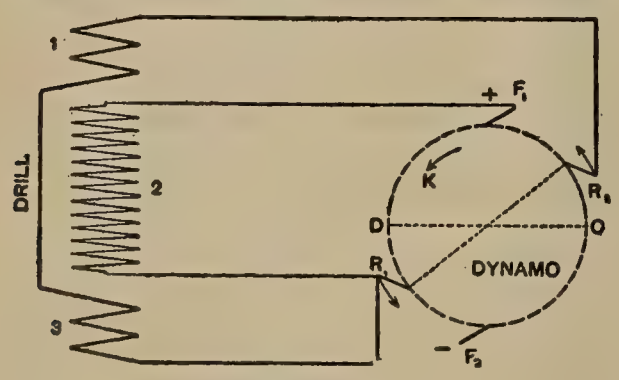


FIG. 14.

or is rotated, certain definite motions may be obtained from the armatures Q and R, in either case. Fixing the centres of armatures Q and R (the same as fixing the rigid connecting link between P and Q, of Fig. 11) would lock this three-link chain, so far as any motion of the centre of P, in space, would be concerned, and the armature P would then revolve as about a fixed centre. Kinematic chains of four or more electro-magnetic links admit of a greater variety of relative and constrained motions; and, as in any case, become convertible into a mechanism by fixing one link. The extreme flexibility of the electro-magnetic connection admits of many combinations of the simple electro-magnetic pairs for producing rotation, translation or helical motion.

Some Industrial Applications of Electro-Magnetic Machinery have been taken from among the many drills operated directly or indirectly by these means. Drilling operations admit of peculiarly compact and portable machines, and ready adaptation of either rotary or reciprocating motions produced and controlled by electro-magnetic means.

The Rowan Electric Drilling Machine, with an electro-magnetic clamping device, is shown in Fig. 13. The main frame $M\ F$ is easily placed in position, and electro-magnetically clamped by the holding-down magnets $H\ M$, to the iron or steel plates to be drilled. The drill is then operated through the usual mechanism for increasing or decreasing the speed, from an electric motor, $E\ M$, mounted on the main frame $M\ F$. The feed is by hand, through the feed-gear $F\ G$. The drill can be moved over the work, along the guides G, G, by the transverse shaft, $T\ Sh$. The Willet's portable electric drill cuts holes two and three-eighths inches diameter through two and one-half inch steel armor-plates, in position on deck, in twenty-one minutes. This work formerly required two men, working a half-day each.

The Van Depoele Reciprocating Electro-magnetic Mining Drill is a good example of the direct application of a controlled reciprocating movement. The length of stroke is about five and one-half inches, and at every stroke the drill turns automatically one-eighth of a revolution about its axis, so that the drilled hole is truly cylindrical. The forward advance is made by a feeding-screw operated by hand. About two horse-power is absorbed in drilling holes from one and one-half inch to two inches diameter. In experiments at Frankfort, 1.4 inches diameter holes were drilled per minute, in gypsum blocks, to a depth of 7.9 inches with water, and 4.7 inches without water. In Odenwald granite, a hole 1.7 inches diameter and fifteen and three-fourths inches deep was drilled in ten minutes.* Two thick-wire outer-coils, 1 and 3, with a thin-wire inner coil, 2, are wound, side by side, and secured to an iron casing completely closing in the magnetic circuit, and so forming an efficient iron-clad construction. The drill-spindle is attached to an iron core introduced into the coils. The coils 1 and 3 are oppositely wound, so that they are equally and oppositely polarized, and connected up in series with the *rotating* brushes R and R_2 of the generating dynamo, or of the distributing motor-dynamo; these coils are therefore traversed by an alternating current. The coil 2 is connected at one end to the *fixed* brush F_2, and at the other end to the junction of the coil 3 with the rotating brush R_1; it is therefore traversed by a pulsating current, and exerts the chief magnetizing effect upon the reciprocating iron core, with a constant polarity. Speaking kinematically of this combination of electro-magnetic elements, forming an electro-magnetic kinematic chain composed of reciprocating pairs, it is seen that the motion of the iron core is determined to a definite extent by the constant direction (polarity) and variable energizing coil 2, in combination with the variable direction (alternating polarity) and variable energizing coils 1 and 3. Moreover, the iron core, as an electro-magnetic link, under the influences of its electro-magnetic pairing with the energizing coils, has its motion completely constrained. This electro-magnetic constrainment of motion of the iron core link of the chain constitutes the combination a true electro-magnetic mechanism; and when the electro-magnetic forces of nature can be compelled to do work through and by this electro-magnetic mechanism, we have a pure electro-magnetic machine. It is to be especially noted that the enveloping forms of the pairs of electro-magnetic elements are such that there is no contact of these elements, while in mechanically-connected pairs of elements the contact of the enveloping forms is a necessary condition to the constrainment of motion. It is therefore possible, in a pure electro-magnetic mechanism, to have constrained motion without the contact of material elements. Oftentimes practical considerations preclude the possibility of using electro-magnetically constrained motion; and it is found best to constrain the motion mechanically by the pairing of material elements; such as the cylindrical turning pair of elements in the dynamo or motor, and the cylindrical sliding pair of elements guiding the drill-spindle in the Van Depoele reciprocating drill.

Direct and Indirect Electro-Magnetic Machines are those in which the transmission of energy, through an electro-magnetic mechanism, is of a direct or of an indirect character, according to whether the electro-magnetic forces act directly at the point of application (as in the Van Depoele mechanism), or indirectly through the intervention of other mechanism, such as a train of wheel-work, as in the Rowan machine. The indirect transmission is, in fact, through electro-magnetically *actuated* mechanisms or devices, which are of themselves essentially of another system, or which call into operation other forces of nature than the electro-magnetic forces; such as the wheel-train of the Rowan machine, transmitting the energy by purely mechanical means, from the electro-magnetic mechanism of the electric-motor to the drill-spindle. It is to be remarked that the self-fixing or clamping device of the Rowan machine, acting as it does by the application of electro-magnetic traction, is an example of a locked kinematic chain, and that in this particular case such a locking, clutching or clamping action is brought about by the contact of material elements in the magnetic circuit. There are, however, examples of such a locking action with no contact of the material elements of the magnetic circuit, as may be seen in the Faraday copper-disc type of dynamo, used as a true electro-magnetic clutch or brake.

The diagram of the cycle of operations of the electro-magnetic mechanism of the Van Depoele machine will be presented in the next paper.

* *The Electrician.* London. Vol. xxviii., Nov. 6, 1891, p. 10.

SUBWAY COMMISSION FOR NEW JERSEY.

A State Electrical Subway and Control Com-

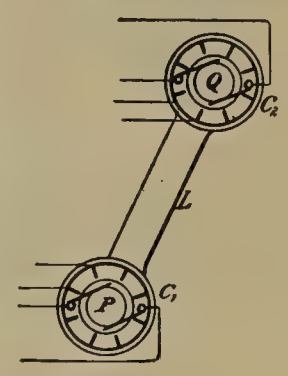


FIG. 11.

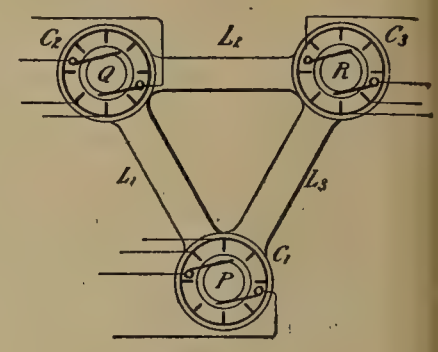


FIG. 12.

mission has been created by the Legislature of New Jersey. The act provides for the appointment of three commissioners for a term of five years, and until the appointment of a successor. The Commission is empowered to appoint a secretary, electrical expert, and such other agents as shall be necessary to carry out the provisions of the act. The duty of the commission is to examine the manner in which telegraphic, telephonic and electric light wires and cables used for the transmission of electricity are constructed and used in the cities of the state, and whenever in the judgment of the commissioners, which shall be final, the public welfare will be advanced by the removal of poles and burial of wires, it shall be the duty of the commissioners to order such poles removed and wires buried. In the event of any telegraph, telephone or electric light company desiring or being required to place its wires, or any of them, under ground, it shall be obligatory upon such company to

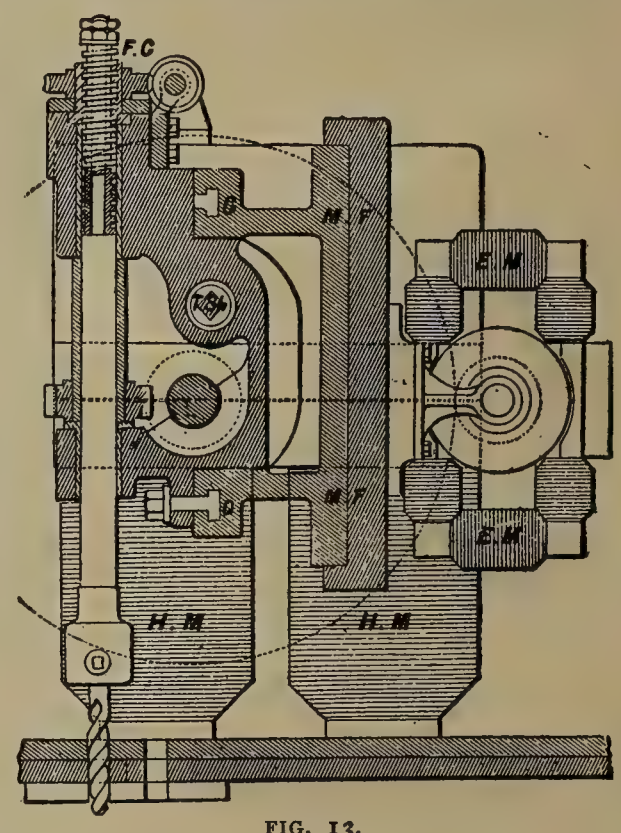


FIG. 13.

file with the commissioners a map or maps drawn to scale, showing the streets, highways or avenues which it is desired to use for such purpose, and giving the general location, dimensions and course of the underground conduits desired to be constructed; and furthermore, no such subway or conduit shall be constructed until a majority of the board shall approve of the plan of construction. It is also provided that the commission, for the purposes of the act, shall have control of all the avenues, streets, and highways of the cities of the state, and may authorize the construction of electrical subways and underground conduits beneath the surface of any such streets and highways, all powers of the local authorities being made subordinate to the powers granted to the board by the act. Hereafter, no telegraph, telephone, electric light or other electric wire shall be constructed along, across or above the surface of any street or any avenue in the State until ap-

proved by the board, other than wires owned by the State, or used for fire and police purposes.

All conduits and subways to be so constructed that they may be used by the city in which they are located without expense other than that of placing the wires in such subways or conduits. The board, after approving of plans for conduits or subways, is empowered to enter into contract with any person or corporation for the construction of same. In addition to the rentals charged there shall be assessed upon the companies using the conduits or subways an amount equal to the salaries and expenses of said board.

Messrs. Allan McDermott, Miles Ross and James Smith, Jr., have been appointed commissioners under the act, and they have appointed O. S. Wiley, of Orange, as the expert electrician of the commission. Mr. Wiley has had a great deal of experience in many branches of electrical industries, besides having been at one time a laboratory assistant of Thomas A. Edison.

SINGLE MOTORS FOR CARS.*

BY E. A. SPERRY.

(*Continued from page* 166.)

Each tooth in Fig. 3 is the line of radius, and all its elements are in the line of the cone. And it is a fact that the teeth of the pinion also point in the line of the apex of the cone, and when the axes coincide, as I have stated, there is no friction over and above

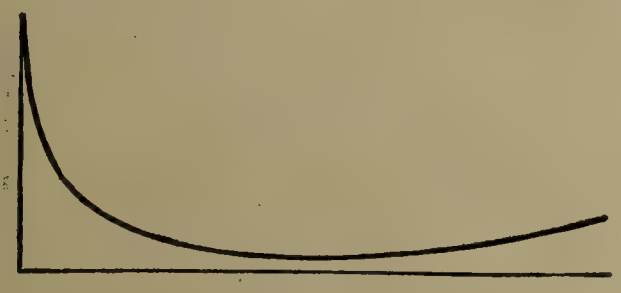


FIG. 4.

a spur-gear, but just as soon as they are allowed to come out of line—and I have drawn Fig. 3 that you may see the effect—those teeth bear on the top at one point and on the under side at the opposite point tending to wedge together and force themselves apart and bind when the axes is an angle as indicated at *II*. This shows the necessity for holding the alignment of the pinion-shaft with reference to the gear absolutely.

Another very serious matter is encountered in designing the equipment. A truck is a very peculiar thing, being one mass of loose joints. It must be so constructed to take short radius curves. Each axle must have lateral play with reference to the truck. It also must have a slight capacity for varying as to parallelism of axle; and at the same time each support at the journal-bearing must have a capacity to rise perpendicularly, individually, without reference to the other. In going over obstructions a wheel will rise, while the other three will maintain their position on the track face. To design gearing which will uniformly and simultaneously rotate these axles, and yet permit all of those motions, is one of the hardest mechanical problems that I have met. It cannot be done by mounting this axle, the pinion-



FIG. 6.



FIG. 5.

shaft, on projections of a truck-frame. If that were attempted the alignment could not be maintained, because the truck-frame rises and falls with reference to the axles, owing to the obstructions on the track; so after casting about, I am enabled to obtain very perfect results indeed by mounting it directly on the axle. For instance, building the armature with its shaft hollow, so that the pinion-shaft may pass entirely through it without touching and allowing thereby an additional advantage of the vibration which is transmitted from the axle to the pinion-shaft to take place freely without being transmitted back to the motor. This involves a peculiar transmitting device between the motor and the axle, one which will allow of the eccentric relation of the two shafts (not an easy thing to design) so that it will at all times perform its functions and at the same time not allow, as I say, the vibration, the hammering blows and concussion in this axle to run back into the motor.

There is one other matter with reference to this gearing that I wish to call your attention to. You will readily see that if either of the axles have an end-wise motion with reference to the truck independent of the other axle, and the end of the pinion-shaft is retained upon that axle and located with reference to the axle in a constant position, the mesh of the teeth will differ.

This difference has been so thoroughly overcome, however, that even a cast pinion and gear will run noiselessly when speeded up to thirteen or fifteen miles. It will run coming down grade even faster than that, with almost no noise whatever, with a thirty-inch wheel. That means that this gear at eleven miles an hour will run about 120 revolutions, and give it quite a high velocity. The gears have been laid out so that even on an irregular track, taking turn-outs, etc., there is no apparent noise from them. So much for the transmission.

Now as to the economy of current. There is one other factor in the absorption of current by two motors per car equipment than the one referring to its direct absorption for the power given. We have here a curve which was drawn by Mr. Pratt, in which the ordinates show the amount of extra current consumption by either one of two motors per car equipment, owing to the fact that they are coupled together and are compelled to revolve in union. It is certain that there is a want of uniformity of absorption of power in the case of two motors. One of the best contemporary authorities on this matter writes as follows: "It is found in practice that if * * * electric motors as ordinarily constructed and connected in circuits are belted to the same shaft, or are otherwise applied to the same work so that they must revolve together, the results are unsatisfactory, because of the fact that the load will be unequally or disproportionately divided. This is occasioned by the fact that it is very difficult, in fact almost impossible, to construct electric motors so that they will, with the same rate of rotation, and when supplied with current at the same potential, have precisely the same counter electro-motor force. Therefore, if two motors are connected, as ordinary, to the same supplying mains, and operated so that they must revolve together, that motor whose armature produces the lowest counter electro-motor force will take a larger current than the other motor. The effect of this increased flow of current is * * * to greatly exaggerate or enhance the difference existing between the motor, because the magnetic field of the motor is disturbed by the increased flow, and its counter electro-motor force is thereby still further reduced. This motor, requiring a higher speed to produce a counter electro-motor force, equal to that of the second motor, takes the bulk of the work and tends to drive the second motor as a generator * * * and the load is unequally divided between the different motors. It is practically impossible to make motors, running under the conditions mentioned, self-controlled by adjustments affecting only their own circuit."

It is a fact in practice, and it has been one of great interest to me, upon several occasions a street railway superintendent has actually removed one of the motors from a double motor equipment and has reduced the destruction of armatures in the neighborhood of 70 per cent. I know an instance, not many miles from this city, where the superintendent is an ideal superintendent, according to the street railway journals, from the fact that he is a civil engineer with railroad experience, a man in middle life. However this may be, this superintendent has made a success in this particular instance. This line has four grades on it, and in conversation with him he stated that he had removed in every instance one motor from the equipment and the burning of his armatures was reduced to 30 per cent. of its former value. This argues that there is no doubt the confusional or see-saw motion exists, and is continuous and persistent in its operation when two motors are coupled and operated together from a constant potential. I can cite other instances where from practice similar results of this kind have pointed to it very directly, and the curve that has been prepared for us to-night seems to me to be the first instance where the question has been worked out mathematically, and where the values have been assigned for motors that vary from each other, differing to the extent of their electro-motor force capacity for given speed.

The next point is economy in repairs. This needs but a passing comment. There are certainly less parts to wear, and if we can, as in a single large motor, run the motor at lower speed, the repairs will certainly be less in number and less in quantity. When taken in connection with the fact that when a single motor is used for car equipment it is possible to mount that motor in an entirely different manner, and in a manner that is calculated to meet the special requirements of the case, as compared with that where two motors are in operation, it is possible to still further reduce the wear and tear. In the case of single motor per equipment, the motor may be elastically supported and may be removed entirely from the sledge hammer concussion of the axle. The insulation, which is a large component of every motor, and which consists of cotton thread, something which cannot by any possibility stand the sledge hammer concussion, in this manner may be protected from the concussion and jar which is constantly going on in the axle.

The point which I wish especially to bring out, and I will try to be very brief in reference to it, is that where we have a single motor we are enabled to get a great deal more traction. The office of the motor on the car truck is for traction; it is placed there for the sole purpose of pulling the car about, and this result is accomplished through the adhesion of the wheels on the rails.

Now, I have been much interested in the increased traction when four wheels, six wheels and eight wheels have been coupled to the same motor, and experimenting along this line I have had an opportunity that has not presented itself to every one, to ascertain what this is. In conversation, not many days since, with one of the best authorities in railroad locomotive engineering, perhaps one of the best authorities in this country, I brought up the matter, and obtained from him a statement something as follows: That it is a well known fact that where two locomotives are used to pull a train the results are not satisfactory. Where two four-wheeled locomotives are used in the place of one eight-wheeled locomotive, and were the same total weight is on the drivers, the engine with the eight drivers will pull much more than the two engines with four drivers, each with one-half the same total weight on the drivers, leaving out of account the boiler running.

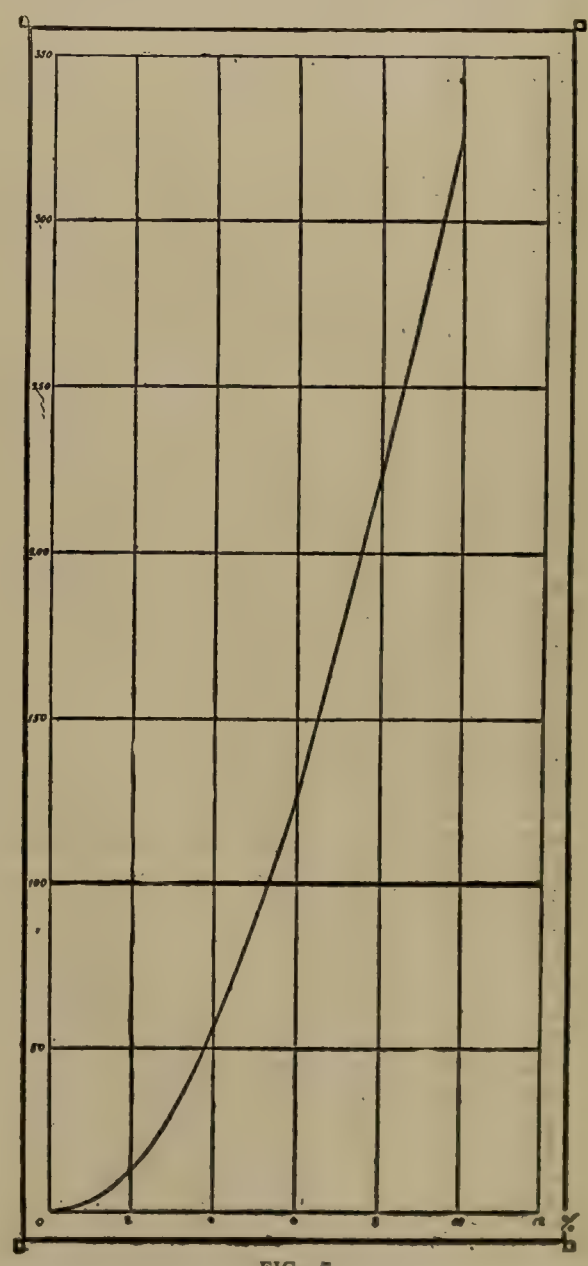


FIG. 7.

The only instance in which this will fail to be a better arrangement is where more speed is required. Where great speed is required two locomotives have an advantage on one, in that the four cylinders have larger total port areas than the two cylinders in an eight-wheeler and the wire drawing is less. This is merely an incidental factor, entirely foreign to the matter of traction. The single locomotive has this advantage over the double locomotive: all the wheels are coupled together and compelled absolutely to revolve simultaneously, especially with reference to their peripheral velocities. One can readily see if any wheel does get down to an actual contact with the rail it finds itself going at exactly the right velocity to help along rather than to slip, as would be the case if the peripheral velocity of the driver were different from the others.

I find different statements with reference to traction. It seems that the idea of adhesion and friction is something like the old idea of static and kinetic electricity, that they are entirely separate and distinct phenomena. I find in some works the state-

* Read before the Chicago Electric Club, March 21, 1892.

ment that adhesion should not be confounded with friction.

The fact is that adhesion and friction are doubtless the same thing, only, as in the case of static and kinetic electricity, it is a matter of degree. The friction not only varies with the pressure, irrespective of the surfaces, but also varies with the velocity; at zero velocity friction is very high. As the friction of quiescence disappears the curve of friction doubtless comes down and goes along almost parallel, and at high speed it is supposed by some to raise again, as shown in Fig. 4. Now, if this is not so I think it would be very difficult to explain one phenomenon, which in Chicago we have excellent opportunity to observe. It is a fact that the friction-brake used on all the South Side cable lines is operated by what is known as the momentum brake system, an invention of Thomas I. Jackson, of Cleveland. Here a double friction phenomenon exists; one controlling the other. On one of the axles is a loose friction disc which is held up by a lever under the control of the gripman against a rotating disc, fastened solidly upon the axle, and to the first disc is fastened the brake-chain which applies the brake-shoe to the periphery of the wheel. Now, in this case we have the reverse of the old way of trying the experiment by taking the resistance of the friction of quiescence and having it come down, as motion is given. It is often said that it is a poor rule that does not work both ways. In this brake-system, if the friction did go up it would be very apparent, much more so than in the ordinary application of brakes. Now what is the fact? The velocity is very great as compared with the loose stationery disc. Therefore we should expect to find the friction low, and we know that the initial reduction of the car is not great. But as the train is brought to a stand-still the curve of velocity drops off more and more quickly, and at last drops off very suddenly, and if you are hanging on the strap, as is usually the case, you feel your body, if you notice carefully, sway further and further, until at last, when rest is attained by the car, you give a sudden lurch ahead, showing that the resistance undoubtedly comes up as we should expect it to do. This gives a most excellent opportunity to observe this interesting fact.

When we speak of journal friction, the value of frictional quality is low as compared with adhesion, or the frictional phenomenon connected with adhesion. In the matter of adhesion on an ordinary 16 foot street car we have about 13,000 pounds per square inch applied; whereas in an ordinary journal we have only from 900 to 1,600 pounds per square inch, which is the highest journal friction in practice. But where we have such a severe application, where only a minute part of the surface is available, and where the wheel would tend to dig itself into or abrade the rail where the velocity differs, the phenomenon that we know as adhesion takes place, we are enabled to know one point on that curve. For instance, we know that friction between chilled cast iron and ordinary soft steel rail is as high as 20–24 per cent., even after a slight motion is attained. Furthermore, that by the application of silicate or sharp sand it can be raised as high as 42 per cent., even after slipping has set in. The idea of adhesion is undoubtedly one of molecular gear. Suppose a wheel surface to be magnified very greatly. In this case we find that the surface is always more or less rough, and when we reduce it to a molecular surface it must certainly be rough, as rudely shown in Fig. 5. In this case we have what may be termed a molecular gear, or gear and rack, and as they roll it might be said that the teeth mash. This is known as the friction of quiescence. We thus obtain the enormous pull that we observe in the high point of the curve. Now, then, why does the curve come down so rapidly? It seems to me that it may be readily explained by saying that the moment a slip takes place, and we can see by the curve that that is the critical moment, these teeth are stripped off; and we have what approximates a surface lift. We can almost illustrate it by an irregular line, moving the straight surface to the rear when the gear teeth has been stripped. See Fig. 6.

In my judgment this all goes to show that we must arrange our truck and our car equipment so that the first or initial slip will be prevented. It is a fact that has been observed that when a train is running double header, just as soon as the driver of one locomotive commences to slip on a heavy grade the drivers on the others will immediately commence to slip, although it has no mechanical connection with it whatever. The tractive power, which was very high, and which was exerting itself upon the load tremendously, just as soon as the slip occurs, is reduced and all the load is thrown on the other drivers, which are not equal to the increased duty required. In the case of an eight-wheeler the advantage exists in the fact that they are all coupled together and all must rotate in unison. When one driver tends to slip, it is held back to its place by its rigid attachment to all the other seven that do not happen to tend to slip at the same instant.

For the purpose of dynamos and motors, cast iron cannot be depended on to within 5%; therefore, two motors with cast iron fields built for the same armature speed when working on the same potential, may easily differ from one another in speed by 10%. There will be a further difference in speed due to unavoidable difference in winding, but this ought not to exceed .1% and may be neglected. Suppose two motors were built to run at 500 revolutions, one may make 475 and the other 525; now if the armatures of these machines are forced to revolve together, either the slower will pull down the speed of the faster, or the faster will increase the speed of the slower, or the speed of both will be affected. Consider the case in which the slower armature reduced the speed of the faster one, the result will be that the counter E. M. F. of the faster will be reduced and a greater current will flow through it. This will increase its torque to such an extent that the slower motor will be unable to hold it down; its speed will increase, raising that of the slower motor beyond its normal. This will raise its counter E. M. F. and a smaller current will flow. All of the work will then fall on the fast machine with the result that its speed will decrease, and then the cycle will be repeated.

Suppose the resistance of each motor were 2.5 ohms and under normal conditions each takes 10 amperes. The drop of potential in each will then be 25 volts, leaving 475 volts for the armature to produce as a counter E. M. F. Now suppose both were designed to make 500 revolutions, but in practice one made 475 and the other 525 when running independently, then, clearly, if the faster one is forced to run 475 revolutions per minute, it will produce an E. M. F. of but 430 volts which leaves 70 volts, and this will produce a current of 28 amperes through the 2.5 ohms of motor resistance. On the other hand, if the slow motor is forced to make 525 revolutions, proportion would indicate a counter E. M. F. of 525 volts, but as this is impossible it will simply run idle while the other motor does the work.

The line in Fig. 7 marked 100 shows height of ordinates of a 15 horse-power motor absorbing 10 amperes when the motor measures two and a half ohms, which is a high efficiency motor for the capacity. The height of the ordinates that intersect this curve at various points shows the amount of power absorbed or the amount of heat put into that motor, which is added to this amount of heat indicated by the above named line, when these motors are run together, and when they vary from each other a differing per cent., measured two, four, eight to ten per cent., so that the height of the ordinate intersecting the curve should be added to the height of the ordinate indicated by 100 to obtain the total amount of heat in the motor.

In the curve the ordinates represent the relative amounts of heat lost for various percentage differences in two motors, over and above the heat normally lost in the motors.

The red line represents the normal heat loss. The curve shows an additional heat loss due to the difference of the motors equal to the normal loss when the machines differ by a little over 5½%.

UNDERGROUND CONDUITS.

"Is there any reliable method of laying electric light wires underground?" is a question that is frequently asked but not easy to answer. A reliable and economical system, it would seem from the report of the Committee of the National Electric Light Association on Underground Conduits and Wires, is yet to be devised.

The report of the committee on this subject, which was read at the convention in Buffalo last February, gave a general description of the various systems in use in this country and various cities in England, and concludes with the following interesting observations:

"After a careful and extensive examination of nearly all underground work in this country the fact has been developed that, with very few exceptions, the system and plans heretofore adopted have proved a failure; in some cases caused by improper materials, insufficient insulation, and in many cases, carelessness in laying the conduit or drawing in the cable, and in a large majority of cases, from using cable with too thin an insulation. High-tension currents can be carried in conduits successfully if the conduits are properly built and cables thoroughly insulated and carefully drawn in, but it is absolutely necessary that all work and materials should be first-class, no half way business or effort to scrimp and save expense by thinly insulated cables or poor construction.

"Investigation plainly shows that a large number of the troubles on underground cables have been caused by workmen in the manholes, as the employés of all companies have access to same; employés of one company have been extremely careless while working over the cables of a competing company and trouble has followed. This shows conclusively that each company should own and control exclusively the conduit in which their wires are placed. The plan of renting conduits is not productive of good results unless the legislatures of the various states pass a law regulating the charges made for rental, and this should be the aim of the National Association, to see that laws, properly controlling the price charged for rental and use of conduits, are passed in all the states where same are used.

"A serious trouble in underground work has been caused by drawing in the cables. This is a very important part of the business, and should only be intrusted to reliable and experienced men, as the least injury to the insulation, while it is being placed in the duct, will surely develop and cause trouble, and many of the burn-outs have been caused in this way. No matter how good an insulation you may have, if it is cut or injured while passing it into the duct, you can depend upon it that this special place will give you notice before long, and in a way that will severely test your ability to obey one of the Ten Commandments.

"Some substance must be used for the conduit that will withstand the action of the gasses, soil, etc., and also resist the affectionate embrace of the Irishman's pick, used in excavating and repairing streets; iron is not desirable, as under certain conditions and places it will be destroyed in a few months, leaving your cable exposed; cement alone cannot be relied upon; wooden conduits soon decay, besides absorbing large quantities of moisture. It would seem that glazed terra cotta, or like substance, set in concrete was the most reliable, and with a cable first insulated with not less than ¼ inch of pure rubber, this covered with a heavy braid well insulated, over this a covering of lead, and then a heavy and substantial braid, saturated with a good compound, will give satisfactory results, and can be used with high-tension currents successfully and without being troubled with burn-outs or grounds. But this entails a large outlay for conduits and cables.

"There is one feature of the business upon which all examinations and reports agree—that is, that the underground plan has been in use for so short a time that it is impossible to give a fair comparison of the cost of maintaining aerial and underground circuits; but it is conceded that the expense of maintaining underground cables is far greater than aerial; also that the durability of conduits and cables, in many cases are mere conjecture, as they have not been used long enough to test their ability to stand the action of acids, gases, and various other requirements, which can only be determined after a sufficient time has elapsed.

"In cities of less than 200,000 inhabitants, compelling companies to place their wires underground will practically prohibit the use of electricity for lights, and leave the inhabitants of those cities to meander through the streets, guided by the sickly rays of the kerosene lamp, or the feeble flutter of the gas burner, as no electric lighting company can afford the expense that this would incur, unless they could obtain double the prices now paid for lights.

"The expense of conduits and underground cables is so heavy that they can only be adopted in a few of the larger cities, thickly settled, and then the electric lighting companies adopting them must be paid a higher price for service, or eventually their company will be bankrupted by the expense and loss entailed. Therefore the taxpayers in any city, who demand that wires shall be placed underground, want to realize the fact that this move means increased cost for lights and larger taxes to pay for same. From data obtained, it is evident that nearly all the cities could be served with aerial lines for the high-tension current in a more acceptable manner and at less expense than with underground conduits, and they could be so arranged as to be perfectly secure and not in any way endanger the public or mar the general appearance of the streets."

ANNUAL MEETING BELL TELEPHONE COMPANY.

At the annual meeting of the American Bell Telephone Co., held in Boston, Mass., March 29, it was decided to increase the capital stock $2,500,000, making a total of $17,500,000, and that the present stockholders might have the first chance to profit by the increase in the proportion of one new share for six old shares at par. The right to subscribe will expire at 2 P. M. on May 15, 1892, and all stock not taken by subscriptions then on file at the treasurer's office will be disposed of as the directors shall determine. The report shows net earnings of $3,126,819 against $2,869,418 for the previous year, and $2,661,888 in 1889. There are 512,407 telephones in use in the United States, requiring 266,456 miles of wire and giving employment to 8,376 persons. The estimated number of telephone connections daily in the United States, made up from actual count in most of the exchanges, is 1,584,712, or a

total in the year exceeding 500,000,000. The total revenue reported by all the companies was $1,638,653.29, and of this sum the extra territorial lines included $763,358.71, of which last sum $42,142.33 went to the company. There are 71,506 miles of underground wires in use—one-quarter of all the mileage in the country.

The old board of officers was unanimously re-elected. They are: Clerk, Charles Eustis Hubbard; Treasurer, William R. Driver; Directors, Thomas B. Bailey, Francis Blake, Charles P. Bowditch, George L. Bradley, Alexander Cochrane, William H. Forbes, Henry S. Howe, Charles Eustis Hubbard, Gardiner G. Hubbard, John E. Hudson, Charles E. Perkins, Thomas Sanders.

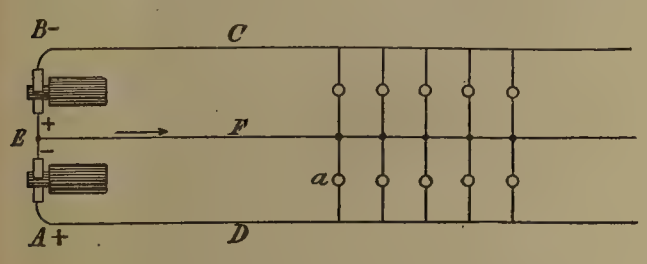
EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

The Edison Three-Wire System.

One of the largest items of expense in an electric-light system is that for the copper wire which must necessarily be used. Copper is used on account of its low resistance. When the current is to be carried a long distance from the generating station the large amount of copper necessary is liable to prove a serious obstacle financially, and various methods have been devised to reduce the amount of copper without impairing the efficiency of the system.

The most effective of these methods is the Edison three-wire system, which is very successfully used in many cities. It consists of coupling two dynamos together in series and connecting the supply mains one each to the outside terminals of the dynamo, as



THREE WIRE SYSTEM.

shown in the accompanying illustration, then running a third wire parallel with the mains, connecting it with the dynamos at the point where the two machines are connected with each other.

Referring to the figure, A and B represent the two dynamos connected in series, the — terminal of A being connected with the + terminal of B, the supply wires C and D being connected respectively with the —terminal of B and the + terminal of A. At the point E the third or neutral wire, as it is generally called (F), is connected. The office of this third wire will be explained presently.

As shown in the figure, there are an equal number of lamps connected between C F and F D. Now so long as the number of lamps on each side of the neutral wire remains unchanged no current will flow along the third wire. The current created by the dynamos, which in this case will have twice the pressure that the current from one machine would have, flows from A along D through the lamp circuits connected with D and F, thence through the lamps on the circuit C F, along C to B, then to the starting-point, none of the current flowing through F, except that portion which it must traverse in order to reach the lamp-circuits on the other side of the system.

Supposing we turn out one lamp between F and D, *a* for instance, there will be then four lamps on one side of the neutral and five on the other. Now the third wire F is called upon to do some work. When the lamps are equal in number on both sides, that portion of F between the lamp nearest the dynamos and the dynamos themselves might just as well be cut out; but in practice it is extremely rare that the number of lamps are exactly balanced. There is always a difference, and it is when this difference exists that F is called upon to perform its important functions.

On extinguishing lamp *a* we increase the resistance of that side of the system as compared with that on the other side, by closing one of the avenues for the passage of the current. When this condition exists a current will flow through F in the direction indicated by the arrow. The value of this current will equal the difference between that required for four lamps on one side and five lamps on the other, and will be just enough to supply the deficiency to the five lamps caused by the extinguishing of the lamp *a*.

Should another lamp be extinguished on the same side with *a* the resistance of that side will increase still further, and less current will be required to supply the remaining three lamps, but the five lamps on the other side will require just as much current as they did before, and F carries double the amount it did for *a* in order to supply the deficiency created by the cutting out of the second lamp.

In case all the lamps should be cut out on one side (which never happens in practice, however), the middle wire F would have to carry all the current necessary to supply the five lamps, and would thus become one of the main feeders.

What has been said with reference to extinguishing lamps on one side applies equally well, of course, to the reverse conditions. In practice the number of lamps installed is made as nearly the same on each side of the neutral wire as possible.

The three wires are confined in one tube and laid underground, and are imbedded in a hard insulating compound, which is run into the tube in a molten condition.

This system affords many interesting points for study which suggest themselves. For instance, it shows that the greater number of paths we present for the flow of current the greater will be the current flow. This is in entire obedience to Ohm's law, which is that the current is equal to the electro-motive force or pressure, divided by the resistance which the latter encounters. If we have but one lamp in circuit it may offer a resistance of, say 10; if we switch another lamp in, we present an additional path for the flow of the current and consequently reduce the resistance to the flow, and, according to the rules for the calculation of derived circuits, the combined resistance of the two lamps will be 5, hence the current will be increased in proportion to the decrease of the resistance.

EXTRACTING METALS BY ELECTRICITY.

One of the most important applications of electrolysis is the separation of metals from their ores, or reduction of ores, as it is usually called. The crude ores are first reduced by chemical means to salts capable of being electrolyzed, or decomposed by the electric current. The principal ores that are reduced in this manner are those of gold, silver, copper, zinc, lead, magnesium, aluminum and sodium.

Bunsen was the first one to separate metals from their ores by electrolysis. This was in 1854. By this process he obtained aluminum, barium, sodium and magnesium, operating on the chlorides of these metals.

Sir Humphrey Davy obtained potassium and sodium from potash and soda, experimentally, in 1807.

Bunsen's method of reducing ores consisted mainly in submitting the fused chlorides to electrolysis in a glazed porcelain crucible, maintained at a red heat, and divided into two compartments by a porous earthenware partition reaching nearly to the bottom. He used coke carbon electrodes, the metals going to the cathode and the chlorine to the anode. Bunsen's method of reducing aluminum was subsequently improved on by St. Claire Deville.

Becquerel, about 1885, obtained silver, copper and lead from their ores by the electrolytic process. He first reduced the silver ore to a chloride and the copper and lead ores to sulphates.

The economical production of current by dynamos has revolutionized the earlier methods of the reduction of ores by electrolysis, which was by battery currents. The batteries were expensive to maintain; but even the dynamo current is not always the most practical or economical.

The salts still generally employed are the chlorides, though the sulphates, nitrates and acetates are preferable for some metals.

The manner of preparing the salts from their ores is by roasting, fusing, pulverizing, treating with acids and other operations according to the nature of the ore and other conditions. The salts are afterwards reduced to liquid form, either by fusion or solution in water.

LEAKAGE IN DYNAMOS.

It is a well known fact that in every dynamo the magnetic force necessary to develop the field in which the armature revolves is always greater than that which is usefully employed, that is to say, more lines of force are generated than actually pass through the core of the armature, the discrepancy being attributable to leakage at different points. To find out the amount and location of the leakage, ascertain exactly the ratio of lines of force actually generated to the lines passing through the core of the armature. This ratio will always be greater than unity. Some of the lines pass directly from one limb to the other, and some leak out of the yoke to the pole-pieces.

By placing a galvanometer in circuit and observing the deflections, the number of lines of force cutting or cut by a coil of wire in two or more given fields can be compared. The galvanometer must be a delicate one, as the resulting E. M. F. is usually comparatively low.

TRANSFORMING MECHANICAL INTO ELECTRICAL ENERGY.

When a wire through which a current is passing is placed in a certain position in any electro-magnetic field, it has impressed upon it a definite mechanical force tending to move it into another part or out of the field; and when a conductor is mechanically moved in a field transversely to the lines of force traversing that field, a certain electro-motive force is determined, which sets up a current in the wire if its two ends are connected. Extensive use is made of both these effects in practice, and on a very large scale. Machines which are constructed to transform energy which exists in the form of electric currents into energy in the form of mechanical motion, and, conversely, machines which are able to transform energy in the form of mechanical motion into energy in the form of electric currents can be included under the generic head of dynamo-electric machinery.

In every machine for the conversion of energy, there is always a certain amount of loss attending the conversion; in other words, less energy appears in the new than existed in the original form. The more perfect the machine the less does this loss become, so that a theoretically perfect machine would be one in which there is actually no loss at all. It is absolutely impossible to construct such a machine, but in every case the chief aim of the engineer should be to make the loss as small as possible, or to make the machine as efficient as possible. The proper way of doing this is to start with the fact established in accordance with the doctrine of the conservation of energy: that energy can never pass out of existence or be destroyed; that, therefore, the whole of the energy put into the machine reappears in some shape or form, although only a part appears in the exact state in which it is desired. Steps should then be taken to ascertain exactly what form the other part takes, and the designer of the machine should study how to reduce that same part, which may be called "waste," to a minimum. In all machines which have moving parts a certain percentage of the energy takes the form of heat, due to friction at the bearings and other surfaces which come into contact. Every dynamo has moving parts, and is therefore subject to loss from this cause, and the well-known methods of reducing friction by good workmanship and design, and by the judicious use of oil or other lubricant, are taken advantage of to minimize the loss. But there are many other causes besides mechanical friction which operate to reduce the efficiency of a dynamo; they are mainly due to electro-magnetic phenomena, and careful study is required in discovering how to eliminate or minimize them, although in some instances the loss may be readily localized, because, like friction, these phenomena convert a certain amount of the original energy of the mechanical motion into heat. One of the principal features, then, by which a dynamo is judged is its efficiency, or by the ratio of the energy reappearing as electric currents to the total amount given mechanically to the machine.

ANSWERS TO INQUIRIES.

EDITOR ELECTRICAL AGE:—I would like to ask you what are the dimensions of arc light carbons, and why are they coated with copper on the outside?

ERIE, PA. J. R. P.

Answer.—The usual length is 12 inches, but the diameter varies according to the strength of the current and candle-power of the light for which the carbons are intended. They range from $\frac{7}{16}$ of an inch for 1,200 candle-power light to $\frac{9}{16}$ of an inch for 3,000 candle-power light. Carbons are coated with copper to reduce their resistance.

EDITOR ELECTRICAL AGE:—I am thinking of getting a dynamo for plating purposes, and I have had so much advice given me regarding the winding, etc., that I know no more about the subject now than I did when I first began my inquiries. Will you please inform me what kind of a machine I should get and in what respects a plating dynamo differs from any other. H. G. D.

EVANSVILLE, IND.

Answer.—A plating dynamo differs from machines used for other purposes in that it is wound for a large current of low tension—that is, with large ampèrage and low electromotive force. Its internal resistance must be kept very low; this is attained by using wire sufficiently large to carry the current without danger. In general terms the resistance of the armature should be about $\frac{1}{20}$ the working resistance of the circuit outside of the dynamo, which includes the electrolytes in the vats, wires, etc., and the field-magnets should have a resistance 20 times greater than that of the working circuit, outside of

the dynamo. The armature coils should be connected in shunt with the field-magnet coils. This is to insure constant current under varying loads, and to prevent reversal of magnetism in the dynamo. All solutions through which an electric current has passed constitute in themselves a galvanic battery with the articles being plated and the anodes of the battery as elements, and unless proper precautions were taken, such as by winding the dynamo field-magnets in shunt with the armature, this current might be sufficient to reverse the polarity of the dynamo.

Editor Electrical Age: In the armature coils of a dynamo is only one current generated; that is, does the current vary between its lowest and highest value in one revolution? R. H. M.

Bound Brook, N. J.

Answer.—Two currents are generated in the armature coils during each revolution; one during each half revolution. Each coil, in one revolution, passes through two neutral points where the currents reverse.

AGAINST THE WESTERN UNION.

Justice Brewer of the United States Supreme Court rendered a decision, March 30, annulling the contract existing between the Western Union Telegraph Company and the Union Pacific Railroad Company, by which the former company conducts the commercial telegraph business on the latter's lines. The case was originally begun in the Circuit Court for Nebraska under the title of the United States *vs.* the Western Union and Union Pacific Companies, in accordance with the provision of the act known as the "Anderson law," which provides that any railroad or telegraph company that had been aided in its construction by the United States shall be required to operate all such lines by their own officers and employés and exercise by themselves all franchises conferred. The primary cause for the suit was the effort of the Postal Telegraph & Cable Co. to secure for itself equal rights with the Western Union Telegraph Co. for the transmission of messages to the Pacific Coast.

It has been stated by Dr. Norvin Green, president of the Western Union Telegraph Company, that an appeal will be taken from the decision of Justice Brewer setting aside the contract made in 1881 between the Western Union and Union Pacific Railway Companies.

AN IMMENSE SUBMARINE CABLE.

The International Okonite Company, Limited, recently shipped from its factory at Passaic, N. J., to go South, a two mile submarine cable in one length, composed of 20 conductors. Its total weight was upwards of 70,000 pounds. Its manufacture was accomplished through the agency of new machines which have recently been put in operation at the Passaic works, and tends to show the progress made by the Company in not being satisfied with remaining quiet, but continually endeavoring to improve its machinery for the production of high class insulated wires and cables.

We are informed that the International Okonite Company (limited) has closed a contract for laying underground in the city of Manchester, England, wires for the purpose of lighting the city. This wire will in all probability be made in its Manchester factory, which is now completed and in running order, thereby relieving the Company of a tremendous strain on its facilities for turning out goods for export and interfering with its American trade.

NEW BOOKS.

A Guide to Electric Lighting. By S. R. Bottone. 189 pages, profusely illustrated. Published by Macmillan & Co., New York. Price 75 c.

In this work the author has endeavored to demonstrate in a clear and succinct manner the means by which electricity can be made subservient to the purposes of illumination and the transmission of power. He has certainly succeeded in the attempt, and the book will be found to contain invaluable information to both amateur and householder.

STORM.

On March 26, during a storm which was the heaviest ever experienced in Omaha, Neb., nearly all of the overhead wires, with which the principal streets of the city were filled, broke down. The electric street railroads had to suspend operations, owing to the mass of telephone and telegraph wires which kept constantly breaking and falling across the circuits. Many horses were killed by coming in contact with the live wires, and several persons received severe shocks. A number of telegraph poles between the city and Council Bluffs were blown down, and telegraphic communication interrupted until the damage was repaired.

"SEA BREEZE" ELECTRIC FAN.

As summer is fast approaching with its accompanying evils of flies, mosquitoes and all the other etceteras which tend to make man's life miserable during the heated term, preparations should be made in good season to prevent these annoyances as much as possible. Nothing will help to accomplish this so much as the possession of a good electric fan. The one described herewith possesses advantages claimed not to be equalled by any other fan.

It is called the "Sea Breeze"—minus the salt—and when in operation, even though the thermometer be well up in the nineties, its gentle zephyrs will soon permeate the heat-laden room with most delightful results. The special feature which it is claimed makes these fans superior to all others invented is to be found in the patent oscillating and rotary motions, which, while creating a current of air, distributes the same so equally that the temperature is the same in all parts of the room, at the same time overcoming the objections and unhealthy effects of being under a continuous current of cool air as produced by the ordinary revolving fan.

In construction, the field-magnets are forged and the armature well constructed, resulting in the highest efficiency with least amount of current. The armature is of the Gramme ring pattern, and attached to the shaft by an improved method. A new process is used in hardening the commutator segments, by which their life is greatly prolonged. All parts liable to excessive wear are hardened and ground. All brass portions are finished in nickel, and the best of material and workmanship used throughout. These fans will be found invaluable in the home, office and public resorts. They are made by the La Boiteaux Electric Motor Fan Co., Cincinnati, O., in different sizes to suit the requirements.

PORTABLE TACHOMETER.

Queen & Co., Philadelphia, are just placing on the market a new portable tachometer which has peculiar advantages that render it of great value for instantly determining the speed of rotating shafts.

Three spindles are geared to the rotating parts inside of the case, each one of them having a separate scale on the dial, so that the indications are direct reading throughout. A detachable point, with slightly flexible end, to fit any of the spindles, is supplied, the flexibility of which acts as a safeguard, for if made perfectly rigid there is danger of breakage when not appled exactly at right angles to the shaft.

A scale to correspond with each spindle is graduated on the dial, and the ranges covered are: 40 to 200, 120 to 600, and 600 to 3,000, which gives a maximum capacity of 40 to 3,000 turns per minute. A conveniently shaped handle is attached to the body of the instrument, so that it can easily be held in the hand.

The apparatus is well made and presents a handsome appearance, the different parts being nickel-plated.

A tachometer like this is very desirable for both expert and practical work, and those interested in the subject should write to the makers for a copy of circular No. 310.

INSULATION OF HIGH VOLTAGE CURRENT.

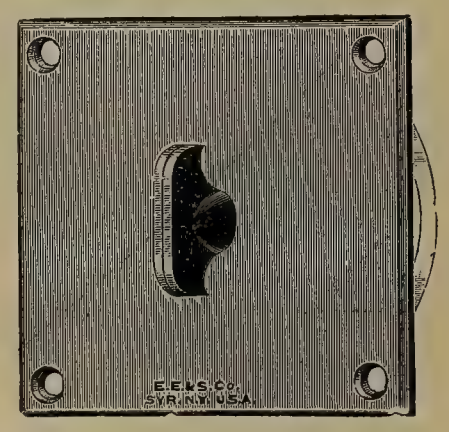
The success of the long-distance transmission of power between Lauffen and Frankfort, Germany, last year, and the recent experiments of Mr. Nikola Tesla before the Royal Institution, London, have awakened considerable interest among electricians on the subject of insulation of currents of very high voltages.

Some interesting experiments were made on March 11 last at the Central Institution, London, by H. B. and W. Fox Bourne, with a view to determining the insulating properties of many of the substances commonly recognized and accepted as insulators.

The Messrs. Fox Bourne on this occasion, by means of a transformer of a new pattern, obtained a current of about 75,000 volts. The following account of the experiments is given in the London *Daily News* of March 12:

The principal materials experimented with were an ordinary telegraph insulator, such as is employed for the wires overhead, plates of glass, ebonite, slate, asbestos fibre, wood, and various kinds of oil. The telegraph insulator having been placed in circuit, the pressure was gradually increased, and at 70,000 volts the current cracked it. With regard to this experiment Mr. H. B. Fox Bourne explained that with a transmission plant working by means of overhead wires at even 40,000 or 50,000, it would be difficult to avoid "creeping discharges" over the surface of the insulators. The insulator might insulate if it could be kept absolutely clean and dry; but this was an impossibility. While the experiment was in progress, indeed, with the lights in the lecture-room lowered, the creeping discharge referred to became visible some little time before the breaking pressure was reached. The best of all insulators, the experimenter added, was air, if you could get enough of it; but as to this it was now doubtful how much was required, the "sparking distances" recently obtained being such as to upset all established notions on the subject. An experiment was here made with a view to showing that the sparking distance across ebonite was much greater than across air. It was also sought to be shown that a plate of ebonite $\frac{1}{8}$ of an inch in thickness was penetrable. The current did, in fact, pass with the ebonite in circuit, but as the plate of this material was small there was a doubt as to whether the electricity did not jump round it, and this experiment was not regarded as conclusive. Plates of glass were, however, penetrated easily, and slate, asbestos fibre and wood were shown to be very inferior as insulators.

The experiment with the piece of wood, which was a thin board about two feet in length, yielded some peculiar results, due apparently to the fact that this substance is a sort of mosaic of conducting and non-conducting areas. As the pressure was increased,



FLUSH SWITCH.

beads of fire appeared in the wood at intervals of a few inches, showing that a number of small arcs were being formed inside, and these increased until the whole block burst into flame. The heating effect, it was explained, manifested itself in most solid insulators, and was very marked in glass.

With regard to fluid insulators, the experiments did not seem to show much difference between one kind of oil and another, though if this material were employed in the insulation of cables, as has lately been suggested, it would of course be necessary to select oil which had no chemical action on copper. Castor oil, paraffin, and resin oil were shown to have a very good insulating effect. When some dust was thrown into the fluid it was found that the current used the floating particles as so many stepping-stones in order to pass through it, and the insulation practically ceased. The heating effect, so marked in the solid insulators, appeared in these fluids to be almost absent. At the conclusion of their insulating experiments, the Messrs. Fox Bourne expressed the opinion that, owing to the danger of "creeping discharges," a cable overlaid with a coating of rubber a foot thick would be useless for the conveyance of a pressure of 30,000 or 40,000 volts if the insulating material contained the smallest crack.

FLUSH SWITCH.

We illustrate herewith the new Flush Switch recently designed and put upon the market by the Electric Engineering and Supply Co., Syracuse, N. Y.

The time is rapidly approaching when the clumsy devices which have heretofore been tolerated, in connection with electric lighting apparatus, will become things of the past. The unsightly bumps on the wall which have for many years answered the purpose for controlling incandescent lamps will, we think, within a very short time be superseded by switches with a much more beautiful design; and this style of switch we think at least a step in advance of what has heretofore been used for this purpose.

NEW INCORPORATIONS.

Metropolitan Duplex Fire Alarm and Police Signal Co., Portland, Me., incorporated March 19 with a capital stock of $500,000, to manufacture and deal in fire-alarm systems and other electrical apparatus.

Incorporators: Albert Watts, Boston, Mass.; James Stephenson, Philip K. Dumaresq, Brookline, Mass.

Electrical Piano Company, Newark, N. J., incorporated March 19, with a capital stock of $300,000. Incorporators: J. Stahl, L. Schiff, J. Schoenhaar, F. A. Feld Kamp, Newark, N. J.

The Mexican Electric Steam Boiler Compound Company, Chicago, Ill., incorporated March 21 with a capital stock of $100,000. Incorporators: C. M. Lawson, John H. Pritchard, J. R. Perry.

The Delafield Construction Company, Jersey City, N. J., incorporated March 23, with a capital stock of $100,000, to construct, build and equip railways and electric light works. Incorporators: T. Delafield, W. G. Cook, New York, N. Y.; R. N. Billings, Passaic, N. J.

Portland West Side Railway Company, Portland, Ore., incorporated March 21, with a capital stock of $600,000, to construct and operate railways and tramways to be operated by electricity, steam or otherwise. Incorporators: R. L. Durham, T. A. Wood, F. R. Cardwell, all of Portland, Oregon.

Kingston City Electric Railway, Kingston, N. Y., has been incorporated with a capital stock of $175,000. Incorporators: L. S. Wenne, E. H. Loughran, C. W. Deyo, all of Kingston, N. Y.

The Hinton Electric Light and Power Company' Hinton, W. Va., incorporated March 24, with a capital stock of $50,000. Incorporators F. R. Van Antwerp, J. A. Parker, L. P. Graham, all of Hinton, W. Va.

Storm Lake Electric Light and Power Company, Storm Lake, Ia., incorporated March 24, with a capital stock of $25,000. Incorporators: Edgar E. Mack, Z. C. Felt, E. C. Coles, Storm Lake, Ia.

The Electric Company of America (incorporated in W. Va.), New York, N. Y., incorporated March 23, with a capital stock of $3,000,000. Incorporators: Egbert Titus, W. E. Osgood, Worth Osgood, Brooklyn, N. Y.

Austin Electric Company, Austin, Minn., incorporated March 23, with a capital stock of $50,000. Incorporators: H. M. Byllesby, H. C. Levis, B. F. Week, Jr., W. P. Johnson, St. Paul, Minn.; W. S. Pierce, Austin, Minn.

Glenwood Electric and Power Company, Glenwood, Ia., incorporated March 24, with a capital stock of $20,000. Incorporators: W. H. McClusky, J. H. Howe, Glenwood, Ia.

The O'Neil Crossing Alarm Company, Chicago, Ill., incorporated March 28, with a capital stock of $500,000, to manufacture, buy and sell railway crossing alarms and electrical railway appliances. Incorporators: W. D. Drake, J. C. O'Neil, W. P. Johnson.

The Johnson's Creek Electric Light and Power Company, Johnson's Creek, Wis., incorporated March 26, with a capital stock of $2,000. Incorporators: J. D. Bullock, G. C. Mansfield, H. C. Christians, H. J. Grell.

White Fish Bay Water, Light and Power Company, Milwaukee, Wis., incorporated March 26 with a capital stock of $50,000. Among other things it will build and operate electric light plants. Incorporators: C. R. Gether, D. Harlow, H. W. Gilbert.

E. F. Brooks Gas and Electric Light Fixture Company, Alexandria, Va., has been incorporated with a capital stock of $25,000. Incorporators: E. F. Brooks, W. F. Brooks, L. H. Schneider, C. W. Meyers, E. T. Bates, Washington, D. C.

ENGLISH EXHIBITS AT THE WORLD'S FAIR.

At a recent meeting of the Committee on Display at the World's Fair, held in London, William Henry Preece, F.R.S., the distinguished expert, being in the chair, it was developed that there was every prospect of British electrical interests being adequately represented at the Fair. It is understood that the display of engines and dynamos will be particularly good, and it is expected that the room devoted to the exhibits will be lighted with furnishings of English pattern similar to the style which proved to be such a great attraction at the recent Crystal Palace exhibition.

CHICAGO NOTES.

The electric subway laid at the Fair grounds up to date is 2,850 feet, which comprises 351,964 square feet of lumber.

Night work has been begun on the Electricity Building at Jackson Park and will be kept up from now on.

Work at the World's Fair site is being pushed with all possible speed and vigor. The Electricity Building is well advanced, the framework for all the towers up to the main entrance line is completed, about one-third of the gallery floor has been laid, and the roof boarding completed over the gallery trusses.

Four electric stamp cancelling and post-marking machines have been ordered by the Government for use in the Chicago Post Office, and will be put in operation April 1. It takes nearly one hundred boys to do the work of cancelling as it is done to-day, but by the use of these machines the number will be greately reduced, each machine requiring only four boys to feed it. The capacity of each machine is 30,000 per hour.

It is given out that the surveyors engaged in lining out the route of the Chicago and St. Louis Electric Railway have reached less than one mile distant from Fairbury, in this State. The party is progressing at the rate of about six miles a day, and will reach Chicago about April 10 next. The incorporators of this road claim to have control of a patent on a high speed motor capable of making one hundred miles an hour, from which they expect to make enormous amounts of money, after they have demonstrated the practicability of the invention, which they claim will revolutionize railroading. They expect to have the road in operation by May, 1893.

A new telephone ordinance for a corporation known as the Long Distance Two-Wire Telephone Company has been introduced into the Board of Aldermen by Alderman Plowman. A franchise is to be granted the new company to construct, maintain and operate for a term of twenty-five years a line or lines of conduits and wires or other electrical conductors with all necessary feeders and service wires, to be used exclusively for the transmission of electricity for the purpose of transmitting sounds and signals. Provision is also made regulating the charges, which shall be $75 for the first year, $70 for each subsequent year and $65 per year for a three-years' contract.

If the Thomson-Houston Company wishes to supply any of the electric generators for furnishing power at Jackson Park, it will have to do so free of cost. Its bid for furnishing generators was at the rate of $15.78 per horse-power. The Eddy Electric Manufacturing Company, Windsor, Conn., has agreed to furnish 1,000 horse-power at $2.50 per horse-power, and the Mather Electric Company, of Manchester, Conn., an additional 804 horse-power at the same rate. The entire amount required is 3,351 horse-power, and the construction department has decided that the remaining 1,547 horse-power must be supplied as exhibits, and without cost to the Exposition Company.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, April 2, 1892.

The Brush Electric Light Company has moved its office from 36 Union square to 115 Broadway.

Mr. Andrew L. Riker, electrician of the Riker Electric Motor Company, 45 York street, Brooklyn, N. Y., gave the Electrical Age a call during last week.

Mr. Henry Hine, manager of the Stanley Electrical Company, Pittsfield, Mass., and Mr. L. Warfield, manager of the Detroit Electrical Works, Detroit, Mich., were in town during the week.

H. G. Madden, manufacturers agent, 18 Cortlandt street, has moved to Rooms 109–110 Electrical Exchange Building, 136 Liberty street, where he has greater facilities for carrying a much larger line of supplies.

The Mather Electric Co., Manchester, Conn., manufacturers of the celebrated Mather system of incandescent lighting, has found it necessary to open an office in the Bennett Building, Nassau street, owing to the phenomenal demand in this city for the installation of its system.

The Perkins Electric Lamp Co., of Boston, Mass., manufacturers of the famous Perkins' Lamp, has, owing to its increasing business, opened an office in the Bennett Building, Nassau street, this city. The efficiency of the Perkins' Lamp is so well known that comment is unnecessary.

Mr. G. G. Ward, vice-president and general manager of the Commercial Cable Company, accompanied by his son, Dr. Ward, sailed for Europe on the *City of Paris*, April 6. Mr. Ward goes to Europe on business of the Commercial Cable Company, while his son is off on a vacation made necessary by the years of hard and constant study while in the medical colleges.

Dr. J. B. De Lery, president and manager of the Electric City, South Lakewood, N. J., is highly elated at the great progress being made at the "City." The company is grading and improving Edison, Thomson, Westinghouse, Kennedy, Faraday, Watt, Ohm and other avenues. A fine residence occupies a prominent place, and a number of handsome ones are under course of erection. The place is noted for its temperate and healthful climate, pine groves and dry soil. The Doctor has received many flattering cash offers for his interest in the "City."

Hatzel & Buehler, 29 W. 26th street, will on May 1 move to 114 Fifth avenue, where they have secured large and handsome quarters, their present ones having long since proved inadequate for their largely increasing business. They have recently closed a contract with the New York Hospital Society for the installation of a 1,200 light incandescent plant. Two straight-line engines and Detroit dynamos, for which they are agents, will be used. The following contracts have also been closed: Installation of one 30 H. P. and one 15 H. P. Detroit motors for Austin, Nichols & Co.; wiring for 400 incandescent lights, Saint Mary's Church, Williamsbridge, N. Y.; wiring for quarters of the Society for the Prevention of Cruelty to Children, 106–108 E. Twenty-third street; wiring residence of H. F. Noyes, Glen Cove, L. I., and many others.

The Essick Printing Telegraph Company has removed its offices from No. 170 Broadway, corner Cortlandt street, to No. 1 Broadway, Rooms 91, 92 and 105, on the fifth floor. The Essick system is the only machine telegraph that is in actual operation at the present time. The company is transmitting messages between Boston and Providence and other towns in New England, and it is stated that it is doing exceedingly well, financially, considering its limited facilities. Mr. Abner McKinley, the general manager of the company, expresses himself much pleased with the outlook. The company is now beyond the experimental stages, and is making a large number of machines for actual operation. It is stated that this was the only printing telegraph system ever used successfully, and by reason of the large expenditures of money made during the past six years it is deserving of the success which is now assured.

Mr. William A. Rosenbaum, who has been for the past five or six years the manager of the patent business heretofore conducted by the W. J. Johnston Company, Limited, publishers of *The Electrical World*, has recently purchased from that company the entire "good-will" of the patent business, together with the extensive library and office accoutrements used in connection therewith, and will hereafter conduct the business in his own name. Mr. Rosenbaum is well and favorably known among the electrical fraternity and especially by the inventors. His excellent work for the clients while with the Johnston Company will no doubt insure him a continuance of their patronage, especially so as the Johnston Company will not hereafter conduct a patent business. We trust his new venture will win the success he so well merits. He desires that all communications regarding patent matters hereafter be addressed to him personally at 177 Times Building, New York City.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co.	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	9 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Engineering Co., N. Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co., N. J.	25,000	100 00	420 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	17,000,000	100 00	195 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	114 00
Brooklyn Edison Electric Light	1,500,000	100 00	75 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush ElectricLight Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*95
Circleville, O., L. & P. Co	100,000	100 00	98 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	30 00
Commercial Cable Co	7,716,000	100 00	155 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.	35,430,000	100 00	111 00

Cons. Gas & E. Co., Batavia, 6s..	80,000		*95
Cons. Subway Co., N. Y.....	3,000,000	100 00	25 00
Darlington L. & W., 7s. S. C....	15,000		*99
Desant Elec. and Sig. Co., N. Y..	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.....	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s....	300,000		*101
Detroit Electrical Works.....	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd.....	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co....	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.....	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.....	100,000	100 00	100 00
Edison Electric Co.....	50,000,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.....	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa....	80,000	10 00	13 75
Edison Illuminating, N. Y.....	4,500,000	100 00	81 00
Edison Electric Light Co., Phila..	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	96 75
Edison General Receipts.....		100 00	97 50
Elec. Sup. & Con. Co., N. Y.....	120,000	15 00	16 00
Elizabeth E. L. Co., N. J.....	100,000	10 00	4 50
Elmira Municip. Imp. Co., 5s....	1,800,000		par
Erie Telephone.....	4,800,000	100 00	45 00
Excelsior Electric Co. 6s, N. Y...	300,000		par
Fargo Gas & Elec. Co. 6s, Dak...	100,000		*92
Fidelity Trust Receipts.....	25,000,000		75 50
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*98
Fort Wayne Elec. Co.....	4,000,000	25 00	13 00
Franklin Electric Co., N. Y.....	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co.,O	95,000	100 00	102 50
G. T. Woods Mfg. Co., Ky.....	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	19 00
Great Western Elec. Sup. Co.....	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guarantee Identification Co., N.Y.	50,000	50 00	51 00
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co.....	250,000	100 00	20 00
Hickory Electric Co., N. C.....	12,000	100 00	105 00
Hoboken Land & Imp. 5s.....	1,000,000		*100
Hunt Engineering Co., N.Y., 6s..	30,000	100 00	*95
Hunt Engineering Co., N. Y.....	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill....	50,000		*95
Kansas Elec. Co. 6s, Mo.....	20,000		*96
Laclede Gas Co.....	7,500,000	100 00	18 50
Laclede Gas pref.....	2,500,000	100 00	55 00
Laclede Gas 5s.....	10,000,000		*81
Law Telephone.....	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s....	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light.....	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marshalltown Elec. Co. 6s, Iowa..	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph.....	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y..	3,500.000	100 00	100 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver..	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s..	26,000		*107
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N.Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N.Y.....	500,000	100 00	101 00
Nat'l Aut. Fire Alarm, L. I.....	150,000	100 00	100 00
Nat'l Elec. Manuf. and Const. Co., N. Y.....	50,000	100 00	101 00
Nat'l Lead Trust.....	9,000,000	100 00	19 00
New England Butt Co.....	100,000	1,000 00	1,000 00
New England Phonograph Co....	12,500	100 00	†20 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel. 5s..	1,500.000		*90
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co.....	20,000	100 00	20 00
Newark L. & P.....	150,000	100 00	58 00
Newark E. L. & P Co. 6s, Ohio..	50,000		*98
North American Railway Co....	39,767,200	100 00	14 00
North New York Lighting	150,000	100 00	10 50
Northwest Elec. Co. 6s, Manitoba.	50,000		*95
Postal Telegraph.....	10,000,000	100 00	37 00
Pennock Baty. E.L.& Impt.Co.,Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light.....	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.....	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*90
Richmond L. H. & P., S. I.....	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*96
Rockaway Elec. Light.....	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston.....	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich..	50,000		*95
San Diego Gas & Elec. Co, 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co.....	16,000	100 00	†80 00
Swan Incandescent.....	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y..	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.....	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y..	100,000	100 00	105 00
The Ongley Electric Co., N. Y...	250.000	100 00	85 00
The Railway Impt. Co., N. Y.....	10,000,000	100 00	100 00
The Siemens & Halske Co., Ill....	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	80
The Wells & French Co., Ill..	600,000	100 00	par
Thomson-Houston Electric Co....	6,000,000	25 00	58 00
Thomson-Houston pref.....	4,000,000	25 00	28 25
T.-H. Electric Co. 5s, Boston.....	500,000		*100
T.-H. E. L. Co., Yonkers, 6s.....	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99

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Unker Elec. Const. Co., N. Y....	50,000	100 00	100 00
United Elec. Light and Power....	3,000,000	100 00	40 00
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co.....	100.000	100 00	
Western Union.....	86,188,852	100 00	87 50
Westinghouse Elec. & Manf. Co..	7,000.000	50 00	28 50
Westinghouse Elec. Co. pref. 7s..	4,000,000	50 00	43 00
Westinghouse Ass. Rects.....		50 00	17 00
West Point W. Lt. & P. Co., Va..	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Consolidation has received a new accession since our last issue, the sweetest of the lot. Spreckels held out until the business end of his composition admonished him that the time had arrived for him to surrender, and $7,000,000 overcame all of his scruples, patriotic, charitable, personal or otherwise. It was a long and determined fight. The sugar corporation is now the largest and most powerful organization in existence of its kind, since the Standard Oil as a single trust or company has ceased to exist. For the purpose of absorbing all the sugar interests under one management it was determined, as long ago as last January, to increase the certificates of the trust from $50,000,000, which was the limit of capital stock fixed in the original deed of trust, to $75,000,000, although it is estimated that the actual value of the sixteen original companies was only $25,000,000. The amount of crude molasses or natural water is apparent, but is justified by the fact, that despite all opposition, the stockholders received in profits from 1887 to 1890 the snug sum of $28,000,000 net. Prior to the consolidation the old corporation's capacity was about 65 per cent. of the total refining business of the United States, and with the entire industry in hand it is quite safe to conclude the profits will correspondingly increase. The Board of Trustees consists of H. N. Havemeyer, Franz O. Matthieson, J. E. Searles, Jr., J. A. Stersburg, Theo. A. Havemeyer, J. B. Thomas, J. Ferguson, John E. Parsons, W. E. Havemeyer, Wm. Dick and C. O. Foster. Following immediately on the heels of this is the incorporation of the United States Rubber Co. under the laws of the State of New Jersey (I wonder how soon the little State over the river will put an extra tax on them), with a capital of $50,000,000, with William Barbour, Wm. L. Trenholm, John J. Watterbury, J. Edward Simmons and John P. Townsend as incorporators. Report has it that the corporation owns the stock and patents of every rubber company in the country except one in Boston, and that, like poor checkmated Spreckels, will soon fall in. The rubber industry, perhaps next to copper, is more closely allied to the electrical industry than any other. Rubber enters so largely into all insulation that as a factor for all calculations of electric equipment its price may often determine the profits of investments. The public are to be congratulated on the fact that the management of both of these corporations is composed of men of broad, liberal views, who will reduce the price of their product and increase its merits, while the investors can also rely on the safety of their stock and a larger income than can be obtained from interest on deposits in any of the ordinary banking or kindred institutions. I await with considerable unsatisfied curiosity the development of the electrical consolidation which to-day is unchristened, and of that peculiar structure one hardly knows whether to write of as He, She or It. This month will probably decide the problem and make public name, component parts and capital.

The financial difficulties of the Panama Canal have been a source of great annoyance, and to say the least, questionable profit for over a generation, and they will not cease for several years to come. M. De Lesseps should have rested on his laurels when he rendered it financially possible to complete—ready for British occupation—the Suez Canal. To-day and for some time past his fair fame has been smirched and his fellows seek to brand with disgrace and dishonor his gray hairs now so near the tour to the great unknown. In the courts of France he is charged with, mildly speaking, "breach of trust," particularly in connection with the purchase of the Panama Railroad, which was necessary to his canal enterprise. It is alleged that he, in collusion with many noted American financiers and investors, obtained for the road more than its value, and retained the surplus. The French Government has obtained an order from the New York Supreme Court to compel the American to testify as to the methods adopted and prices paid or money disbursed in conveying the railroad to the Canal Co., among them are Messrs Seligman, Winslow, Francklyn, Drexel, Morgan & Co., Leverich, Leverich & Co., Whitehouse & Co., Russell Sage, Leland, Bayard Brown, Joseph Ogden, Kernochan and Samuel C. Thompson, who were all shareholders, and who are expected to supply the missing link between the current value and price paid for the road, and such details regarding the matter as they may be possessed of.

TRADE NOTES.

The Peckham Motor Truck and Wheel Co., Kingston, N. Y., has closed contracts to supply 60 trucks for the New York and Morrisania road, 20 for the Brooklyn and Coney Island road, and 50 for the Atlantic Avenue road, Brooklyn, N. Y. They are all of the standard radial-gear non-oscillating type.

The Interior Conduit and Insulation Co., of 42 and 44 Broad street, does not confine its operations to this country alone, as its foreign agents are placing large and satisfactory orders all the time. Mr. Everett Frazer, of 124 Water St., N. Y., the company's agent for China and Japan, is shipping extensively to the above-named countries. The Chinese and Japs are not behind the age, and evidently know a good thing when they see it.

Mr. E. A. Sarran, late of the Thomson-Houston Company, Cincinnati, O., has opened an office at 145 Central avenue, that city, where he will carry a full line of electrical supply goods. Mr. Sarran is agent for the Keystone Electric Company; the "Backus," an electrical combination exhaust ventilation and ceiling fan; the Daisy Fan Motor, and the Kester Electrical Co. Mr. Sarran reports business good and prospects very bright.

A contract for 150 typewriters, has been awarded by the War Department, Washington, D. C., to the Smith-Premier Typewriter Company, of Syracuse, N. Y. Before awarding the contract, the Department appointed a board of experts to hold a competitive examination of the various machines manufactured. After an exhaustive examination the board decided that the Smith-Premier excelled all the others in point of improvements and mechanical construction, and the contract was therefore given that company.

The descriptive price-list recently issued by the H. W. Johns Mfg. Co., 87 Maiden Lane, this city, contains full and complete descriptions of its universally known paints, and also of its various manufactures of asbestos, for structural, mechanical and electrical purposes. In each copy of the price-list is enclosed a very handsome miniature color-chart, on the back of which is printed an interesting digest on colors, definitions, principles and rules. The company will be pleased to furnish samples and prices of any of its manufactures upon request.

BIDS FOR LIGHTING.

Bids for lighting Hopkinsville, Ky., with electric arc lamps will be received by the city clerk until noon, April 25. W. P. Winfree, City Clerk, will give all the necessary information.

The Stillwell & Bierce Mfg. Co., Dayton, O., have issued a circular which contains a copy of a decree issued by Judge George R. Sage, District Judge for the Southern District of Ohio, in their favor in the suit brought by the company against S. N. Brown & Co., declaring that a Hoppes Live Steam Feed-Water Purifier used by that company to be an infringement of the Stillwell patent.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued March 29, 1892.

471,534. System for Transmitting Signals. Henry A. Chase, Boston, Mass., assignor to Albert Watts, same place. Filed Nov. 27, 1891.

471,535. Telephone-Receiver. James A. Christy and Elias J. Baldwin, San Francisco, Cal. Filed March 16, 1891.

In a telephone-receiver, the combination, with the diaphragm and chamber in which it is mounted, of a system of perforated magnetic tubes in chamber connected to the actuating electro-magnet and extending up to the diaphragm.

471,538. Storage-Battery Plate and Process of Making the Same. William W. Donaldson and Roderick Macrae, Baltimore, Md. Filed Aug. 13, 1891.

A storage battery plate having perforations through both the active and inactive material and a space between the adjacent inner surfaces of the active material.

471,543. Electric Railway. William C. Goss, Lynn, Mass. Filed April 3, 1891.

In an electric-railway system, a supply-conductor, a slotted inclosing housing comprising a bottom wall having upwardly-extending sides provided with horizontal and vertical flanges, side walls resting thereon, and a series of insulators supported at intervals along housing in contact with the conductor for supporting the same.

471,549. Attachment for Telephones. James E. Hills, New York, N. Y. Filed April 27, 1891.

A support for a telephone receiver or transmitter, consisting of an elongated loop having normally-distended curved sides, a lower coil and an upper closed end, and a slide adjustably mounted thereon.

PATENTS—Continued.

471,564. Current-Motor. Lemuel C. Neal, Lewiston, Idaho. Filed Oct. 16, 1891.

In a current-motor, the combination, with suitable floats, of a funnel-shaped sluice or water-way connected with float, a rectangular gate and guard pivoted to the front flared end of sluice and provided with fenders across the front thereof, an endless chain paddle-wheel located within sluice, and means for raising and lowering gate and guard over the front end of sluice.

471,576. Manufacture of Incandescent Electric Lamps. Frank S. Smith, Pittsburg, Pa. Filed Dec. 22, 1890. Renewed Oct. 5, 1891.

An incandescent electric lamp consisting of a carbonized conductor, an inclosing bulb of glass, leading-in conductors of iron wire, glass fused upon the wires and to which the bulb is fused, and a cement or ceiling substance surrounding the iron wires at the point of entrance into the glass.

471,587. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed July 10, 1890.

The combination of a conducting-wire and a corrugated covering of insulating material surrounding wire.

471,588. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed April 9, 1891.

The combination, with the electric conductor and the insulating-layer, of the intermediate cover provided with bosses or projections.

471,590. Secondary Battery. Charles F. Winkler, Troy, N. Y. Filed Nov. 8, 1890.

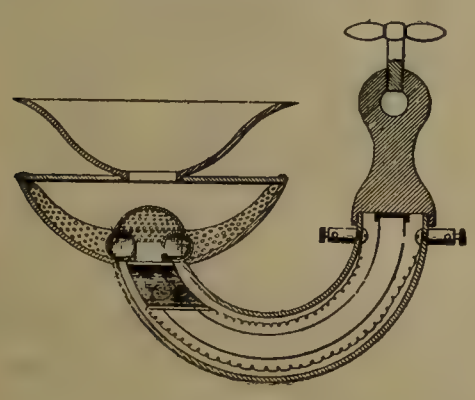
In a secondary battery, the combination, with plates containing active material and an acid solution in the form of a jelly serving to hold the active material in place, of a non-oxidizable su'phate, such as the sulphate of ammonia, contained in the solution.

471,591. Secondary-Battery Electrode. Charles F. Winkler, Troy, N. Y. Filed June 26, 1891.

A secondary-battery electrode consisting of a non-conductive supporting element in the form of a series of troughs or shelves, in combination with active material and electrical conductors supported by said troughs or shelves.

471,592. Secondary Battery. Charles F. Winkler, Troy, N. Y. Filed Sept. 29, 1891.

In a secondary battery, a horizontal supporting-plate made of insulating material and provided with a main



471,535.—TELEPHONE-RECEIVER.

trough, and a series of branch troughs therefrom with free spaces between the troughs of the series for the circulation of the electrolyte, in combination with an electric conductor having a main strip, wire, or back-bone and branches extending therefrom, the backbone being located in the main trough and the branches located, respectively, in the branch troughs, and active material deposited in the troughs and surrounding and embedding the conductor.

471,612. Electric Switch. Harvey Hubbell, Bridgeport, Conn. Filed Oct. 5, 1891.

The combination, with a spindle carrying a cross-piece and a contact-bar turning freely on spindle, cross-piece and contact-bar having depressions, of a spring acting to force the cross-piece downward and pins engaging, respectively, the depressions in the cross-piece and contact-bar.

471,625. Joint for Electric Wires. Roger H. Smith, Lexington, Ky. Filed Aug. 24, 1891.

The coupling for trolley wires, consisting of the two truncated cone-shaped end pieces having longitudinal openings for the passage of the wires and bored bases having vertical walls at their inner ends bored bases being formed with ininternal right and left screw-threads, respectively, and the outer or tip ends of end pieces having slots by which they may be soldered to the wires, a connecting piece having horizontal projections formed with threads corresponding with and adapted to engage the threads of end pieces, and the wires having upset ends adapted to engage the vertical walls of bases.

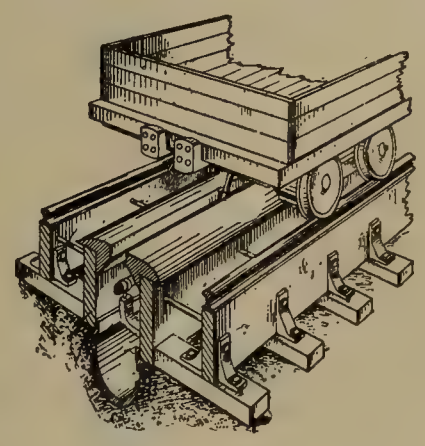
471,645. Support for Electric Lamps. Charles J. Klein, New York, N. Y. Filed Dec. 1, 1890.

The combination, with a lamp-support having a neck-like portion provided with a metal strip and a centrally-located nipple insulated from metal strip, of a shell detachably secured thereto for fastening an electric lamp to support.

471,655. Device for Transmitting Motion. George S. Strong, New York, N. Y., assignor to James N. Gamble, Cincinnati, Ohio. Filed May 29, 1891.

471,656. Device for Transmitting Motion. George S. Strong, New York, N. Y., assignor to James N. Gamble, Cincinnati, Ohio. Filed May 29, 1891.

As a device for transmitting motion, the combination of a shaft having a pinion, a tight casing inclosing pinion but free to turn on the shaft, casing having a chamber fitting neatly around the pinion, one or more communicating chambers and communicating ports arranged along the connecting-line at the end or ends of chambers, a pinion fitting neatly in each chamber arranged to engage pinion, a valve or valves arranged to regulate the opening between ports,



471,543.—ELECTRIC RAILWAY.

electro-magnetic armature-windings secured to the casing, and a relatively fixed magnetic field arranged around the casing.

471,686. Automatic Guest-Call. William H. Perry, Chicago, Ill. Filed May 9, 1890. Renewed Nov. 12, 1891.

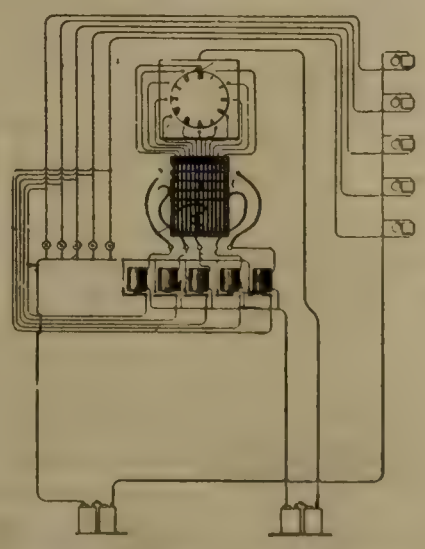
In an electric guest-call, the combination with clock-circuits and insulated time-strips in circuits, of a series of relay-magnets permanently included in the normally-open clock-circuits, circuits being closable by flexible conductors attached to one side of the relay-magnets and insertible in the time-strips, and a corresponding series of bell-circuits connected through the relay-armatures.

471,691. Dynamo-Electric Generator or Motor. Claude W. Atkinson and Llewelyn B. Atkinson, London, England. Filed Aug. 18, 1891. Patented in England and in France.

In a dynamo-electric generator or motor, the combination of a commutator having contact-strips on its face at or about at right angles to the axis of rotation, with a casing adjustably attached to the framing of the machine carrying the brushes, the casing being capable of adjustment toward the face of the commutator to compensate for wear and maintain the smallest volume, the space between the rotating periphery of the commutator and the casing being as small as possible and of such a length as to prevent the passage of flame.

471,693. Dynamo-Electric Machine or Motor. Walter T. Goolden and Llewelyn B. Atkinson, London, England. Filed Aug. 18, 1891. Patented in England.

In a dynamo-electric generator or motor, the combination, with the commutator, of a fixed air-tight inclosing cover, making absolute stationary and rubbing joints throughout and carring the brushes, the cover being capable of adjustment by slotted bolt-holes in the fixed frame, through a suitable angle to give required lead to the brushes.



471,686.—AUTOMATIC GUEST-CALL.

471,725. Governor for Marine Engines. Ernest F. Wallgren, Philadelphia, Pa., assignor of one-half to Axel H. Engström, same place. Filed Dec. 8, 1891.

An electric governor for marine engines, comprising a throttle-valve for regulating the admission of steam to the engine, a vane hinged to the hull adjacent to the propeller and water-line and held out of normal position by the resistance of the water and by currents engendered by the revolutions of the screw and returning to normal position upon withdrawal from the water, and electrical connections interposed between vane and valve for causing the movements of the former to actuate the latter.

471,730. Mast-Arm Switch for Electric Lamps. Thomas Dillon, Indianapolis, Ind., assignor of one-half to John Caven, same place. Filed Nov. 4, 1891.

In a mast-arm switch for electric lamps, the combination of the bracket, the shaft mounted in bracket so as to turn thereon, the arm rigidly secured to shaft and carrying an electric lamp, two pairs of segments mounted upon shaft so as to turn therewith, arranged in line in the plane of rotation, and electrically disconnected from each other, one pair of segments being arranged in form terminals of an open circuit in which the lamp is included and the other pair of segments being electrically connected with each other so as to form a short circuit in which the lamp is not included, and the pair of metallic strips mounted in a fixed position on the bracket and forming the terminals of an electric line circuit, all arranged to co-operate, whereby the lamp is included in the line-circuit when the mast-arm is raised and is excluded therefrom and the line-circuit is maintained when the mast-arm is lowered.

471,732. Bracket for Incandescent Electric Lamps. John H. Goehst, Chicago, Ill. Filed March 9, 1891.

471,745. Telephone. James H. Howard, Medford, Mass. Filed Sept. 21, 1891.

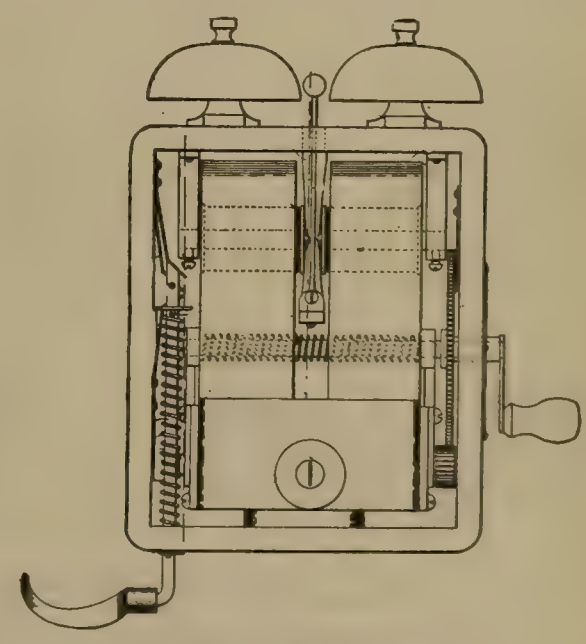
A telephone having the bell-ringing or ringer-actuating coils or magnets arranged inside of the curve of the horse-shoe-magnets.

471,759. Pole for Supporting Electric Wires. John H. Huntress, Janesville, Wis. Filed Oct. 24, 1891.

In a post, the combination, with a series of corner-pieces, of sides secured thereto composed of wire.

471,760. Electric Switch. Charles G. Perkins, Hartford, Conn. Filed July 24, 1888.

In an electric switch, the combination, with two circuit terminals, of a curved contact-plate constructed of spring



471,745.—TELEPHONE.

metal, and moving block or plug, to which the contact-plate is swiveled midway between its two ends, so as to bear with a yielding or spring pressure upon one or both of the terminals.

471,790. Electric Telpherage Apparatus. Midbury W. Hassan, Rochester, N. Y. Filed Dec. 29, 1890.

The combination of the conductor-wire, provided with spiral grooves or threads, the ground-wire, the car, provided with armature and field-magnets, the armature engaging with the spirals, and the trolley attached to the car and engaging with the ground-wire.

471,792. Commutator-Brush. Robert Hirsch, Milwaukee, Wis., assignor of one-half to Herman Meminger, same place. Filed Oct. 29, 1891.

The herein described commutator-brush, comprising a suitably-shaped body, composed of a plurality of strips or bars, each independently coated with a film or covering of electrically-deposited metal, and the series of strips or bars united together by means of a second film or covering of metal.

471,812. Power-Transmission. John F. Devold and Gustav Monrath, Chicago, Ill.; Theodor Devold and Olaf E. Ray, administrators of said John F. Devold, deceased. Filed Feb. 2, 1891.

In a power-transmitter, the combination, with a motor, of double driving-pulleys, one of which is fixed and the other of which is loose upon the shaft, and springs for connecting pulleys.

471,819. Brush-holder for Electric Motors or Dynamo-electric Machines. Charles A. Hussey, New York, N. Y. Filed May 6, 1889.

PATENTS—Continued.

The combination, with an electric motor or dynamo-electric machine, of the brush-holder supported and rotating in the bar, an arm on said brush-holder, a spring, connected to the arm, a windlass, inserted in the bar, a connection between the spring and windlass, and a carbon-strip inserted in the brush holder.

471,837. Support for Electric-Lights. James J. Walsh, Paris, Tex. Filed Sept. 15, 1891.

The combination, with an arc-lamp or other device to be suspended, of a cord attached to the same for raising and lowering, a support for lamp, such as a cable or mast-arm, and a V-shaped lever pivoted eccentrically to the lamp or device, one arm of the lever having a hook adapted to engage with cable or mast-arm and the other arm of the lever being arranged to strike the cable or mast-arm and throw the hook into engagement therewith.

471,850. Electro-therapeutic Electrode. Harry Bonis, Blanchard, Ontario, Can. Filed Aug. 10, 1891.

In an electro-therapeutic electrode, the combination, in one and the same electrode, of an electrolytic fluid and the means for introducing high artificial resistance into the circuit.

471,913. Electric Lock. James G. Thompson, Boston, Mass. Filed Aug. 12, 1891.

A combination electric lock comprising an electro-magnetic controlling device, a suitable source of electricity, a circuit including controlling device and source whose respective wires are divided, a set of conductors interposed between the two parts of each wire of the circuit, and means for connecting the two ends of each circuit-wire with opposite ends of any wire in the interposed sets.

471,929. Automatic Electric Fire-Alarm. Leonidas G. Woolley, Grand Rapids Mich. Filed Dec. 14, 1891.

An automatic electric fire-alarm comprising a permanent magnet, an armature therefor, an induction-coil, a stored power for suddenly separating the armature and magnet, and a thermostatic releasing device.

471,945. Galvanic Battery. William Burnley, North East, Pa. Filed June 13, 1891.

In a galvanic battery, the combination, with an electro-positive element consisting of an outer containing-jar, of an electro-negative element, a porous cup of less depth than the containing-jar, a depolarizing compound consisting of manganese and carbon packed in porous cup around that part of the electro-negative element inclosed by cup, a semi-solid exciting material packed around the porous cup, and a seal formed of suitable wax closing the mouth of the outer jar.

471,947. Electrically-Controlled Trap-Door. Frank C. Callahan, Bridgeport, Conn., assignor of one-half to Jacob B. Klein, same place. Filed Dec. 14, 1891.

The combination of the doors, a spring device for automatically opening them, armatures carried by doors, and electro-magnets which attract armatures and thereby maintain the closed position of the doors against the resiliency of the spring element.

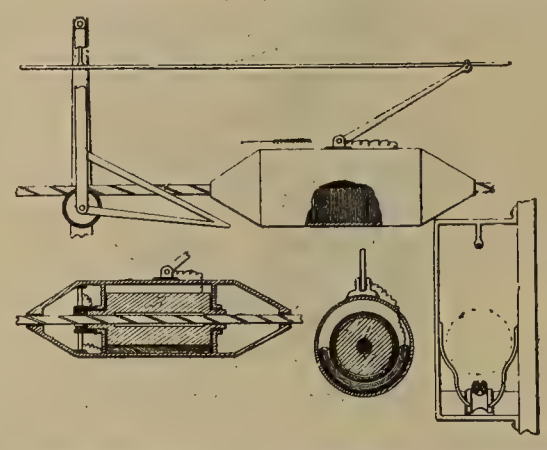
471,968. Electric-Light Crane. James Gallagher, Oakland, Cal., assignor of one-half to John A. Britton, same place. Filed July 13, 1891.

471,986. Electrical Annunciator. Nelson M. Watson, Detroit, Mich., assignor of three-fourths to Alfred H. Heath, William B. Heath and Sarah A. Millard, same place. Filed Jan. 2, 1891.

471,987. Electrical Annunciator. Nelson M. Watson, Detroit, Mich., assignor of three-fourths to Alfred H. Heath, William B. Heath and Sarah A. Millard, same place. Filed Aug. 17, 1891.

471,990. Endoscopic Instrument. John W. Daily, Denver, Col. Filed Oct. 14, 1891.

An endoscopic instrument having a recess formed therein, an incandescent electric lamp located therein, and a removable fenestrated plate secured to the instrument in such a manner as to permit the light to illuminate the cavity during use.



471,790.—ELECTRIC TELPHERAGE APPARATUS.

471,993. Reciprocating Snap-Switch. Jacob S. Gibbs, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing Company, of Connecticut. Filed July 3, 1891.

In an electric-switch, the combination, with the base, the line-terminals, and the bracket secured to the base, of a reciprocating rod, having a cross-bar at its lower end provided with downwardly-projecting levers having an unobstructed space between them, a tension-spring located in space and bearing at its ends against the levers, and the angular plug carrying contact-points at its outer ends and provided at its interior with angular opposing faces, the angle which slopes from the top of the same being less acute than that which slopes from the bottom, the said angular faces forming a bearing and guide for the lower ends of the levers.

471,997. Automatic Electric Cut-Out. Edward A. Manship, Minneapolis, Minn. Filed June 30, 1891.

In an automatic cut-out, the combination with a solenoid, of a core therefor, an electric-switch, means for holding the same in a closed position, levers arranged to trip switch to release the same, and means whereby core acting in one direction engages one of levers to trip switch and acting in the other direction engaging the other lever to trip the switch, whereby switch is opened by a maximum current in solenoid or a loss of current therein.

471,999. Valve-Controller. Nathan E. Nash and George A. Eddy, Cleveland, Ohio, assignors to the National Electric Valve Company, same place. Filed Nov. 20, 1890.

The combination, with a valve, valve-stem, and pistons, on the opposite side of the valve, of a spring-pressed balance valve controlling the supply of fluid to both pistons, an armature connected with the latter, and an electro-magnet or equivalent device for actuating the armature, whereby the balance-valve is moved.

472,019. Method of and Apparatus for Producing Musical Tones by Electro-Magnetism. Eli C. Ohmart, Detroit, Mich., assignor to Melvin L. Severy, Boston, Mass. Filed April 28, 1890.

The method of producing musical tones, which method consists in producing musical vibrations in strings, wires, reeds, diaphragms, or any other sonorous body by the action upon these bodies of attracting or repelling forces produced in electro-magnetic or inductive devices by intermittent impulses of electricity, either pulsatory or undulatory, corresponding in frequency to the number of vibrations, being a multiple or sub-multiple thereof, in the musical tone produced by the vibrating sonorous body and automatically determined by the movements of the sonorous vibrating body and when the circuit conveying these intermittent, pulsatory, or undulatory electric impulses does not include the vibrating body.

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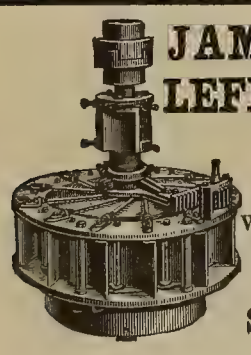
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VOL. X. NEW YORK, APRIL 16, 1892. No. 16.

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NEW YORK, APRIL 16, 1892.

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IMPROVED APPEARANCE.

The absence of electric poles on Broadway is quite noticeable, and it is hardly necessary to say that the improved appearance of that thoroughfare is decidedly great. Some of the buildings that are going up, however, might, in the dark, be taken for poles.

THE ELECTRIC CLUB.

At a largely attended meeting of the Electric Club in this city on Monday night, April 11, it was decided to give up the present house on 22d street and procure new quarters down-town, in the business section of the city. The Board of Managers will report at a meeting to be held on April 18. The club's financial difficulties were straightened out, and its successful continuance is assured.

A ROYAL INVENTOR.

The American notion of the Sultan of Turkey is that he lives a life of perpetual indolence, and that such a thing as a practical idea ever entering his royal brain is quite impossible; but, judging by a recent report, our royal Oriental friend must possess some ability that few of his American friends credit him with. It is stated that he is the inventor of a telegraph instrument, and that he is desirous of exhibiting it at the World's Fair next year. It will indeed be a novelty to see a telegraph instrument invented by a Turk.

ELECTRICAL ACTIVITY IN MONTREAL.

Those who attended the convention of the National Electric Light Association in Montreal last September, and who noted, with considerable surprise, the lack of street-car facilities in that city, will be glad to hear that better times are in store for its citizens. There is a lively competition there now for right-of-way through many of the streets for the purpose of running electric cars on the overhead trolley system.

Who dares to say that this awakening on the part of our Canadian friends is not the result of the convention? Matters electrically have taken a decided turn for the better since the convention was held. This fact has been generally noted.

THE WORLD'S FAIR ELECTRICAL EXHIBITION.

A vast amount of thought and work will be necessary to make the electrical exhibition at the World's Fair as successful as its projectors have planned it to be. Those of the exposition authorities who have this department in charge must be aided in their laudable efforts by those in accord with its purposes, and intending exhibitors—in other words, they must have outside co-operation. They cannot be expected to do all the work alone and make a success of the exhibition; yet, no doubt, there are many who look at the matter in that light.

A thorough awakening on this subject should be inaugurated at once, and as soon as all those who are interested have the matter properly brought to their attention, and they begin to talk and think about it, a good deal will have been gained in the direction of co-operation.

It is gratifying to learn that the Electrical Congress Committee of the World's Fair is already actively at work, and has issued a preliminary address (which we publish on another page) calculated to arouse enthusiasm among those interested. If all do their part, this and all other departments of the electrical exhibition will, without question, far surpass anything the world has ever seen. All who intend to make exhibits, read papers, take part in the discussions in the congress, or in any way contribute towards making the electrical portion of the Fair a success, should lose no time in arranging their plans and getting into action.

ARMATURE BURNOUTS.

It is not always the case that the burning out of armature coils is due to overload. Such accidents are liable to occur from various causes which are avoidable, and it often happens that burnouts which are ascribed to overload are really due to something else.

A prominent case of this character is described on another page in an article by Mr. E. E. Stark, an electrician of this city. Last Fall there was a remarkably large number of burnouts in alternating-current dynamos in this city for a short period. It was during a cold, dry spell, and among the machines under Mr. Stark's charge the trouble occurred with a frequency that was serious, and which led to the suspicion that it was not due to overloading at all, but something entirely different. It seems that the true cause of the trouble at this particular time was discovered by an accident. One of the workmen about one of the dynamos received a Leyden jar shock while touching some parts of the machine, which at once opened the way to a determination of the cause of the trouble. It seems that the static electricity generated by the rapidly-moving belt accumulated on the iron framework of the machine, and when it attained a sufficient potential it broke down the insulation of the armature-coils, thus burning them out. The remedy for this trouble was found in grounding the base of the dynamo, but as this expedient was inadvisable on account of the possibility of developing other trouble through the use of a ground connection, experiments were made which resulted in a complete solution of the problem without the necessity of maintaining a direct-ground connection.

A small Geissler tube, constructed to discharge at a potential lower than that capable of piercing the insulation of the armature-coils, was connected between the base of the dynamo and the ground, and the battle was won. These Geissler tubes are now doing good service in this direction, and no doubt their general adoption would save a great many armatures.

ART IN ELECTRIC LIGHTING.

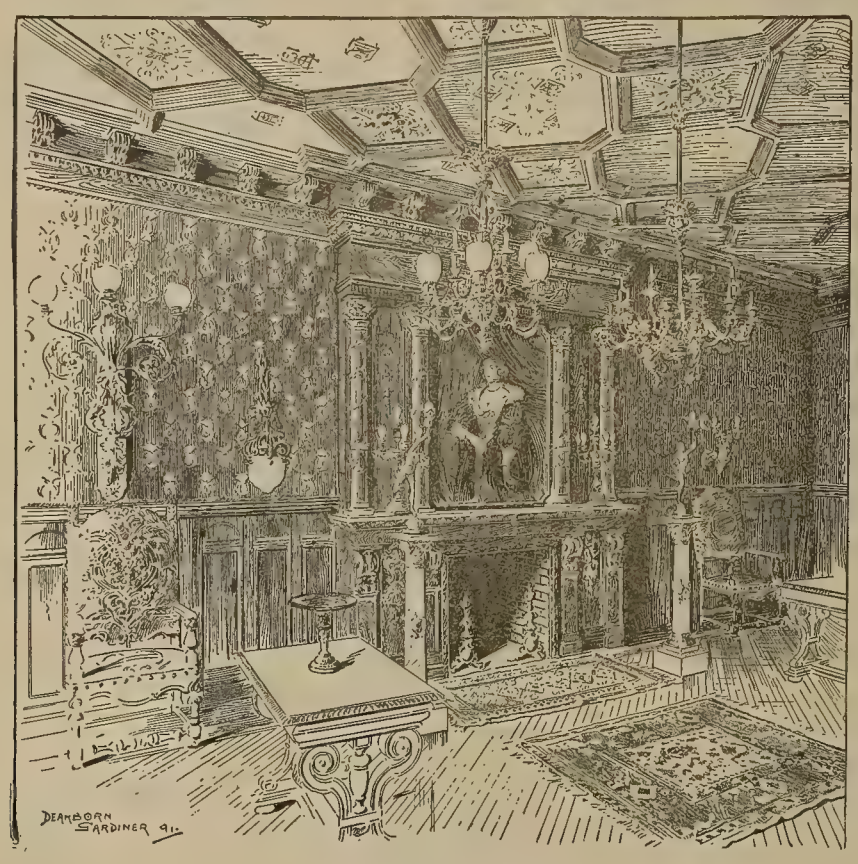
The flexibility of the electric system of lighting is one of its greateat features, and it is surprising to see how artistically incandescent lamps can be combined with the decorative art to produce most beautiful effects, unattainable by any other known means of illumination. The light can be placed in most inaccessible places, and be controlled in a manner that will produce varying results and effects. For decorations it is incomparable by any other light, and in this field it clearly stands alone, master of the situation.

Having learned of these valuable features of electric lighting, our wealthier classes, who are constantly looking for something novel and beautiful, have not been slow to use the incandescent light for the attainment of the highest possible artistic effect in the adornment of their homes, and the result has been that accessories of the most elaborate kind, and rich in construction, have been wrought in order to meet this growing demand. There seems to be no end to the variety of ways in which the incandescent light can be applied for decorative purposes, and a visit to the sample-rooms of the modern electric manufacturing concerns is a delight and a study.

We give some illustrations of electric illuminating effects on another page, which tell their own story. Words cannot convey to the mind any idea of the beauty and skill of these displays; they must be seen to be appreciated. Even on paper they have an artistic and pleasing effect; so what must they be in reality?

ÆSTHETIC ELECTRIC LIGHTING.

The uses of the great new illuminant, electricity, in the lighting of house interiors, have during the past few years progressed rapidly from the experimental stage, until to-day they may be said to have almost reached perfection. Most of the stately mansions in towns of this country where electricity is available have had the beauty of their interior decorations strikingly enhanced by the substitution of the electric lamp for the less desirable gas-jet. The light that will only burn upwards is fast being superseded by that which will burn in any position which can possibly be given to it. The æsthetic possibilities of electric lighting having once been admitted, the realization of them has been speedily brought about. All the varied styles of interior decoration, each marking its own distinctive era, have been in their turn adapted and utilized. The Renaissance with all its glow of delicate and intricate tracery; the more staid styles of Louis XIV.; the less sober characteristics of the Louis XV. period, inflating and degenerating into the wild curves of the rococo; the revulsion of the Louis XVI. period, finding its highest expression in the classic lines of the empire; each one has contributed. Instead of abortions in the shape of chandeliers, appliques, standing lamps, brackets, swinging and entrance lamps which characterized American house decoration twenty years ago, we now find perfect forms of true artistic conception.



RENAISSANCE ROOM.



COLONIAL ROOM.

The Edison General Electric Company, recognizing the advent of a new artistic era, has made the production of the highest art work in this branch an object of deliberate policy. It would be impossible to give in so short a space as this any adequate conception of the numerous beautiful designs manufactured by this company. The entire building at No. 275 Fifth avenue has been fitted up with a view of illustrating the finer decorative and illuminating effects that can be produced by the electric fixture in its varied forms, and we give some interior views of this building. Each room is fitted up in the style representing its period. There is an Oriental room, decorated with rich arabesques, and replete with Saracenique ornamentation; the Colonial room, with the distinctive characteristics of the early colonists' taste; the Renaissance room, with the rich portrait of Henriette d'Entragues and profuse ornamental decorations; the Den and its intimate surroundings; the library, in which the light is softened, and the decorations fitted to the requirements of repose and study; the Louis XVI. salon in which, against the pearl gray ground, the golden and white ornaments stand out in bold relief, and the delicately sculptured furniture completes a truly artistic picture; and lastly, the coquettish Louis XV. boudoir, in which the rococo style runs merry riot. Indeed, the entire house, from the entrance, where light-footed Mercury stands a-tiptoe on the newel of the staircase to the roof, is fitted up with a view of enabling those desirous of decorating their houses to choose their lighting fixtures, with every opportunity for careful and artistic discrimination.



STAIRWAY.



LOUIS XVI. SALON.

The fixture manufactory is the New York works of the company, at No. 292 Avenue B, and occupies a huge building six stories high. Here under careful management and expert superintendence is effected the realization of the many artistic conceptions, which, in their concrete form are sent thence to all the points of the United States. The White House fixtures, as well as those of the palace of the Mikado of Japan; those of the Vanderbilt mansions as well as of the Whitney palace; those of the stately Holland House, and of the Trenton Capitol are excellent examples of what can be done by artistic minds, aided by expert hands, all informed by a guiding managerial energy.

STARTING AND CONTROLLING RHEOSTAT.*

We give below a description of a new starting and controlling rheostat for motors running on high-voltage currents, which has been recently designed.

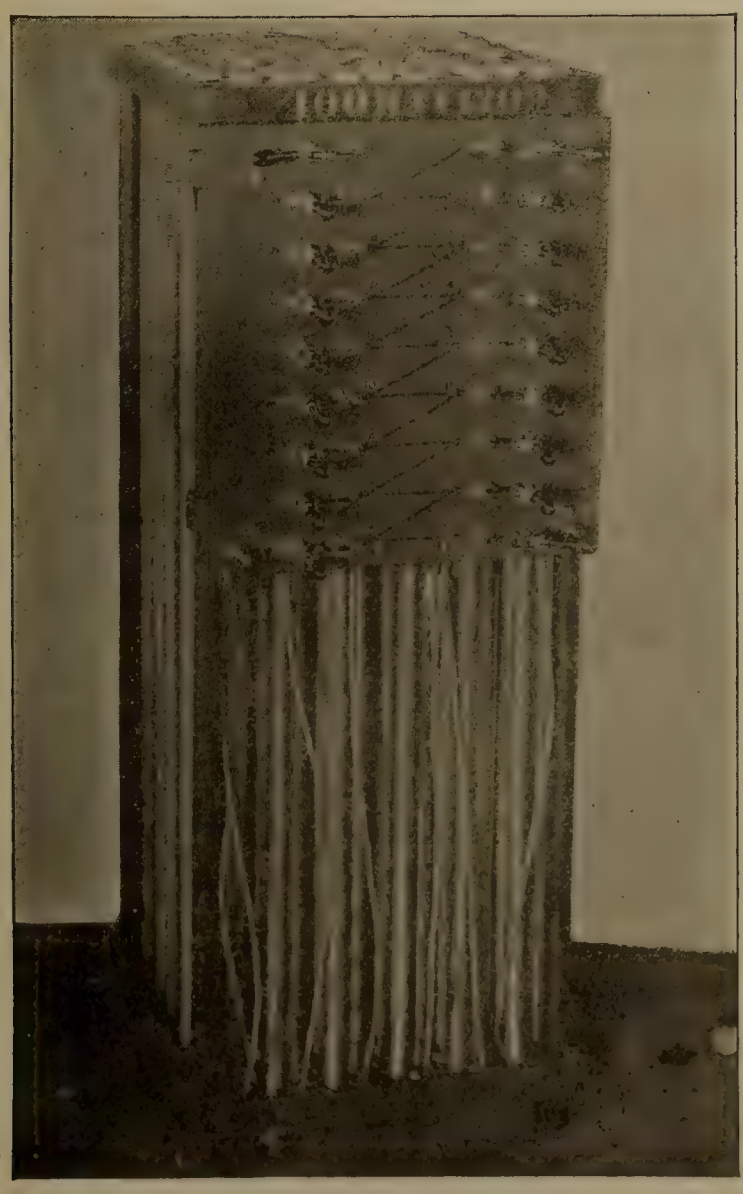
This rheostat is a modification of the standard Edison starting-box for motors of large current capacity, which is furnished with an ordinary switch base, fitted with a number of contact-blocks and plates arranged in a semicircle around the pivot upon which turns the switch-arm.

The formation of arcs between the contact-blocks, resulting in their deterioration and destruction when the rheostats were used on high-voltage circuits, constituted a difficulty which it became necessary to eliminate. The arcing could be avoided by employing a larger number of blocks on the board, but this would necessarily increase the cost of manufacture as well as the size of the board.

The modification consists in the substitution of a switchboard with several separate and distinct switches in place of the ordinary board just mentioned. By the employment of several separate switches it is possible to arrange the coils of the rheostat in multiple with themselves, so that if it is required to carry a larger current, or remain in circuit constantly for the purpose of reducing the speed of the motor, it is comparatively simple to manipulate the switches according to requirements. The resistance is built up of tinned-iron wire wound in spirals arranged in sections. Each of these sections can be thrown in or out by means of its proper switch.

The rheostat shown in the cut is designed to start and control the speed of a 100 K. W. motor, working on a 1,200-volt circuit. The range of resistance is very wide, its greatest resistance being 72 ohms, while with the switches properly arranged it can be reduced to .25 of an ohm; the current-carrying capacity for the smaller resistance being increased in the same proportion. The over-all dimensions of the box shown in the cut, designed for an electric-mining plant, are: height, 5 feet 6 inches; width across switch-board, 25 inches; depth, 26 inches

Rheostats of this design are absolutely fire-proof, are strong and substantial in construction, and have been arranged with a view to securing a high, insulation resistance.



STARTING AND CONTROLLING RHEOSTAT.

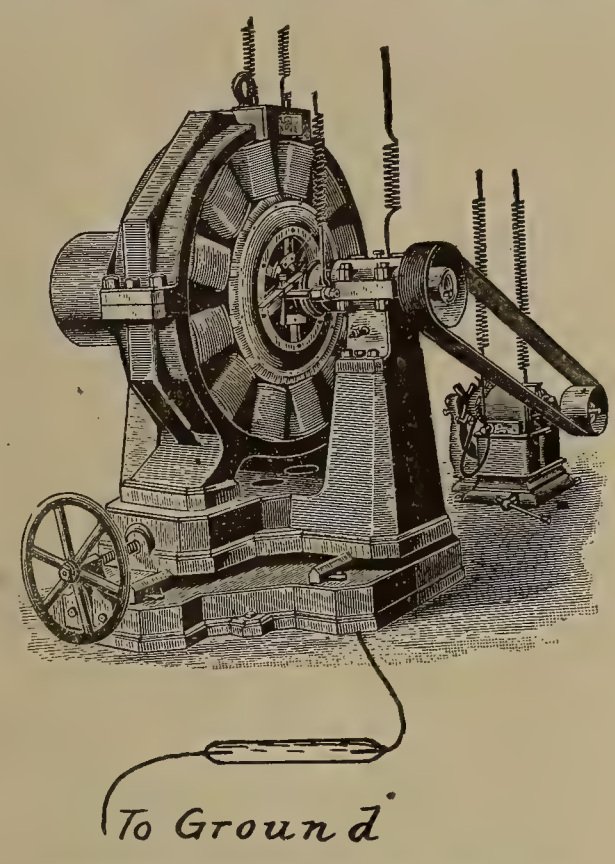
The Coatesville Electric Light, Heat and Power Company, Coatesville, Pa., incorporated March 28, with a capital stock of $25,000. Incorporators: Charles H. Speakman, M. W. Pownall, of Coatesville, Pa.; J. V. Penneger, Lancaster, Pa.

* Edison General Electric Co., New York.

REMEDIES FOR ONE OF THE CAUSES OF ARMATURE BURNOUTS.

BY EDGAR E. STARK.

All those having alternating-current dynamos under their charge probably have noticed, much to their distress, that at certain times there seems to



SLATTERY DYNAMO AND GEISSLER TUBE.

be an epidemic of armature burnouts. The burnouts follow each other in rapid succession for a while, and the close observer, who puts this thing and that thing together in his effort to arrive at the cause of the effect, has settled on the significant fact that these burnouts occur in dry, cold weather.

During a dry spell in New York about the middle of last October, a remarkable number of alternating-dynamo armatures were lost by the different electric lighting companies in the city. The company with which the writer is connected, the Manhattan Electric Light Company, New York, lost no less than five armatures in one week. These machines were Slattery dynamos with drum armatures, wound with two layers of wire. The burnouts were invariably at the core and between the two turns of the adjacent coils, at the point of greatest potential difference.

In following out the history of loads on armatures at the time of burnouts, with the hope of finding a clue which would lead to the determination of the cause of the breaking down of the insulation in these cases, the records show that not one armature was ever burned out during overload. This fact, no doubt, will be a surprise to many, but such is the record.

Another peculiar feature about these wholesale burnouts in our machines was that, during the early part of the dry spell, they were confined to a certain portion of the building, and it was noticed that the machines having long belts were more susceptible to the trouble than the others. One in particular was extremely troublesome, and it was not until the remedy, which will be described presently, was applied that the armatures placed in it would run a reasonable length of time.

Extraordinary precautions were taken in the matter of insulation, etc., in the winding of the armatures to replace the ones burned out, so as to ensure immunity from a repetition of the trouble should that be the weak point.

One of these new armatures was put in one of the machines having a long belt, and showed no weakness during its first run, but on starting it up for its second run there was evidence of impending trouble. We watched the armature carefully, and finally discovered small blue flames or sparks passing from the field-cores to the armature band wire. As yet, however, no definite results could be determined.

The machine was shut down and a very close and critical examination was made of it. All that was noticed of an irregular nature were a few rough places in the banding wire and the field-cores, caused by the sparks in the passage across the space between the cores and the armature. The mica and other insulating substances bore not the slightest evidence of being burned or even scorched.

Up to this time we were still groping about in the dark, so to speak, when an accident occurred which lifted the veil from before our eyes and comprehension. During the examination of the machine just referred to, one of our men received a very severe Leyden jar discharge through his head and hand from the brush to the machine frame. This occurrence revealed the secret of all the trouble. It was all caused by the static charge generated by the rapidly moving belt accumulating electricity until it attained a potential sufficient to puncture the insulation of the armature conductors.

Having at last found the cause of our troubles, the next step was to devise means to prevent their recurrence. Mr. E. A. Leslie, the general manager of our company, and the writer at once entered upon a series of experiments. We first rigged up grounded collections of pointed wire on the running-on side of the belt, then the working side and then on both, but a ground wire still gave a discharge from the bed of the dynamo. Tin plates with pointed collections grounded were afterwards tried. All of these expedients, however, decreased the discharge but slightly.

We next tried grounding the machine bed through a fine fuse wire, and the sparking phenomenon at once disappeared; thus the problem was solved. We tested the efficacy of our method by trying it on old armatures which would sooner or later have yielded had they been allowed to keep on discharging the static electricity through the core insulation. On these old armatures we could not draw a single spark from the machine frame with a ground wire while the dynamo was carrying a circuit.

It was therefore settled that grounding the frames of the machines would obviate all the trouble from static electricity; but dead grounding frames, in our opinion, was not good practice, since it opened up another avenue to possible trouble both inside the armature and outside of the circuit. We therefore carried our experiments further with a view to securing the effect of a ground without an actual ground connection.

We substituted the fine fuse wire by a Geissler tube three inches in length, which would discharge by test at 3,000 volts. This potential was generated by a "step-up" converter and measured by a series of incandescent lamps. This tube was found to discharge all the static electricity that accumulated on the frame and yet act as insulation for lesser voltages. The armatures as wound by this company withstand an alternating current of 4,000 volts between the wire and core; it is obvious, therefore, that a tube that will discharge at 3,000 volts is a sure protection for the armature.

After further experimentation, the tubes finally settled upon as giving the best results are four inches long by about ½ inch in diameter. The vacuum break, *i.e.*, the distance between the platinum electrodes inside the tube, is 1½ inches, which, with the proper vacuum, will discharge at a potential of 3,000 volts.

OLAN RECORDING CURRENT METER.

A simple, reliable and cheap electric-current meter which will measure the current passing through it and make a permanent record of such measurements, is an apparatus for which there has always been a need, but which, up to the present time, has not yet made its appearance.

Many devices planned with this object in view have been invented, but so far as we know none has fulfilled every requirement; they fail in one important respect or another.

It needs no argument to demonstrate the value such an instrument would be where electric currents

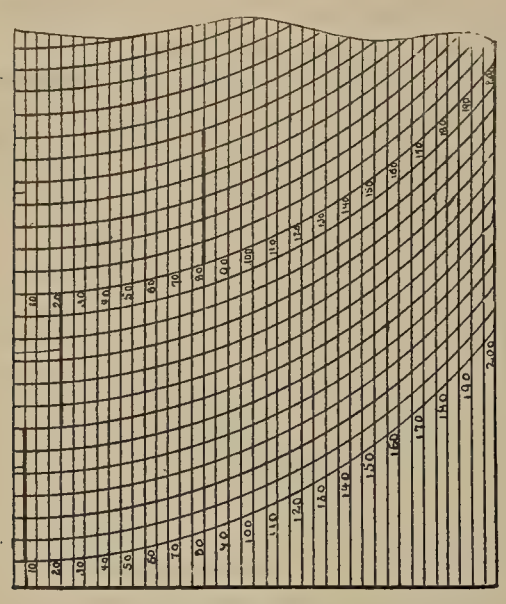


FIG. 3.

are used and measured. There are plenty of instruments, and excellent ones, that will measure the current, but do not make a record which can be referred to at any future time. Records, of course, can be made of their readings by hand, but that requires the service of an attendant who must be paid a salary. In ordinary work, therefore, it would be out of the question to keep a special corps of attendants to make records of the readings of the meters. What is needed is an instrument that will make the record itself.

Mr. J. W. T. Olan, of New York, has recently obtained letters patent on an instrument of this

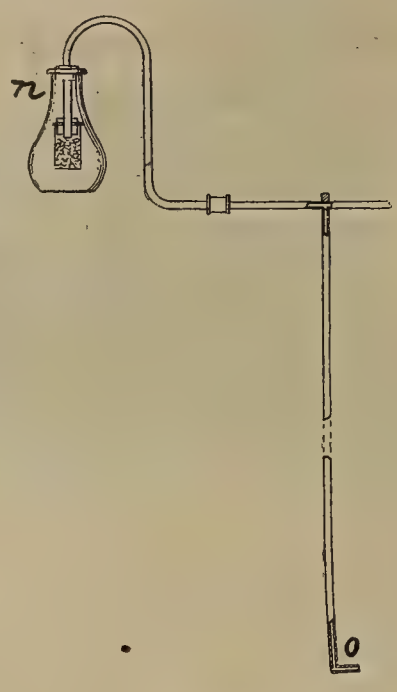


FIG. 4.

instrument is the manner of making the record, which we will now describe.

The parallelogram in Fig. 1 indicated by *d* represents the paper on which the record is made. This paper is unrolled (by clock mechanism in that portion of the illustration shown at *e*) from the large roll *f* in Fig. 2 and wound on roll *g* (Fig. 2).

By tracing the course of the paper from the roll *f* to roll *g*, it will be seen that it must present a moving surface to the action of the needle or pointer, and in this way a continuous record is made while the instrument is in action. *i* (Fig. 2) is called the time-wheel, and its speed is so regulated that it will make one revolution an hour. It is evident, therefore, that a certain length of the paper will pass by the needle-point in one hour when the instrument is in continuous operation, and in this way a record is made of the duration as well as strength of current in a manner which will be explained presently.

Roller *m* (Figs. 1 and 2) prints the curved and vertical lines on the paper as it passes between the two rollers *m* and *i*. These lines, as has already been explained, represent the time and current strength respectively. A small ink-roller, shown in Fig. 2, keeps the large roller *m* supplied with fresh ink.

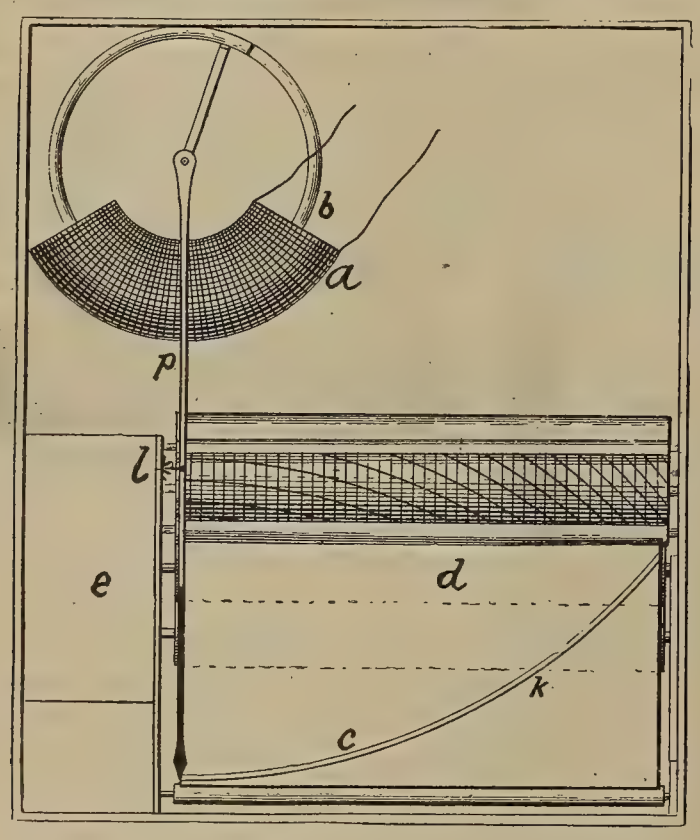


FIG. 1.

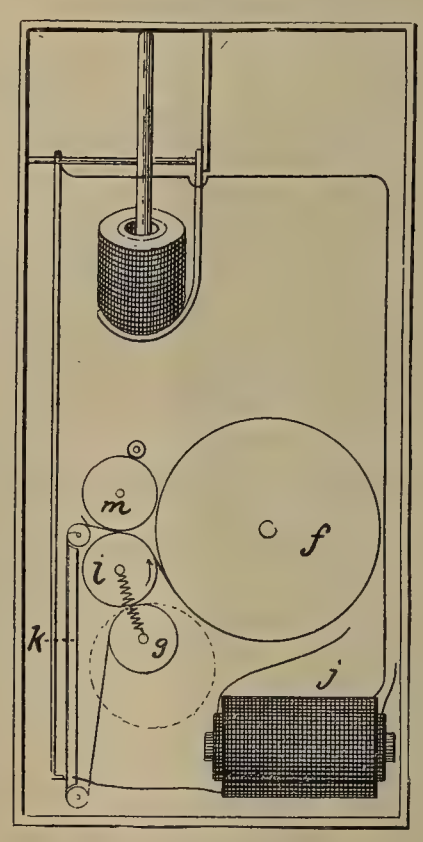


FIG. 2.

character which seems to meet every one of the points referred to at the beginning of this article.

The operation of this device will be understood by reference to the illustrations which accompany this description.

Fig. 1 shows a front view of the meter, and Fig. 2 a sectional view of the same.

a is a solenoid of the well-known form, and *b* is the iron core which is drawn into the coil by the electro-magnetism generated by the current. To this core is attached the pointer *p*, which in its movement over the face of the recording sheet describes an arc of a circle, as shown at *c*.

These parts of the apparatus do not differ essentially from corresponding parts of other measuring instruments. The important feature of the *j* (Fig. 2) is an induction coil, one of the secondary poles of which is connected with the strip or plate of metal *k* which lies under the path of the needle-point in its oscillations—but underneath the paper and the other secondary pole is connected with the pointer as shown in the figure. The primary wire of the coil is connected in the usual manner with a source of current.

Having described the essential parts of the apparatus, we will now consider the operation of the instrument.

Suppose now a current flows through the solenoid, the needle is deflected and at the same time a catch *l* (Fig. 1) which controls the clock-work, is released and the clock mechanism operates. The pointer takes a certain position which represents a definite strength of current, and while the paper is moving past the point small sparks generated by the induction coil pass from the needle-point through the paper to the metal strip *k*, and in this way a record is made on the paper. The length of the record on any one of the vertical lines shows how long a period the current remained at that strength. For example, we may assume that the space between the curved transverse lines (Fig. 3) indicates five minutes of time, and by reference to the record we will see that the current was at first 5 ampères for thirty minutes; or, in other words, the record shows two and a half ampère-hours; then the current jumped to 20 ampères for another half hour (10 ampère hours), and so on.

One very important feature of the instrument needs to be explained here. The needle is so constructed that there is a little air-space between its point and the paper through which the perforations are made for the record. This feature Mr. Olan claims as the most important one of his meter, as it makes a record without friction. The delicacy of the needle adjustment is therefore unimpaired.

Mr. Olan has provided another method of making the record in place of the induction-coil apparatus. This is shown in Fig. 4. It consists of a bottle or receptacle *n*, in which sulphuric hydrogen gas, or any other gas to the same effect, and with low pressure, may be developed by using the proper chemicals, which gas passes through the hole of the hollow needle to the point *o*.

The escaping gas forms an atmosphere at the needle-point, and this coming in contact with the paper, which is previously treated with lead salts, preferably acetate of lead, a discoloration of the paper is effected, and the record is thus made.

In both methods of making the record it will be noticed that the needle-point does not touch the paper at all.

From this description of the meter it will strike the reader as being an ingenious device, and if it performs all the functions that are claimed for it, we think it will meet with a long-felt want; it seems to be a very practical and meritorious instrument.

COMBINED SWITCH AND CUT-OUT.

The Interior Conduit and Insulation Co. of New York, has recently placed upon the market an arti-

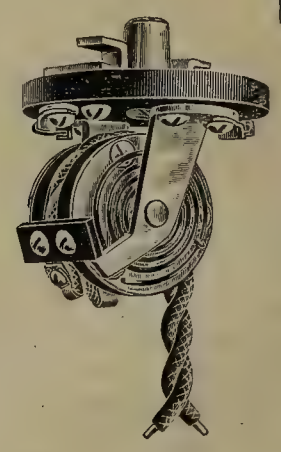


FIG. 1.

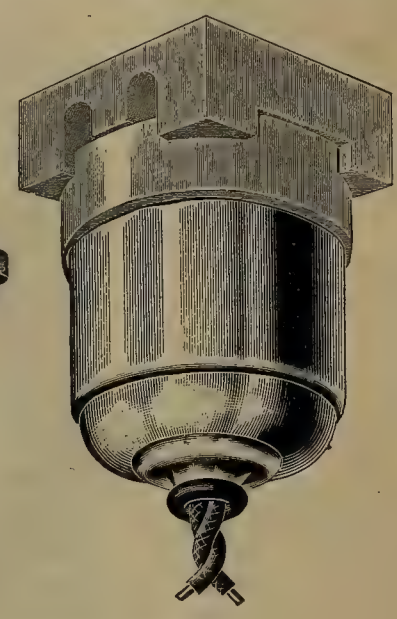


FIG. 3.

cle which is meeting with instant recognition and commendation from the trade. We refer to its new

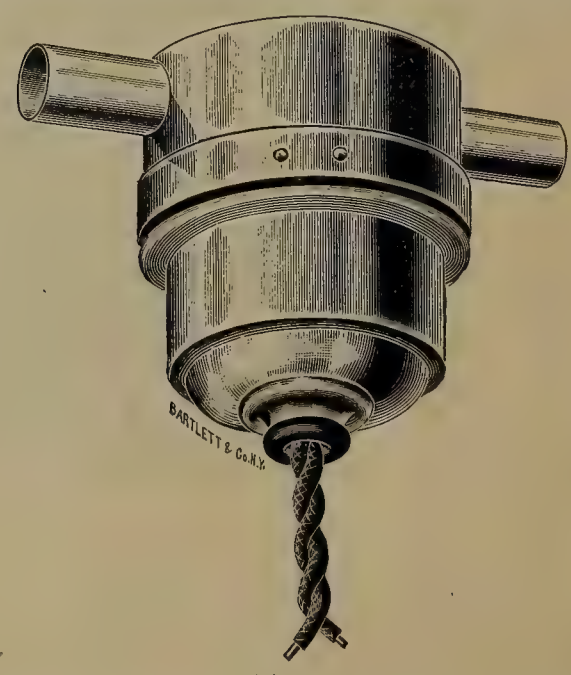


FIG. 2.

Combined Pull-switch and Ceiling Pendant Cut-outs, and its new Pendant Pull-switches, invented

by Mr. E. T. Greenfield, the electrician of the company. These goods, made in a variety of forms, are illustrated and briefly described below.

Fig. 1 illustrates the interior mechanism which is employed in the different styles of switches and is concealed within the shells of the same. This new form of switch overcomes in every way the difficulties experienced in turning on and off any style of key socket suspended from flexible pendants. Grasping either the cord or the lamp with the hand, the light may be turned on or off by a slight pull only. This form of switch will be found very advantageous for use in place of a key-socket or other switch in circuit, as in clothes closets and in like places where the lamp is within reach of the hand.

Fig. 2 illustrates the switch made to fit the Standard Conduit Branch Junction Boxes and Cut-outs



FIG. 4. FIG. 5.

manufactured also by the Interior Conduit and Insulating Co., and Fig. 3 represents the switch as adapted to the base of their "V.V." Ceiling Cut-out. The same mechanical principle employed in the Combined Pull-switch and Ceiling Pendant Cut-out is used to great advantage in the Pendant Pull-switches, cuts of which appear herewith.

Fig. 4 is a pendant Pull-switch designed for attachment to flexible cords for controlling incandescent lamps with the same freedom and safety as is experienced in handling an ordinary push button on an annunciator circuit. The switch may be used as a pendant from the centre of electroliers, thus dispensing with key-sockets, and affording ready means for easily controlling the current.

In general, it serves to bring within control lamps that are otherwise out of reach, permitting them to be turned on and off from any point that may be reached by a flexible cord.

Fig. 5 illustrates another application of the same mechanical principle embodied in the foregoing designs, and may be used with advantage in flexible cord pendants where it is not convenient to substitute the Combined Ceiling Pull-switch and Cut-out for the ceiling-block already in use. This switch may be inserted in any flexible cord pendant by simply cutting the cord and attaching the terminals to the binding screws provided for that purpose. As in the other forms of the same switch, the light may be turned on or off by a slight pull of the cord only. These switches are easily and quickly wired and are thoroughly reliable in every respect.

A CANADIAN ENTERPRISE.

The Royal Electric Company, of Montreal, Canada, has decided to carry out a most extensive and important undertaking. A charter has been obobtained for utilizing the Chambly Rapids, and operations will be commenced as soon as the water is low enough. The rapids are susceptible of developing at lowest water over 20,000 horse-power, and it is the intention of the company to distribute in Montreal not only arc and incandescent lights, but also to supply power for manufacturing purposes, operation of elevators, mills, etc. Work is to be vigorously pushed, and it is expected that at least one-third of the power will be developed by the end of the coming summer, but it will probably take two years to develop the full power. It is said that one of the effects of this scheme will be the reduction of the price of electric lights at least 25 per cent. below that of gas. In addition to supplying the city with lights, the company will also manufacture railway motors and all other electrical appliances, and will have charge of equipping the new electric railway service which is to be inaugurated, supplying it with power, etc. The Hon. R. Thibeaudeau is president of the company.

ELECTRICAL SOCIETIES.

BROOKLYN INSTITUTE.

On April 15 Prof. Robert Spice will deliver a lecture on "Long-Distance Transmission of Electric Power" before the Department of Electricity of the Brooklyn Institute. Prof. Spice will illustrate his lecture, which will be held in the large lecture-room, 502 Fulton street, Brooklyn.

OBITUARY.

A. B. ULINE.

The many friends of Mr. A. B. Uline, general manager of the Hudson River Telephone Company, Albany, N. Y., will regret to hear of his sudden death from heart disease at Nassau, New Providence, on April 4. Mr. Uline was born at Sand Lake, N. Y., on July 17, 1836, and was a resident of Albany since 1863, in which year he assumed control of the Merchants' Dispatch and Transportation Company. He was appointed Fire Commissioner of Albany in 1883, which office he retained up to the time of his decease. Mr. Uline became associated with the telephone industry at its inception. He left New York a short while ago in company with Mr. Sargent, of the New York and New Jersey Telephone Company, and Mr. Hall, Manager of the Bell Telephone Company, of Buffalo, N. Y., on a visit to Nassau, in search of recreation, and expected to be away about two months, when he was suddenly stricken down. He leaves a wife and three children, one, a daughter, being married.

WORLD'S FAIR NOTES.

The officials of the World's Fair enterprise announce that the Exposition Company will pay $20 per lamp for the 5,000 to 6,000 arc lamps required for electric lighting. The 100,000 incandescent lights which will be needed have not yet been contracted for.

Regarding the arc lamps, it will be remembered that there was a dispute regarding the price per lamp between the Fair officials and the Thomson-Houston Company. The differences have been settled.

Contracts for a boiler capacity of 10,000 horse-power have been let by the World's Fair Company at $79,300. Oil will be burned for fuel instead of coal, and 225,000 barrels of it will be required. The oil will cost the Exposition Company 72½ cents a barrel.

DESANT CASH REGISTER.

A reliable and simple cash register has long been a *desideratum* in the mercantile world, and the demand for such an apparatus has naturally led to the invention of various devices of this character. They all, however, have one or more objections—they are either expensive, complicated in construction, or are not free from the possibility of being tampered with so as to return false records.

Mr. W. F. Z. Desant, a well-known electrician, who resides at 316 East 119th street, New York City, has invented and recently perfected a cash register which is now about to be put upon the market. This register seems to meet all of the objections raised against every other, and has advantages of its own which render it of great value to store-keepers and business houses. It will keep any number of accounts, either at the point of sale or at a distance. For instance, the sales made in the store can be recorded at the proprietor's house, whether it be above the store or situated several blocks away from it. The proprietor in this way can keep a record before him of all cash transactions at his place of business.

The mechanism of this register is extremely simple; it consists of an ordinary clock-spring and three gear-wheels. The action of the machine winds the spring sufficiently to move the mechanism connected with the make-and-break contact-wheels of the electrical part of the apparatus. The counting is done by a pair of magnets and an armature connected with five wheels that engage with each other, and any amount can be registered, from one penny up to $999.99.

The cash-drawer is opened automatically by the action of the lever in the act of registering the sale. The drawer can be opened and change made without registering, but every time it is opened a record is made of the fact; that is to say, if the drawer is opened simply to make change there is no record made of a sale, but a record is made of the fact that the drawer has been opened for the purpose of making change.

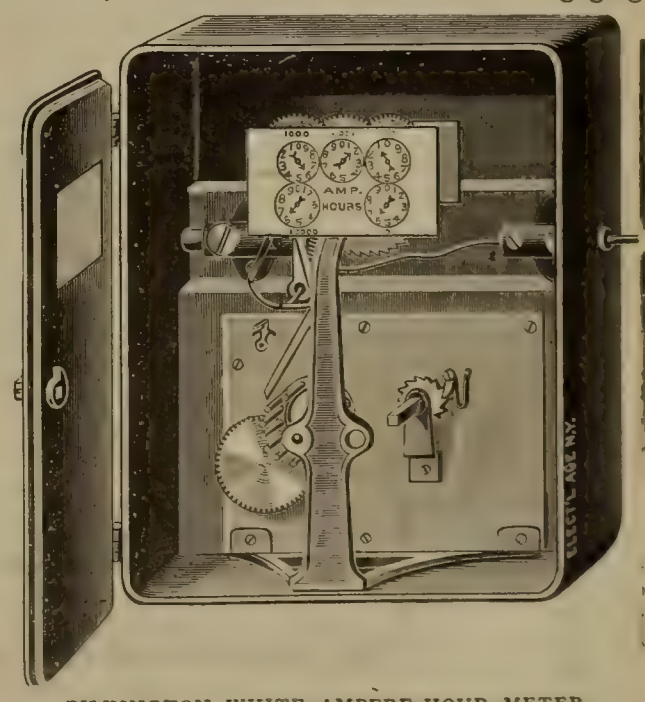
There is no possible way of "beating" the machine. If any attempt is made to tamper with it the bell rings, and it rings whenever anything gets out of order, and continues to do so until attention has been given to the machine. No money can be taken from the drawer without detection.

The main points of this register are cheapness, reliability and simplicity of construction. There are very few parts, which necessarily implies simplicity and less liability to get out of order. This also implies that the device can be made very cheaply, and it is expected by the inventor that the apparatus will find a very large and rapid sale in all classes of business houses. The battery will last 16 months without recharging, and the only expense in that time will be about 30 cents for a new charge. On account of the simplicity of the machine there is absolutely no repairing necessary.

The device is so simple in construction and so reliable in its results that there seems to be no reason why it should not meet with an excellent demand.

DIRECT-READING AMPÈRE-HOUR METER.

The "Pilkington-White" direct-reading ampère-hour meter, recently put on the market by the Electric Construction and Supply Co., of 18 Cortlandt st., New York, is of special interest to private consumers and central stations. It is of very simple construction, consisting of a solenoid ammeter, to the core of which is fastened a lever, pivoted in the center. When one or more lamps are turned on a spring-actuated wire drum, with wires of unequal length, is brought in contact with the lower end of the lever, the other end at the same time engaging



PILKINGTON WHITE AMPÈRE-HOUR METER.

a toothed wheel connected to a counter-gearing similar to the index of a gas-meter. The pins of the drum are so arranged that the smallest fraction of an ampère-hour is recorded on the index. The meter is compact, and combined with its commercial utility, is accurate, economical and reliable, and as it registers in direct ampère-hours it enables a customer at any time to know the exact amount of current used. It is made in different sizes, ranging from five to forty ampères.

ASSIGNMENT OF PATENTS.

In the case of an assignment of the whole interest in an invention, or of the whole interest in the patent to be granted, the patent will, upon request of the applicant, issue to the assignee; and if the assignee hold an undivided part interest, the patent will, upon like request, issue jointly to the inventor and assignee; but the assignment in either case must first have been entered of record, and at a day not later than the date of the payment of the final fee; and if it be dated subsequently to the execution of the application, it must give the date of execution of the application, or the date of filing, or the serial number, so that there can be no mistake as to the particular invention intended. The application and oath must be made by the actual inventor, if alive,

even if the patent is to be issued to an assignee. If the inventor be dead, it may be made by the executor or administrator.

If it appear that the inventor, at the time of making his application, believed himself to be the first inventor or discoverer, a patent will not be refused on account of the invention or discovery, or any part thereof, having been known or used in any foreign country before his invention or discovery thereof, if it had not been before patented or described in any printed publication.

Joint inventors are entitled to a joint patent; neither can claim one separately. Independent inventors of distinct and independent improvements in the same machine cannot obtain a joint patent for their separate inventions; nor does the fact that one furnishes the capital and another makes the invention, entitle them to make application as joint inventors; but in such case they may become joint patentees upon the condition above named.

THE ELECTRICAL CONGRESS.

The Electrical Congress Committee of the World's Columbian Exposition, consisting of Professor Elisha Gray, Col. R. C. Clowry and Professor H. S. Carhart, Professor Gray, chairman, has issued its preliminary address as follows:

"It is eminently fitting that at suitable times and on suitable occasions men in all departments of science and industry should come together for interchange of thought, and for the discussion of subjects that have to do with the great activities of life—practical and intellectual.

"What more fitting time to hold a series of congresses than during the great World's Columbian Exposition at Chicago in 1893? In pursuance of this object the World's Congress Auxiliary of the World's Columbian Exposition has been organized under the support of the exposition corporation, and has been recognized and approved by the government of the United States. Under this organization committees have been appointed to organize a series of congresses. Among others, a general committee, consisting of a local committee and an advisory council, selected from men eminent in the science, both in this and in foreign countries, has been appointed by the World's Congress authorities to organize a World's Electrical Congress, to be held at Chicago some time during the summer of 1893.

"The movement is as yet in a formative stage, and much thought must be given to it before a detailed programme can be formulated. It is the intention of the general committee to so organize the congress that the greatest good to the science and to all interested in electrical progress may be attained. It is desirable that the work of the congress should be divided into sections, the number of which will be determined after consultation with the advisory council. The first and most important section should give its time and thought to the more purely scientific phases of the subject, such as the revision of the existing electrical units, and the addition of such others as the state of the science may require. Other sections should be devoted to the more practical questions of applied electricity.

"In addition to the meetings of the various sections, there will be general meetings, where all will come together to listen to papers from men eminent in the science from all parts of the world. An audience-room will be furnished, where such general meetings of the congress will be held, in connection with which will be smaller rooms, suitable for the meetings of the various sections.

"In order that their conclusions may have the authority both of scientific ability and of official sanction, the members of the first or scientific section should be appointed by the respective governments from which they come. The delegates having this very important work in charge should represent the best talent from all parts of the world or from such countries as, by reason of achievements in the domain of electricity, are entitled to a voice.

"We invite the hearty co-operation of all persons interested in electrical progress, not only by any suggestions they may have to make, but also by their presence at the congress in 1893. Already there is a lively interest felt in the matter, in this and other countries; for the idea of holding an electrical congress at the time of the World's Fair is not a new one either to European electricians or to the profession in this country. Several associations of electricians have suggested it; for three years past the American Institute of Electrical Engineers has had an active committee on this subject; and at the electrical congresses of Paris (1889) and Frankfort (1891) its delegates extended a formal invitation to their European associates to come to America in 1893. Since those invitations were extended, the present authorities have been appointed by the World's Congress Auxiliary of the World's Columbian Exposition. When these authorities presented the matter officially to the Institute, they immediately saw the fitness of having the congress held under the auspices of the World's Fair; and by a formal and unanimous vote of its council and special congress committee it has pledged itself to give all possible support to the agencies now intrusted with the responsibility of making a success of the proposed electrical congress at Chicago in 1893. It is the hope and expectation of the Committee on the Electrical Congress that other electrical associations at home and abroad will give us the same hearty co-operation.

"The time of meeting will be most auspicious, as the representatives of the world's best thought and best work will be centred here, and the congress will meet under the shadow of the greatest palace of electricity the world will ever have seen. Other announcements will follow this one, from time to time, as the work of organization goes on. All communications in the way of suggestion or otherwise should be addressed to the chairman."

The following names of those composing the advisory council of the Electrical Congress, as it is at present constituted, are appended to the address:

Sir William Thomson, F.R.S. (Lord Kelvin), The University, Glasgow, Scotland.
William H. Preece, F.R.S., electrician-in-chief, General Post-Office, London, England.
Prof. W. E. Ayrton, F.R.S., City and Guilds of London Institute, Central Institution, Exhibition Road, London, S. W., England.
Lord Rayleigh, Terling Place, Witham, Essex, England.
Prof. S. P. Thompson, D.Sc., City and Guilds of London, Technical College, Finsbury, London, England.
Prof. E. Mascart, College de France, No. 176 Rue de l'Université, Paris, France.
E. Hospitalier, No. 6 Rue de Clichy, Paris, France.
Dr. Werner Siemens, Berlin, Germany.
Prof. H. Von Helmholtz, Berlin, Germany.
Prof. Galileo Ferraris, Turin, Italy.
Joseph Kareis, K. K. Baurath, Wien II., am Tabor 6, Austria.
Prof. Dr. Weber, Ecole Polytechnique, Zurich, Switzerland.
Prof. E. Gerard, Inst. Electro-Tech. de Montefiore, Liege, Belgium.
Prof. A. Repman, Moscow, Russia.
Prof. A. Stoletow, Moscow, Russia.
S. Yslas, de los Telegrafos Federales, City of Mexico, Mexico.
Director-General of Telegraphs, Madrid, Spain.
Prof. Geo. F. Barker, M.D., University of Pennsylvania, Philadelphia, Pa.
Prof. C. F. Brackett, College of New Jersey, Princeton, N. J.
Prof. Henry A. Rowland, Ph.D., Johns Hopkins University, Baltimore, Md.
Prof. T. C. Mendenhall, LL.D., Director of U. S. Coast and Geodetic Survey, Washington, D. C.
Prof. B. F. Thomas, Ohio University, Columbus, O.
Prof. Thomas Gray, Rose Polytechnic Institute, Terre Haute, Ind.
Prof. A. E. Dolbear, Tufft's College, College Hill, Mass.
Prof. John Trowbridge, D.Sc., Harvard University, Cambridge, Mass.
Prof. F. E. Nipher, Washington University, St. Louis, Mo.
Prof. Sidney H. Short, Cleveland, O.
Prof. Henry Morton, Stevens Institute, Hoboken, N. J.
Prof. Brown Ayres, Tulane University, New Orleans, La.
Prof. John E. Davies, LL.D., University of Wisconsin, Madison, Wis.
Prof. A. P. Carman, Purdue University, Lafayette, Ind.
Prof. Lucian I. Blake, Ph.D., University of Kansas, Lawrence, Kan.
Charles F. Brush, Cleveland, Ohio.
W. E. Channing, Pasadena, Cal.
Michael Pupin, Ph.D., Columbia College, New York, N. Y.
Prof. Elihu Thomson, Lynn, Mass.
Franklin L. Pope, Elizabeth, N. J.
George M. Phelps, New York, N. Y.
Frank J. Sprague, New York, N. Y.
Edward Weston, Newark, N. J.
Prof. William A. Anthony, Manchester, Conn.
Louis Duncan, Ph.D., Johns Hopkins University, Baltimore, Md.
Prof. Alexander Graham Bell, Washington, D. C.
Francis B. Crocker, Columbia College, New York, N. Y.
Nikola Tesla, New York, N. Y.
Thomas A. Edison, Ph.D., Orange, N. J.
Carl Hering, Philadelphia, Pa.
T. Commerford Martin, New York, N. Y.
Prof. Edward L. Nichols, Ph.D., Cornell University, Ithaca, N. Y.
Prof. Edwin J. Houston, Central High School, Philadelphia, Pa.
Dr. William E. Geyer, Stevens Institute of Technology, Hoboken, N. J.
A. E Kennelly, Orange, N. J.
Thomas E. Lockwood, Boston, Mass.
Prof. Charles R. Cross, Mass. Institute of Technology, Boston, Mass.
Louis Bell, Ph.D., New York, N. Y.
George A. Hamilton, Elizabeth, N. J.
Ralph W. Pope, Elizabeth, N. J.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Armature Cores.

The core of the armature of a dynamo-electric machine plays a very important part in the system. Soft iron is the only metal that can be used with advantage in the construction of the core. Wood, china or any other substance could be used, but it would have little or no effect in the resultant electrical currents, as compared with soft iron. Any of these substances would serve only the purpose of giving a foundation for the armature coils, whereas an iron

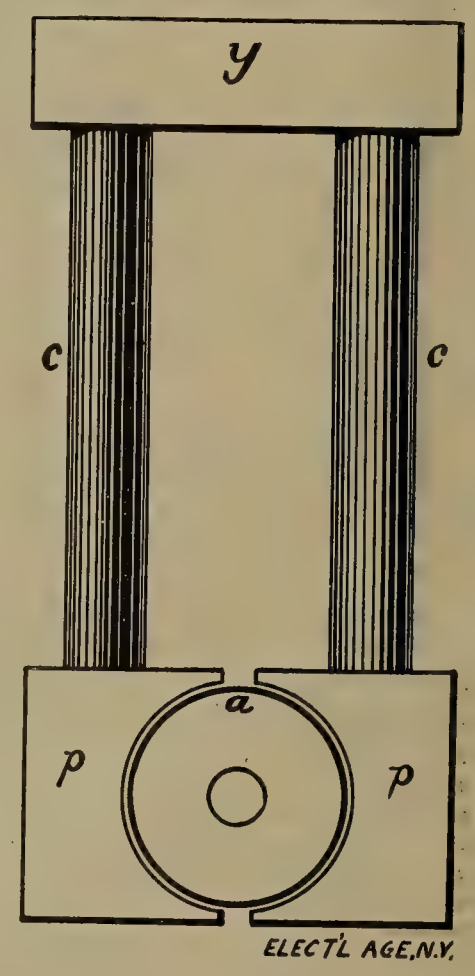


FIG. 1.

core not only serves as a foundation, but also nearly completes the magnetic circuit in the manner which will be described later on. Every dynamo has what is known as a magnetic circuit. Soft iron is the medium through which the magnetic action can take place with the least resistance, in the same sense that an electric current meets with the least resistance in a copper wire.

The magnetic circuit of a dynamo consists of the core and yoke-piece of the field-magnets and the air-



FIG. 2.

gap between the pole-pieces (see Fig. 1). If the air-gap did not exist and the space was filled with iron by the extension of the pole-pieces, the magnetic circuit would be complete and unbroken, and the resistance to the flow of magnetic lines of force would be the least possible to attain. But the existence of the air-gap interposes a great resistance to their flow, and the reduction of this resistance is one of the functions performed by the core of the armature. Being of the same material as the field-cores

(iron), it largely fills the gap and so reduces the resistance. The lines of force are projected from one pole-piece to the other, and as the iron of the core offers a path of less resistance to their flow, more of the lines are concentrated through its substance than would pass through the same space of air were the armature removed. The effect of this power of concentration is to render the field denser than it would otherwise be, and consequently the wire on the armature-coils have many more lines to cut through in its revolutions.

The denser the field the greater will be the current generated in the armature-coils, because there will be a greater number of lines of force to cut through, from which it is evident that the gap should be as small as possible.

In the practical dynamo there yet remains an air-space between the surfaces of the pole-pieces and the armature-core, which is unavoidable. We cannot entirely fill the space with the armature because the latter must revolve freely. It must not touch the pole-pieces, and it is desirable to construct it in such a manner that it will fill the space as much as possible without touching either of the pole-pieces. The space between the pole-pieces and the circumference of the armature is therefore made very small.

Then there is the space occupied by the coils on the armature-core which adds to the gap through which the magnetic lines of force must be projected before they reach the iron of the core itself. It requires nice calculation to have all the parts balanced properly, so that the best results may be obtained. The space between the pole-pieces must be as small as possible; it is desirable to have the armature-core as large as possible, to fill the space, and as much wire as possible in the armature-coils is desirable, within certain limits. All of these factors can be calculated exactly by the proper method. The formula for these calculations can be found in most of the text-books on dynamo construction.

The core of the armature must be laminated—that is, it must be built up of discs of thin iron, separated from each other by some insulating substance, such as mica, air, ebonite, shellac-paper, etc. The discs or laminations should also be perforated to admit of a free circulation of air to keep the temperature as low as possible.

Fig. 2 shows one form of disc, with projections on the circumference for the purpose of retaining the coils in place, and also gives a longitudinal sectional view of the core built up of such discs, with the armature-shaft running through the centre.

The object of constructing the core in this manner is to avoid eddy currents in the iron as far as possible, which cause a useless expenditure of energy. The energy dissipated in this way appears in the form of heat.

In a future article we will consider the subject of eddy currents.

ANSWERS TO INQUIRIES.

Editor Electrical Age: Will you kindly inform a young student how it is that electric currents are generated in a dynamo-electric machine? Also please give the name of a good book on electrical engineering, and oblige, T. M.

Maumee, Ohio.

Answer.—The wire on the armature of a dynamo in its rapid motion in the space between the two pole-pieces of the field-magnets cuts the magnetic lines of force which fill the space. The simple fact of cutting a magnetic line of force with a wire induces an electromotive force, and consequently a current in the wire. The wire, however, must pass through the line of force at right angles. An excellent work on electrical engineering is "Electrical Engineering," by Slingo and Brooker, which can be had at this office. Price $3.50.

Editor Electrical Age: Are the products of combustion of an arc light as deleterious to health as those of gas-jets? T. D. P.

Woonsocket, R. I.

Answer.—No; they are very much smaller in quantity and far less harmful. While the carbons are consumed by ordinary combustion some of the particles unite chemically with the constituents of the atmosphere.

Editor Electrical Age: I have an electrical machine (static) for experimental purposes which is rather uncertain in its action. It is at times very difficult to get a charge from it, while at others it works very well. Can you tell me what is the trouble and what I should do to secure more uniform results? E. R. M.

Elkton, Md.

Answer.—The machine must be kept scrupulously clean and dry. The dampness in the atmosphere is probably the cause of the irregular behavior of your machine. The glass is hygroscopic, and should be dried by the application of warmth so as to dissipate the film of moisture which collects on the surface. Keep your machine free from dust and dampness and you will get better results.

BIOGRAPHICAL SKETCHES.

SAMUEL S. BOGART.

One of the best-known men in the electrical field, particularly that department which relates to telegraphy, is Mr. Samuel S. Bogart, the subject of this sketch.

Mr. Bogart was born in Plainfield, N. J., 47 years ago, and received an education at Blair College. In 1863 his first experience in the telegraph service is recorded, and his first office was on the Delaware,



SAMUEL S. BOGART.

Lackawanna and Western Railroad, the telegraph lines of which were operated by the United States Telegraph Company. During the building of that company's system Mr. Bogart worked as climber and foreman, and at this time he received his first experience in line building, for which he has become celebrated in late years.

He was afterwards the manager of the office at Trenton, N. J., and later on worked in Philadelphia, Baltimore and Washington. During the war Mr. Bogart was for some time in the military telegraph service, and afterwards was appointed chief operator on the Lehigh Valley Railroad.

We next hear of him as flagman and conductor on the Erie road, and he subsequently filled the offices of yardmaster and train dispatcher. After service on this line he took positions on the Central Railroad of New Jersey as night, then day operator, and later on was connected with the engineering corps of the Lehigh and Susquehanna Railroad. Between 1869



OSGOOD S. WILEY.

and 1884 Mr. Bogart was in the service of the Western Union Telegraph Company, first as night operator, then day operator and afterwards chief operator. He was finally appointed wire chief of the company in New York, which position he filled with extraordinary ability, and displayed great tact in the performance of the exacting duties of this position.

After leaving the service of the Western Union Company he was appointed general traffic manager of the Baltimore and Ohio Telegraph Company, and subsequently became superintendent of telegraph and signals for the New York, West Shore and Buffalo Railway; New York, Ontario and Western Railroad; Wallkill Valley Railroad; Syracuse, Ontario and New York Railroad, which were combined with the New York State and part of New Jersey superintendency of the Baltimore and Ohio Telegraph Company. He afterwards became connected with the Edison General Electric Company as inspector, and at the present time is the electrician of the Electric Secret Service Company, of New York. Mr. Bogart is the inventor of the individual selecting system, controlled by this company, for picking out any office, electric light or motor and cutting the same in and out without disturbing the others on the same circuit.

This is only one of the many inventions which Mr. Bogart has devised for the greater convenience and simplicity of the telegraph and railroad professions. He has sought rather the advancement of the service than his own personal advantage.

Mr. Bogart is an expert in electrical and railway matters, and though he has had great experience he is still young looking. He is well known in the electrical fraternity, and is as well liked as he is known. He is a good companion and an entertaining talker, and is stocked with a fund of electrical information such as is possessed by no other living mortal.

Mr. Bogart lives at Greytop, Schraalenburgh, N. J., which is said to be one of the finest places in Bergen county. His family consists of wife and five children, and his home is a happy one.

OSGOOD S. WILEY.

Osgood S. Wiley was born in Orange, N. J., in 1855. After having finished at a high school, he entered the University of New York in 1872, taking an eclectic course, devoting most of his time to chemistry and electricity under Professor Draper. In 1876 he went to New Orleans where he was employed as a telegraph operator until 1877, when he returned to New York and for five years occupied a similar position with the Western Union Telegraph Company at 195 Broadway, up to 1883, when he was appointed Train Dispatcher on the New York and New England Road, at Hartford, Conn. In 1888 he went to Europe for Mr. Edison with the phonograph and his magnetic ore separator, and was one of the assistants who exhibited the phonograph to the Prince of Wales at Sandringham Palace. Returning in 1889, he had charge of the electric lighting on the Chicago, Milwaukee and St. Paul Road, which system was used on the cars between Chicago and Minneapolis for lighting the cars. Mr. Wiley, has just received the appointment as electrical expert of the Board of Subway Commissioners recently created in the State of New Jersey.

IN WOODS' FAVOR.

In the suit of J. S. Zerbe, superintendent of the American Engineering Company, which was tried in the Gates Avenue Police Court, Brooklyn, on April 3, against Granville T. Woods, the colored inventor, for criminal libel, a verdict was rendered by the jury in Woods' favor. The evidence showed that Zerbe had made a contract with Woods by which he was to be employed at a stated salary and receive part of the capital stock, for the invention of an electric system for the propulsion of street cars. Zerbe, according to Woods, did not fulfil the terms of his contract, and Woods accordingly withdrew, but could not secure his patents, which he claimed had been pocketed by Mr. Zerbe. He then published a warning in Street Railway News, and it was the publication of this warning which resulted in the trial. A full and complete description, with illustrations of Mr. Woods' system, was published in Street Railway News of February 27.

F. P. Little & Co., Buffalo, N. Y., report business very brisk with them. A contract has been closed with the Connecting Terminal Railroad Co., of that city, for installing a plant consisting of one 500 light Thomson-Houston dynamo, one 38 H. P. engine of the John T. Noye Mfg. Co.'s make, twenty-four 2,000 C. P. Mosher arc lamps and 125 16 C. P. incandescent lamps, all equipped complete, ready to operate. A contract has also been closed for wiring the Columbia Bank building for incandescent lights; and they are wiring the City Elevator for 300 incandescent lights and 5 arc lights complete with engine, dynamo, etc.; the Bell Telephone Co.'s building for 150 lights and rewiring Weyand's Brewery for 225 lights, all of that city.

Buffalo and Hamburgh Railway Company, Hamburgh, N. Y., was incorporated March 31, with a capital stock of $150,000. Incorporators: T. Cyrus Wheelock, John H. Meech, Buffalo, N. Y.; Amos Baker, Hamburgh, N. Y.

NEW INCORPORATIONS.

Canton Electrical Company, Canton, Mo., incorporated March 30, with a capital stock of $4,500. Incorporators: W. E. Agee, T. L. Durhee, W. B. Horton, all of Canton, Mo.

Hope Electric Appliance Company, Portland, Me., was incorporated March 29, with a capital stock of $300,000. Incorporators: Augustus Wright, Robert Fessenden, P. Gifford, Providence, R. I.

York Manufacturing Company, Portland, Me., was incorporated March 29, with a capital stock of $500,000, to manufacture and deal in electrical apparatus and appliances of all kinds. Incorporators: John W. Fletcher, Chelsea, Mass.; Henry Wellington, Charles E. Millke, Brooklyn, N. Y.

American and Foreign Electrotype Company, Portland, Me., incorporated March 29, with a capital stock of $30,000. Incorporators: Dana Estes, Brookline, Mass.; Eugene C. Batchelor, Quincy, Mass.; Louis C. Page, Brookline, Mass.

The Felt Electrical Light and Power Company (incorporated in W. Va.), New York, N. Y., incorporated March 30, with a capital stock of $5,000,000 Incorporators: George H. Felt, N. B. Armory, G. L. Felt, all of New York, N. Y.

The Foreign Storelectro Company (incorporated in W. Va.), Cleveland, O., incorporated March 30, with a capital stock of $1,500,000, to manufacture and sell electrical instruments, etc. Incorporators: J. C. Hoyt, A. C. Dustin, M. L. Black, all of Cleveland, O.

Electric Light and Water Company, Hillsboro, Ore., incorporated March 26, with a capital stock of $40,000. Incorporators: H. V. Gales, D. Rankin, W. E. Pruyn, all of Hillsboro, Ore.

The Lewiston and Reedsville Electric Railway Company, Lewiston, Pa., was incorporated March 24, with a capital stock of $24,000. Incorporators: A. B. Spanegle, James C. Hazlett, J. M. Goodhart, all of Lewiston, Pa.

The Crafton Light and Power Company, Crafton, Pa., was incorporated March 28, with a capital stock of $10,000, to supply light, heat and power by means of electricity. Incorporators: S. A. Duncan, Pittsburg, Pa.; William M. Galbraith, Chartiers, Pa.; J. A. Langfilt, Wilkinsburg, Pa.

Kenosha Electric Street Railway Co., Kenosha, Wis. Incorporated April 2, with a capital stock of $100,000. Incorporators: J. W. Munson, H. Pennoyer, H. B. Robinson.

The Wheeling & Belmont Railway Co., Martin's Ferry, Ohio, incorporated April 1, with a capital of $100,000. Incorporators: Harry Northwood, Jos. T. Hanes, Theo. Keller.

The South Williamsport Railway Co., Williamsport, Pa., incorporated March 31, with a capital stock of $ 5,000. Incorporators: J. Henry Cochran, James B. Krause, Henry C. McCormick, all of Williamsport, Pa.

Vallamont Passenger Railway Co., Williamsport, Pa., incorporated March 31, with a capital stock of $10,000. Incorporators: Jas. B. Krause, E. R. Payne, Henry C. McCormick, all of Williamsport, Pa.

Buffalo, North Main Street & Tonawanda Electric Railroad Co., Buffalo, N. Y., has been incorporated with a capital stock of $60,000. Incorporators: Louis F. Warend, Buffalo; Albert T. Fancher, Little Valley; Frank D. Smith, Springfield.

The Syracuse Storage Battery Co., Syracuse, N. Y., has been incorporated with a capital stock of $300,000. Incorporators: Charles L. Pack, Jacob M. Warner, all of Syracuse, N. Y.

Iona Manufacturing Co., Portland, Me., was incorporated March 31, with a capital stock of $15,000, to manufacture and deal in electric gongs, bells, batteries, etc. Incorporators: Norman Marshall, Boston; Henry P. Stanwood, John O. Holman, both of Brookline, Mass.

Arnold Novelty Co., Tacoma, Wash., was incorporated March 30, with a capital stock of $2.500. Among other things it will manufacture, buy and sell all kinds of electrical appliances. Incorporators: A. F. Esperson, W. S. Arnold, P. N. Boeringer, J. E. Small, E. N. Castillo, all of Tacoma, Wash.

Columbian Underground Electric Traction Co., East St. Louis, Ill., incorporated April 4, with a capital stock of $1,000,000. Incorporators: D. J. Murnane, George L. Van Beek, Stephen Von Phul.

The American Magnetic Boiler Cleaning Company (incorporated in W. Va.), Pittsburg, Pa., incorporated March 28, with a capital stock of $150,000. Incorporators: James Andrews, W. W. Andrews, E. E. Andrews, all of Allegheny, Pa.

The Waddell Entz Company (incorporated in W. Va.), Bridgeport, Conn., incorporated March 28, with a capital stock of $5,000,000, to manufacture and sell electrical batteries, dynamos, motors, insulated wire, etc. Incorporators: Mont. Waddell, W. A. Phillip, Justus B. Entz, all of Bridgeport, Conn.

Citizens' Lighting Company, Hempstead, N. Y., incorporated March 22, with a capital stock of $25,000, to manufacture and use electricity for light, heat and power. Incorporators: Thomas Henderson, Fred. L. Richmond, Samuel B. Althanse, Jr., all of Far Rockaway, N. Y.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, April 9, 1892.

Mr. D. H. Bates, well known in electrical and telegraph circles, is now connected with Bradstreet's Mercantile Agency, New York.

Mr. Cummings, of the firm of McDougall & Cummings, of Chicago, was in town last week. This firm is the agent for the "Ward" Arc Lamp in the West.

J. W. Dickey, recently of Rochester, N. Y., is in New York with a view to making an engagement. Mr. Dickey is an old and experienced electric-light and railway expert, having installed some of the largest plants in the country. He was also superintendent of the Rochester Electric Railway.

E. W. Applegate, a well-known Western electrician, is now in New York experimenting with his new incandescent lamps and filaments preparatory to placing them on the market. This lamp is constructed of inexpensive and durable material, and it promises to cheapen incandescent lighting very materially.

James H. Smith, electrician of the Park Theatre, Brooklyn, N. Y., was badly burned on the face and hand a few nights ago by an arc which formed on one of the switches that was represented to be ample to carry the load. The switch was melted. It is doubtful if Mr. Smith will again have control of his left hand so badly was it burned, while he had a narrow escape with his eyesight.

The New York office of the Short Electric Railway Co., of Cleveland, O., has been changed from the *World* Building, where its quarters were found to be inadequate to the demands of its rapidly increasing business, to the Mills Building, 35 Wall street. Here large and beautiful rooms have been secured, where will be found the same genial and gentlemanly representatives of this enterprising company, Mr. Edward E. Wessels, manager of the office, and Mr. C. C. Curtiss, confidential agent of the company, who are rapidly making themselves a power in the street-railway fraternity of New York and New England. These gentlemen have in their offices a fine display of the electric-railway apparatus which they are installing.

FINANCIAL.

It is estimated that over $45,000,000 in dividends were paid out in New York on or about the 1st of this month, and April is not by any chance a comparison as a prolific income period to January or July. As the years advance, these incidents increase both in the number of securities and the amount of their earnings. Electrics more than hold their own, and investors are every year becoming more and more pleased with them. There has never been a time when a greater variety of thoroughly sound opportunities to reap large profits from comparatively small ventures in the electric art was possible. Experiment has practically ceased, as there are so many who, from even a cursory examination of the specifications as published in the Electrical Age, can detect any defect in the combination of claims if such exist, and on the other hand, if the assembling of the elements are on correct lines, it is well known that only two other things are requisite—money and brains, or expenses and management. There are a great many completed problems seeking capital with orders to fill, and which are without raw material or cash for labor and machinery, and in some cases a full half interest is offered for a few thousand dollars for this purpose. There are engineering and manufacturing companies owning their own patents and in possession of the requisite models, moulds or patterns, but not able to supply goods, for the lack of from one to five thousand dollars. These supplies all show a profit of at least fifty per cent., and the demand is good. Another prime investment on the top at the moment is the motor, or system which shall take the place of the overhead trolley. A very few thousand dollars will test a system within twenty-five miles of New York, and if not proven of sufficient utility in hard, regular operation, the material will bring in a considerable return, while if successful, with the full positive knowledge of the fact, and a few thousand more to exploit the corporation, a large fortune is assured. The older companies do not seem disposed to aid the impecunious inventor, but on the other hand to ride roughshod over him and his, which is to the detriment of the public. It is even rumored that sufficient capital has been secured by some of the colossal corporations to cause them to ignore patents altogether; that they propose to manufacture and use any of them, and if sued to defend themselves with a part of the profits. There is plenty of room for small fortunes outside of these monopolies, whose shareholders are not receiving more than their share of the $45,000,000 first above written, and as large oaks from little acorns grow, so also do rich bond-holders from small investors. At this writing there is no positive conclusion to report in connection with the consolidation of the Edison and Thomson-Houston Companies; each has lately declared its regular dividends, and the Edison General is practically no longer dealt in on the Stock Exchange, the dealings being more generally in the unlisted receipts. Rumor comes from Boston that parties supposed to be acting in the T.-H. interests are quietly buying up the Westinghouse shares, with a view to carrying it into the consolidation. This will all be settled before the fall business commences on the Exchange, and when the brokers return from their summer outing I predict they will find only one electric stock representing all three of these, and that known simply as the Edison Electric Co., having a capital of $75,000,000, and a long tail of bonds with different names, dates and rates.

PHILADELPHIA NOTES.

The Star Electrix Company, 639–643 Broad street, Philadelphia, Pa., manufacturer of incandescent electric-light specialties in switches, lamp-sockets, cut-outs, fuse-blocks, etc., has added a variety of new lines which it will specially deal in hereafter, carrying, however, its old line of stock which it will continue to manufacture in the interest of old patrons. Both the old and new lines will be sold at prices sure to appeal to the trade and purchasing public generally, and we have no doubt its business will largely increase.

H. T. Paiste, of Philadelphia, the manufacturer and patentee of the Paiste Switch and other specialties, has sold to the Bryant Electric Co., of Bridgeport, Conn., his patents on the Paiste Single-Pole Switch, together with the business of the same. The transfer took place April 1. Mr. Paiste continues business in the specialty line, and will shortly introduce to the electrical trade a number of new devices that he thinks will be appreciated by all.

WESTERN NOTES.

Mr. Thomas Pray, Jr., formerly of 193 *Times* Building, New York, N. Y., is now connected with the Chicago Incandescent Light Company, 75 N. Clinton street, that city.

The Westinghouse Electric Company, of Pittsburg, has secured a contract to furnish the electrical equipment for street railways in Fort Wayne, Ind.; Lincoln, Neb., and Evansville, Ind. The contract will amount to about $218,000.

The Short Electric Railway Company, Cleveland, O., announces recent sales to the Braddock Electric Railway Company, Braddock, Pa.; the Union Passenger Railway Company, Chester, Pa.; the Fort Wayne Electric Railway Company, Fort Wayne, Ind.; the Schuylkill Electric Railway Company, Pottsville, Pa.

Electric headlights for locomotives are rapidly growing in favor in the West. The National Electric Headlight Company, of Indianapolis, Ind., has already placed 70 lights on nine different roads, and an order has recently been received to equip the engines of the "Royal Blue" trains on the Philadelphia and Reading road, between New York and Washington, with electric headlights.

In a very artistically executed card, the Edison General Electric Company announces that it has established a branch of its fixture and decorative bronze department in connection with its ware-rooms in the Masonic Temple, 41 Niagara street, Buffalo, and invites those interested to inspect the stock. Mr. H. B. Oakman is the resident agent. Mr. Oakman made it very pleasant for many of those who attended the recent Electric Light Convention in Buffalo.

TRADE NOTES.

The Rollason Gas Engine Co. will on May 1 remove from its present quarters, 134 Liberty street, to 15 Dey street.

The Germania Electric Co., Boston, Mass., has removed the manufacturing department from Cambridgeport to its new factory at Marlboro, Mass.; all correspondence should be addressed as heretofore to the company's office, 505 Exchange Building, Boston, Mass.

The Ansonia Brass and Copper Co., 19–21 Cliff street, has issued a descriptive pamphlet relating to the celebrated Tobin Bronze, of which it is the sole manufacturer, and which is adaptable to many different purposes. Special attention is directed to pages 10, 11, 12, which contain details of various tests, tensile, torsional and corrosive, to which it was subjected.

Mr. Thos. F. Clohesey, president of the Metropolitan Electrical Corporation, 415–417 Whitney Building, Kansas City, Mo., which was recently organized, announces that the company is prepared to act as consulting and contracting electrical engineers, furnish plans, specifications and supervision for complete steam and electrical installations. It is also agent for first-class railway equipment, high-grade arc, incandescent and alternating dynamos, electrical motors of any capacity and voltage, automatic high-speed engines, single cylinder, compound, condensing and double-tandem compound, gas, gasoline and petroleum engines.

The following letter, received by the Shultz Belting Company, of St. Louis, Mo., from A. R. Cogswell, superintendent of the Halifax Illuminating and Motor Co., Limited, speaks for itself:

"Please send us, per express, one Endless Covering for 18-inch diam., 13-inch face pulley. Also send us one pint tin of your belt cement, as we have had nothing to equal it. If it was not for your covering on pulley we would not be able to run without increasing our length of belt, and that we can't do. Belt has slipped on 6-ft. driver, and stuck well without slipping on small pulley with your covering."

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued April 5, 1892.

472,026. Galvanometer. Sigmund Bergmann and George A. Scott, New York, N. Y., assignors, by mesne assignments, to the Interior Conduit and Insulation Company, same place. Filed Feb. 25, 1891.

In an electrical meter, the combination of a magnet, a metal strip longitudinally curved and gradually widened from one end to the other and supported adjacent to the pole of magnet, and a weight or its equivalent for moving the strip in the reverse direction to that in which it would be moved by the magnet.

472,027. Switch and Switch-Box. Sigmund Bergmann, New York, N. Y., assignor, by mesne assignments, to the Interior Conduit and Insulation Company, same place. Filed March 13, 1891.

In a conduit system, the combination of a cylinder or receptacle for a switch, a base-piece removably fitted in cylinder or receptacle, a switch made complete in one structure secured to the base-piece and removable therewith from the cylinder or receptacle, a cap-piece for holding switch and base in place, and a spring surrounding a rotary part of the switch and serving to press cap-piece outward and bearing inward on switch.

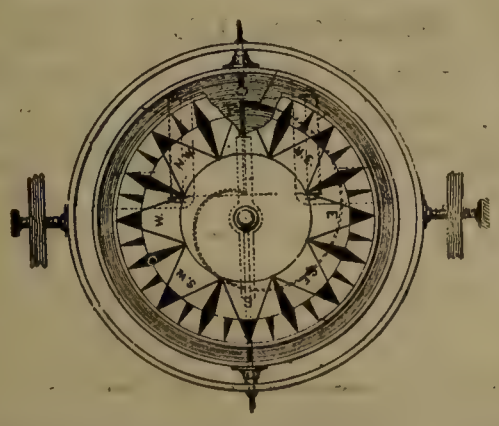
472,037. Thermo-Electric Element. Edward N. Dickerson, New York, N. Y., assignor to the Thermo-Electric Company, of West Virginia. Filed Feb. 27, 1890.

In a thermo-electric element, a series of parallel plates of different metals held firmly in contact with each other and adapted to be heated at one end.

472,055. Carbon-Holder. Henry Howard, Halesowen, near Birmingham, England. Filed Oct. 21, 1891.

In a carbon-holder, the combination of a support for the carbon, a screen of colored glass carried by the support, and an opaque bar interposed between the carbon and the screen.

472,062. Rheostat. James R. Masury, Providence, R. I., assignor of one-half to Lawrence J. McCarty, Boston, Mass. Filed June 29, 1891.



472,124.—ELECTRIC RECORDING DEVICE FOR COMPASSES.

472,064. Electric-Arc Lamp. John A. Mosher, Chicago, Ill., assignor to the Mosher Arc Lamp Company, Abilene, Kan. Filed June 20, 1891.

In an electric-arc lamp, the combination, with the guide-tube and the carbon-holder arranged to move in the tube, of the movable frame carrying feed mechanism and a chain or cord attached to and supporting the holder and the other end attached to the movable frame and passed over a pulley on the tube.

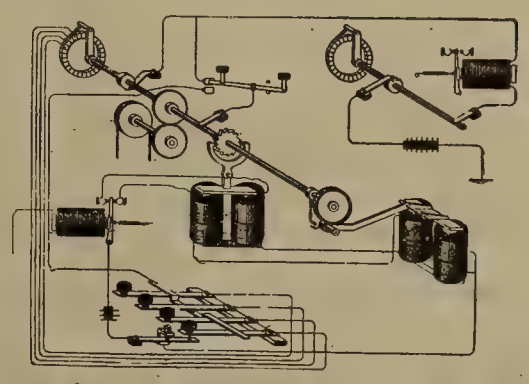
472,084. Safety Cut-Out. Mandeville Thum, Louisville, Ky. Filed June 5, 1891.

472,124. Electric Recording Device for Compasses. Charles L. Jaeger, New York, N. Y. Filed April 14, 1891.

472,135. Lightning-Arrester. Edward G. Miller, Wilkinsburg, Pa. Filed Aug. 27, 1890.

472,169. Toll-Collecting Apparatus for Telephones. Jesse J. Kato and Thomas H. Rhodes, Los Angeles, Cal. Filed March 28, 1890.

In combination with a telephone, a toll-collecting apparatus comprising a coin-receiver, a normally-closed local electric circuit, means for breaking circuit by the deposit of a coin, a second normally-closed local electric circuit, clock mechanism, and connections for breaking second circuit by winding the clock, and means whereby clock mechanism is adapted to simultaneously close both of circuits at a predetermined point in its movement.



472,237.—UNISON APPARATUS FOR PRINTING-TELEGRAPHS.

472,193. System of Electrical Distribution. William Marshall, New York, N. Y. Filed Feb. 28, 1891.

In a system of electrical distribution, a direct-current generator and a translating device in the circuit of the generator, a condenser in a branch of the circuit, and an automatic circuit-changing device having connections both to the branch or condenser circuit and to the main circuit containing the translating device, the connections being such that the circuit is alternately set for charging the condenser and for discharging the same through the translating device.

472,207. Apparatus for Propelling Vessels. Frank G. Curtis, New York, N. Y. Filed Oct. 24, 1890. Renewed Dec. 1, 1891.

472,220. Hanger for Electric Wires. Henry H. Luscomb, Boston, Mass. Filed July 20, 1891.

472,237. Unison Apparatus for Printing-Telegraphs. Henry Van Hoevenbergh, New York, N. Y. Filed July 20, 1891.

In a printing-telegraph, the combination, with a main line circuit of a step-by-step transmitter organized to drop or intermit one of a series of breaks or impulses and a receiving-instrument organized to supply the break or impulse omitted by the transmitter.

472,243. Telephone-Transmitter. Edward G. Acheson, Pittsburg, Pa. Filed June 29, 1887.

472,261. Thermo-Electric Battery. Robert J. Gülcher, Berlin, Germany. Filed June 18, 1891.

472,265. Electrical Meter. John F. Kelly, New York, N. Y. Filed Aug. 18, 1891.

A coulomb meter consisting in the combination, with a motor having a constant field, of a shunt or path of low resistance around the terminals of the motor, whereby the difference of potential at the terminals will be determined by the shunt, a load consisting of such a device as a fan, and means for indicating or registering the revolutions of the shaft.

472,274. Electric-Arc Lamp. Samuel W. Rushmore, Brooklyn, N. Y. Filed July 27, 1891.

The combination, in an arc lamp, of a movable carbon or carbon-carrying rod, a shunt-coil, a clutch ring or plate controlled thereby, a series coil, and a separate feeding device controlled thereby, one of devices acting as a check on the other.

472,283.. Switch-Box for Electric Motors. Parvin Wright, Denver, Col., assignor of one-half to Joseph W. Kinsey, same place. Filed Jan. 31, 1891.

An electric motor having its field-magnets located directly in circuit with a source of electrical energy and its armature in a derived circuit thereto, in combination with a pole-changing switch for reversing the direction of the current through the armature, and a second normally-open independent circuit operatively connected to the armature with circuit connections, whereby the first-named circuit may be broken and the second closed, and vice versa.

472,326. Automatic Telegraph. Frank Anderson, Peekskill, N. Y.; Annie L. Anderson, administratrix, and Gilbert H. Anderson and Homer Anderson, administrators of said Frank Anderson, deceased. Filed March 8, 1890.

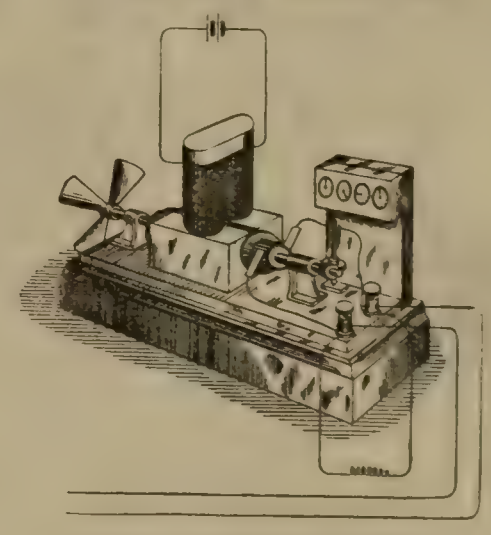
A perforating-machine having perforating devices, key-levers, and fillet-feeding mechanism, in combination with a rotary driving-shaft carrying a driving-pulley rigidly secured to it and having a loose driving-belt, which normally slides over the pulley, and mechanical connections between the key-levers and it, whereby the shaft is allowed to rotate one revolution only for each depression of a key and the fillet is perforated and fed forward.

472,329. Electric Wheel-Locking Device. George W. Blanchard, Waterville, Me. Filed Aug. 10, 1891.

In combination with a rotating wheel, a disc turning therewith, dogs or locking devices engaging the disc, and electrically-actuated means for drawing them into such engagement.

472,346. System of Arc Lighting. Horatio A. Foster, New York, N. Y. Filed Jan. 29, 1891.

In an arc lamp, the metallic-lamp mechanism box insulated from the current-carrying parts of the lamp and provided with a flange for the upper edge of the lamp-globe, the yoke, the negative-carbon holder insulated from the



472,265.—ELECTRICAL METER.

lamp-box walls, a globe inclosing the yoke and holder, and a globe-support secured to the yoke by suitable means, and lamp-terminals suitably insulated and inclosed in metallic casings.

472,352. Compound for Insulating Electric Wires. Louis Hill, Waterbury, Conn. Filed July 11, 1891.

A compound for insulating wire, consisting of pittizite pitch, candle-tar, coal-tar, asphalt pitch and rosin.

472,359. Electric Indicator for Railroad-Blocks. Robert W. Jaggard, Philadelphia, Pa. Filed April 6, 1891.

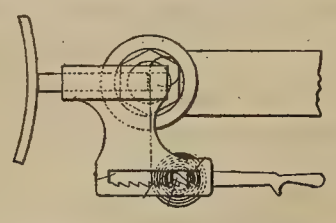
472,379. Production and Distribution of Electricity. William Marshall, New York, N. Y. Filed Nov. 23, 1889. Renewed Sept. 3, 1891.

The method of distributing electrical energy from an electric source, which consists in alternately charging an

electrical condenser from the said electric source and throwing into the line beyond the condenser the currents of both the condenser and the electric source, these acts being performed with such rapidity as to make the effects in the line appear continuous.

472,435. Brush-Holder. John R. Coffman, Detroit, Mich., assignor of one-half to C. A. Benton, same place. Filed Sept. 30, 1891.

The combination, with the commutator-brush fixed movably in a slideway to be pressed against the commutator and the spring pressing the brush therein, of a holder for spring also fixed movably in a slideway toward the commutator, and means to adjust holder and maintain substantial



472,435 —BRUSH-HOLDER.

uniformity of pressure of the brush on the commutator by the spring.

472,439. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Filed Dec. 22, 1891.

472,440. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Filed Dec. 22, 1891.

472,444. Electric Mining Pick and Drill. John Fish, South Bend, Ind., assignor of one-half to George M. Fish and Manning Fish, Joliet, Ill. Filed April 29, 1891.

The combination, with an electric motor, of a drilling device and supporting-frame therefor hung upon the extended armature-shaft of the motor, and devices connecting the shaft and drill for operating the drill.

472,447. Inclosed Supply System for Electric Railways. John C. Fyfe, Denver, Col. Filed Dec. 26, 1890.

In combination with the main conductor, the feeder-wires extending therefrom at intervals along the line of conductor, normally open local-circuit connections correspondingly arranged along the line of conductor, adapted when closed to take current through mercury in contact with feeder-wires, and mechanism actuated by a moving car for making contact between circuit connections and the mercury in contact with feeder-wires, so as to automatically close the local circuits.

472,461. Electro-Magnetic Valve Controller. Olof E. Lundstedt, Brooklyn, N. Y., assignor, by mesne assignments, to the New York Electrical Device Company, of Virginia. Filed Aug. 6, 1890. Renewed Oct. 14, 1891.

The combination, with the spindle of a rotating valve and an arm extending radially therefrom, of a pivoted bent lever having arms of unequal lengths, an armature upon the shorter end of lever, an electro-magnet attracting armature, a spring retracting it, a single lever pivoted at one end at a point beyond the long arm of the bent lever to extend thence toward the pivotal axis thereof, a link coupling the long arm of the bent lever with single lever near to its pivotal axis, and a link connecting the outer end of single lever with the radical arm of the valve-spindle.

472,466. Rotary Transmitting - Dynamometer. Franklin Van Winkle, Paterson, N. J. Filed Nov. 11, 1891.

In a rotary transmitting-dynamometer, the combination of a plate adapted to be made fast to the shaft and provided with a central hub, the exterior surface of which is spherical, and a loose plate adapted to be mounted upon spherical hub and capable of changing its angular position relatively to the fast plate around the axis of rotation of the dynamometer and also of assuming positions in different planes inclined to the plane of the fast plate.

472,480. Adjustable Armature for Electro-Magnets. Emil Hofmann, Ballard Vale, Mass., assignor to the Craighead & Kintz Company, same place. Filed Sept. 22, 1891.

The combination, with an electro-magnet, of an armature-carrier having recessed side arms, an armature, guide-pins thereon to enter recessed side-arms, and a screw having an annular groove connecting armature and carrier, and a screw or pin entering groove.

472,494. Automatic Electric-Lamp Lighter and Extinguisher. John H. Caughy, Baltimore, Md., assignor of one-half to Frank J. Caughy, same place. Filed Nov. 17, 1891.

An apparatus for making or breaking an electric circuit at a predetermined time, comprising a clock provided with an alarm movement, a spring-actuated switch-arm in the circuit, a pivoted latch to separately engage and hold switch-arm against the spring action, and means actuated by the alarm-movement for tripping the latch, and thereby disengaging it from the switch-arm and releasing the latter.

472,500. Electrical Indicator. John W. Henderson, Philadelphia, Pa., assignor to the Wharton Railroad Switch Company, same place. Filed Nov. 13, 1885.

In a railroad-signal, the combination of the signal-arm contacts, circuits, battery and an electric detector to indicate the position of said arm and sound an alarm while arm is passing from one of its extreme positions to the other, the detector and alarm consisting of electro-magnets armature, pointer, contacts, local circuits and alarm.

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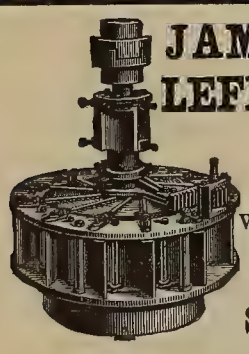
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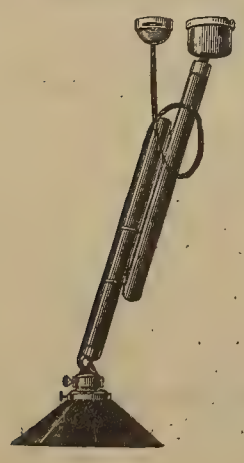
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THE ELECTRICAL AGE.

VOL. X. NEW YORK, APRIL 23, 1892. No. 17.

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NEW YORK, APRIL 23, 1892.

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INJUNCTION DISSOLVED.

The injunction which was obtained by the W. J. Johnston Company on February 18, 1892, by unfair means, restraining Mr. W. T. Hunt from soliciting advertisements for the ELECTRICAL AGE, and the ELECTRICAL AGE Publishing Company from employing Mr. Hunt as its advertising solicitor, was dissolved by Judge Truax, of the Supreme Court, this city, on April 14.

The plaintiff sought to restrain Mr. Hunt from working for the ELECTRICAL AGE Publishing Company as its advertising solicitor, and the ELECTRICAL AGE Publishing Company from employing Mr. Hunt as such from the date of the injunction until June 1, 1895.

It had been arranged between the attorneys on both sides that Mr. Hunt should receive due notice when the argument for the injunction was to be made, but no such notice was given by the Johnston Company's attorney. The consequence was, the plaintiffs attorney, taking advantage of Mr. Hunt's absence, secured the injunction. The motion to dissolve the injunction was finally heard and granted as above reported, the Court deciding that the Johnston Company had no grounds for a case.

The causes which led to this suit, although of a somewhat personal nature, will be of interest to our readers, on account of the prominence of the parties concerned.

Mr. Hunt had made a contract with the Johnston Company June 6, 1890, to serve for it until June 6, 1895. He claims that the terms of the contract were violated by the W. J. Johnston Company, and on this ground he felt at liberty to sever his relations with the company whenever he deemed it desirable to do so. On January 11, 1891, Mr. Hunt bought an interest in the ELECTRICAL AGE Publishing Company, and became its solicitor for advertisements. From that time to this he has been pursued and harassed with a vindictiveness that is seldom met with in this enlightened age in any line of business.

The idea that a man should be restrained by one individual or company from earning an honest living simply because he chooses to give his services to another savors too much of barbarism or slavery to find any justification these days; yet, such a notion seems to linger in the minds of some. But, thanks to the law, society is protected from such unwholesome conceptions of man's relations with man.

We may be pardoned for giving these details of the case because we have very good reason to believe that the sympathies of the trade at large were in our favor, and it is but fair to our friends and ourselves that the result of the action should be known. We are glad to take this opportunity to thank our friends for the kindly interest they have shown towards us, and we feel that they will rejoice with us in our victory.

CARELESS LEGISLATION.

Some one should go to Washington and give the people's representatives in Congress a few points on electricity and its use and abuses. When the subject of electricity comes up for discussion in any form, the nation's lawmakers become electrified or stupefied, or something else of an extraordinary physical nature happens to them. They do one thing to-day and undo it to-morrow.

In 1888 Congress passed a bill prohibiting the erection of overhead wires within the limits of the city of Washington, and further decreed that existing overhead wires should go underground. Now the House turns around and passed a bill the other day, which, among its other provisions grants the right to the Metropolitan Street Railway Company to erect trolley overhead wires. This action on the part of the House caused considerable surprise, and no wonder. It simply goes to show how carelessly legislation is carried on sometimes, even in Congress.

A GOOD RECORD.

The annual report of the Thomson-Houston Electric Company contains many figures of general interest, outside of those concerning the finances of the company. During the first year of its existence, 1883, it established 5 electric light companies, with 365 arc lamps. At the present time there are no less than 873 companies operating its system, with an aggregate of 100,293 arc lamps. In 1887 the first incandescent work was undertaken, and in that year 11,275 incandescent lamps were installed. There are now 806,500 incandescent lamps in use on this system, showing a marvellous expansion of the business.

The greatest yearly increase in the number of incandescent lamps installed, as shown by the report, was during the year 1890–91, when 335,000 new lamps were put into operation.

The comparative figures show a steady increase in the number of companies started, which must be very gratifying to the stockholders. They also show the preference of the people in the matter of light.

The Thomson-Houston Company has very good reason to be proud over its record, and the report shows what wise and conservative management of so vast a business can accomplish.

EFFECT OF ELECTRIC ROADS ON SOCIETY.

An interesting article from the pen of that prolific writer, Mr. Otis K. Stuart, is printed on another page in this issue. Mr. Stuart's subject concerns the effect on society of electric railroads, and he handles his theme in a novel and interesting manner.

Granting the truth of the proposition that about five cents per car mile are saved by using electric instead of horse-power on street railways, Mr. Stuart calculates that the aggregate amount of money that would be saved were all the street railroads in the United States operated by electricity, would be $25,000,000 per annum. He then very clearly resolves this aggregate saving into different units, and shows that it is equal to the labor of 20,000,000 men for one day, at the rate of $1.25 to each, or about 55,000 men for one year; and he estimates that the stockholders of the various street-railway companies in the United States—if all roads were operated by electricity—would each receive over $200 a year increase to his income.

Mr. Stuart's argument is an ingenious one and full of instruction; moreover, it bristles with facts that are of deep concern to street railway men, and we commend the article to their thoughtful consideration.

DIRECT-COUPLED ENGINES AND DYNAMOS.

One of the most important factors in calculations touching the cost of an electric-light plant in any large city is that of ground space, or in other words, the land on which the station is to be erected.

The larger the city the larger does this element of expense become, and it is natural that electrical engineers should turn their attention to devising ways and means to economize as much as possible in the matter of space.

In large cities where the incandescent service is in thickly populated districts, an abundance of room for a central station cannot as a rule be obtained except at fabulous prices, and it is sometimes a serious question as to how the business can be carried on successfully in limited quarters.

The Edison General Electric Company has given considerable attention to this question as well as many others affecting the practical and successful operation of illuminating stations in cities. It has to some extent solved the economy of space problem in a very satisfactory manner by combining electrical and mechanical apparatus.

We give on another page an example of what has been done in this direction by this company. Two multipolar dynamos are coupled direct, one on either side of a triple expansion engine. Such a combination avoids the necessity of using belting and countershafting, and effects a great saving in floor space. In addition to the saving in space greater efficiency is, it is said, secured.

The increased diameter of the multipolar type of machine gives a very large heat radiating surface, which permits carrying heavy loads for any length of time without danger of overheating.

The engine and dynamos are mounted on one bedplate, which is extremely massive and especially designed with a view to securing perfect alignment and rigidity of the machines with reference to each other.

This excellent arrangement will be easily understood by the illustration and description of the apparatus.

THE EDISON TRIPLE EXPANSION ENGINE AND MULTIPOLAR GENERATORS.

One of the most serious problems that to-day confronts the management of electric illuminating companies in large cities, is the cost of the land necessary to accommodate the large station buildings. When land costs $1,000 and upward a foot-front, every square foot of ground space that can be saved materially reduces the necessary investment of the company. Recognizing this fact, the Edison General Electric Company has recently brought out a new line of central station units, consisting of two multipolar dynamos coupled direct, one on either side to a triple expansion engine, and ranging in capacity from 100 to 1,500 indicated horse-power. This combination does away with all belting and counter-shafting, and thus secures an increase of efficiency, and a great saving of floor space—two most important factors in central station practice.

The important features of this type of generator are given in the following description, which will undoubtedly prove of interest to central station managers.

THE GENERATOR.

The saving of floor space being one of the chief objects, the necessity of coupling the generator directly to the engine naturally suggests itself; but as the armature of the bipolar generator now in general use must, of necessity, be run at a comparatively higher number of revolutions per minute, it is evident that unless a special engine is employed, another design of generator is called for.

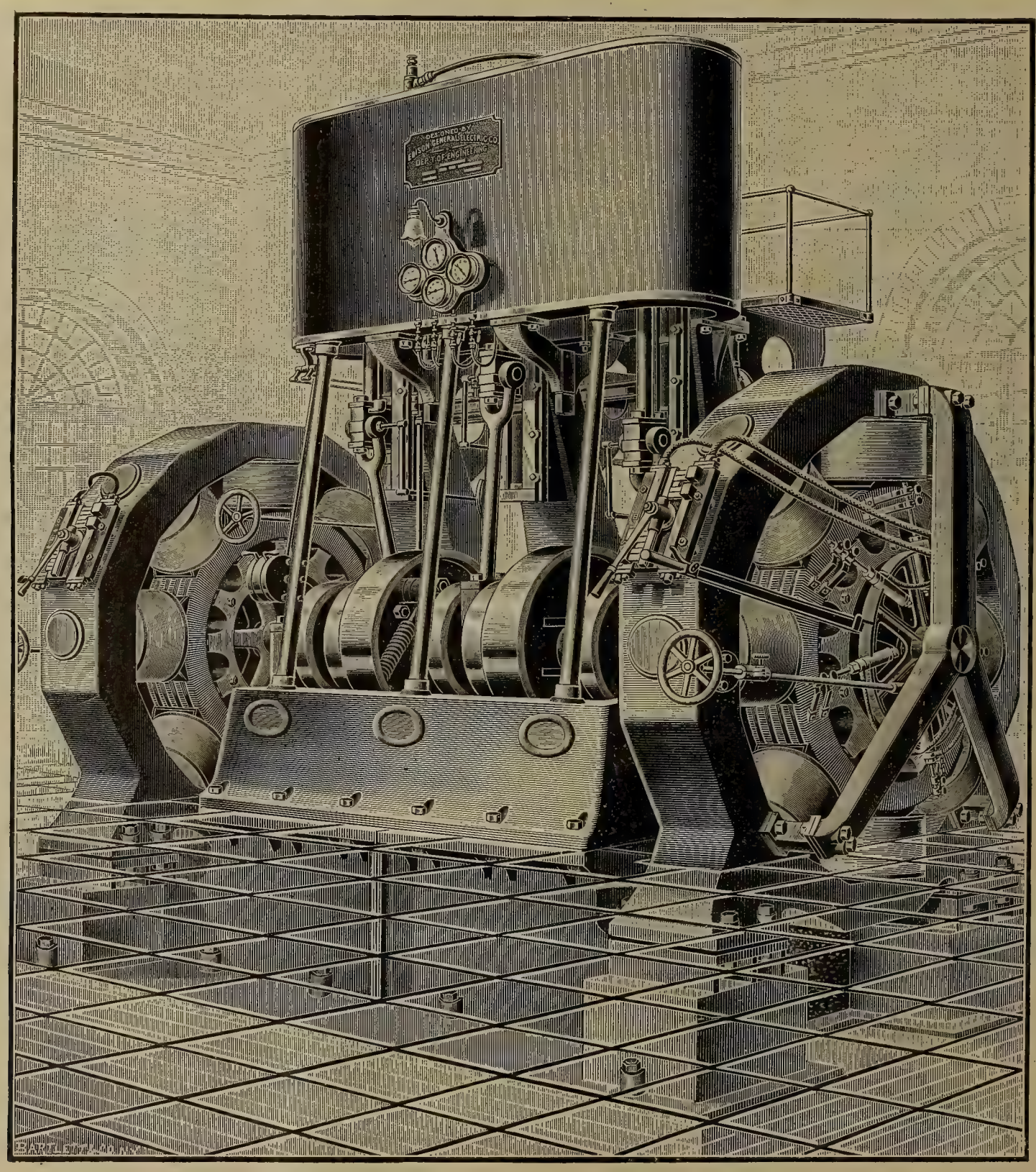
The multipolar generator is peculiarly adapted to this purpose, as it may be designed to generate any desired electrical output, at an armature speed corresponding to that of a slow speed engine. This type presents the additional advantages of requiring but small floor space, of being able to withstand sudden variations of the load, and of carrying heavy loads continuously without danger of overheating.

The armature is of the German ring type, of very simple construction; it is built up of ⊏ shaped copper strips, which are slipped (in a single layer) over the laminated wrought-iron core, the upper end of one being connected with the lower end of the adjoining loop by a copper bar of corresponding thickness, these bars acting as the segments of the commutator. The number of brushes corresponds to the number of poles of the generator, and it is found that the large current output can be divided among these brushes much more conveniently than if only one set of brushes were used to carry the whole current generated. The mechanical device for controlling these brushes allows of their being operated together, so that when once adjusted, the whole can be handled as though but one set were used.

The field coils are wound on separate spools, which are slipped over the field magnets; these field magnets are then inserted in an annular or polygonal field frame, mounted on the bed-plate of the engine. The bed-plate being heavy and massive and of special design, perfect alignment and rigidity of the field-frame with relation to the engine is secured.

The increased diameter of the armature in the multipolar type of machine gives a very large heat radiating surface. This point, in connection with the special construction outlined above, allows the Edison generators to maintain heavy loads for periods of any duration, a factor that will be admitted as eminently desirable in central stations where such conditions exist.

The armatures are mounted directly on both ends of the crank-shaft, and act as the fly-wheels of the engine.



TRIPLE EXPANSION ENGINE AND MULTIPOLAR GENERATORS.

THE ENGINE.

The engine is of the triple-compound 3-crank inverted cylinder, automatic condensing type, well proportioned throughout, having large wearing surfaces which can be easily adjusted. The bed-plate to which the main bearing boxes of the crank-shaft are cast is strong and is firmly bolted to a massive foundation box, which also carries the dynamo frames; thus perfect rigidity between engine and generators is insured. The crank-shaft is of forged steel; fitted with cast-iron balanced discs to which the crank-pins are fitted. There are two bearings to each crank and an additional large bearing on each end of the shaft to carry the armature. On the shaft are three eccentrics, each operated by its own independent governor, so that the point of cut-off in each cylinder is changed equally with the load, thus doing away with any tendency to race, in case the total load is at any time thrown off, or any accident happen. Strong cast-iron columns carry the cylinders, which are bolted together, and the engine made strong, compact and well arranged; indeed, these engines are almost fac-similes of the latest and most improved types at present in use on the finest ocean steamships, with necessary additions to render them as highly efficient for electric generating purposes as their prototypes are for marine work. They are calculated for the maximum efficiency point at about 12½ per cent. below the normal maximum capacity of the generator, and have a range to a maximum capacity of 20 per cent. above the normal maximum output of the generator at 160 pounds initial pressure and vacuum of 24″—thus allowing each engine, in case of an accident to the condensing apparatus, to operate the generator satisfactorily non-condensing. In addition to the many advantages already mentioned, these engines when connected to a suitable condensor will reduce the con-

umption of fuel considerably. This is an item of vast importance in electric light stations, increasing their storage, boiler and engine capacity. The compactness of this arrangement, as shown in the following table, proves the advantages to be gained by the use of the dynamos and engine thus combined.

COMPARATIVE FLOOR SPACE REQUIRED BY TWO GENERATORS AND ONE ENGINE.

TWO BIPOLAR GENERATORS BELTED TO ONE HIGH-SPEED ENGINE.

TOTAL CAPACITY TWO GENERATORS.		MINIMUM FLOOR SPACE IN SQUARE FEET.
K. W.	16 C. P. LAMPS.	
50	900	270
90	1,620	374
200	3,600	511
350	6,300	571

TWO MULTIPOLAR GENERATORS COUPLED DIRECT TO ONE EDISON TRIPLE-EXPANSION ENGINE.

TOTAL CAPACITY TWO GENERATORS.		MINIMUM FLOOR SPACE IN SQUARE FEET.
K. W.	16 C. P. LAMPS.	
50	900	56
100	1,800	121
200	3,600	180
400	7,200	356

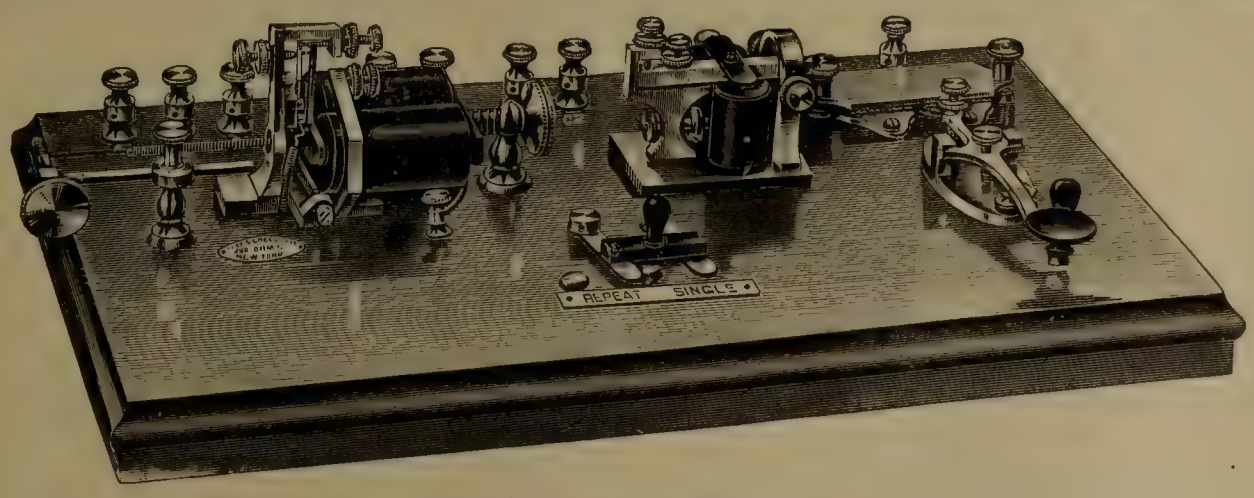
NEW TELEGRAPH REPEATER.

Those who have handled telegraph repeaters of certain kinds, and studied their characteristics, have noticed that there exist complications in their arrangement and construction which might be simplified. The Milliken-Hicks is an example of this class, and while it is an excellent apparatus, yet it is complicated, and requires the services of some one who specially understands it to keep it in working order. What is wanted in every-day work is a repeater which will give the best service with the least attention.

Mr. W. M. Miner, an electrician of New York City, once watched the operation of a Milliken-Hicks repeater, and the thought occurred to him that there were a good many parts to the instrument, and that it might be simplified. He studied over the matter and produced a repeater which is said to meet every requirement of such an instrument. We give herewith an illustration of one half-set of the instruments all ready for operation.

The most noticeable feature about Mr. Miner's repeater is the absence of the repeating sounder. The repeating is accomplished by an extra contact-point on the regular relay armature, which arrangement greatly simplifies the apparatus and necessitates fewer connections. Any operator can keep the instrument adjusted as easily as he can keep ordinary instruments in proper working order.

One feature of special value in this repeater is, that when the line resistance changes, necessitating a change in the adjustment of the relays, the fact manifests itself by producing a "kick" on the



MINER'S TELEGRAPH REPEATER.

sounder, before the repeating functions of the relay are affected, however. Thus the attention of the attendant is attracted when readjustment is required, before the operator at the receiving end of the wire notices any difference in the working of the circuit.

The repeater has been practically tried, and gave excellent results. The range of adjustment is very great, as may be appreciated by the fact that the magnets may be drawn away from the armature a quarter of an inch before the warning "kick" is produced.

This repeater requires no extra local batteries, part of the main battery being used as the "holding battery."

Mr. Miner has worked one of the relays, wound for 200 ohms, from one cell of battery, and a poor one at that, and there was no overloading, as might be supposed.

This repeater is certainly a simply constructed one.

BIOGRAPHICAL SKETCHES.

ELMER STILLMAN SMITH.

Mr. Elmer Stillman Smith, the subject of this sketch, is an Ohio boy, born in the year 1853. He has followed in the footsteps of his father in engaging in a mechanical trade, his father having added many designs and improvements to various inventions now in use.

Mr. Smith, as the records of the Patent Office show, has invented numerous machines, the latest of which is the American High-Speed Engine, which is destined, no doubt, to make him very widely known. He has made a study of mechanical and steam engineering from his youth up, not only in a practical



ELMER STILLMAN SMITH.

way, but in the searching out of the best theoretical and practical methods known to the science of engineering at the present date. He was always a hard worker, and was obliged to work his way by incessant toil, as the start was not made with the proverbial silver spoon. By constant perseverance and application, however, he has been able to accomplish much that only comes by hard work.

Mr. Smith is not unknown in engineering circles. He was the superintendent of the Central Placer Mining Co. and consulting engineer in the construction of the Big Bend Tunnel, Butte county, Cal., which was constructed under the mountains three and a half miles up a heavy grade, and ventilated entirely from below, which was due wholly to his ingenuity, and marked a long step forward in the history of practical tunnel and mine ventilation.

He has been an extensive traveller, having visited nearly every part of the civilized world, studying methods and examining mining property, as well as the mechanical methods of the Old World. He is now the general manager of the extensive works of the American Engine Company, at Bound Brook, N. J.; treasurer and director of the Nayac Cottage Association, on Peconic Bay, Eastern Long Island; also the superintendent of a large enterprise undertaken by the Hon. R. V. Pierce, of Buffalo, N. Y., which embraces the opening up of 235 acres of land in well laid out streets, with complete system of sewer and water pipes; with large electric-lighting plant to light up the entire village, which they propose to make an ideal suburban town; containing all the modern conveniences and the best sanitary arrangements; with telforded roads and stoned sidewalks throughout the grounds. This land lies high and rolling along the banks of the beautiful Raritan river, away from the mosquito-breeding marshes of Jersey, and flanked on the north by a spur of the Blue Ridge mountains, which renders the climate moderate and at all times agreeable.

This place is only one hour from New York and seventy-five minutes from Philadelphia, and the junction point of the Lehigh Valley, Jersey Central, Phila. & Reading and Port Reading Railroads. The Baltimore & Ohio also passes through this village.

The accompanying cut gives an excellent likeness of Mr. Smith, who has a large circle of friends and is a gentleman well worth knowing.

INSULATION RESISTANCE.

The underground wire question is an important one in this country at the present time, and the difficulties met with in construction work of this class sometimes assume an alarming aspect to those who are not thoroughly familiar with the work.

Passing over the mechanical considerations of the question, we come to the part which concerns the transmission of the electric current, namely, the conductors.

The insulation of underground conductors is, of course, the first and most important desideratum. What, then, should the insulation resistance be?

At the last convention of the National Electric Light Association, which was held in Buffalo last February, Mr. E. A. Leslie, general manager of the Manhattan Electric Light Co., of New York City, gave some interesting facts and figures on this sub ject in a paper which he read.

Concerning insulation tests Mr. Leslie said:

"The initial tests of cables laid by any of the companies in New York City must show an initial insulation resistance of not less than 15 megohms per mile per 100 volts of current used. This means that, with an alternating current of 1,000 volts, the cable must show, before the current is turned into it, to have an insulation resistance of not less than 150 megohms per mile, with an arc circuit of 2,500 or 3,000 volts, or even 4,000 volts initial insulation resistance must not be less than 375 megohms, 450 megohms and 600 megohms respectively. Taken into consideration with the fact that on an ordinarily humid day, overhead circuits will not show an insulation resistance of more than from 200,000 to 500,000 ohms per mile, the above requirements seem altogether impossible of attainment and to be ideal rather than practical, but this is not the case. On the contrary, it is rare, indeed, that the initial tests of cables laid in New York City do not show from three tofour times the initial insulation resistance required by the rule, and, of the hundreds of miles of cable actually in operation at the present time and which have been in operation from two to three years, and with which I am personally familiar, I do not believe that there is one that will show, under like conditions, nearly, if not quite the same high degree of insulation as when the original test was made. In fact, I have proved this to be true many times."

A GOOD SHOWING.

One of the most interesting features of the last annual report of the Thomson-Houston Electric Company is that portion relating to the electric railways operated on that company's system.

The company has been putting out street railway apparatus for three years, and the figures show that it has been remarkably active in this direction. Up to the present time it has equipped no less than 204 companies with electrical apparatus, and when it is considered that this has been accomplished within a period of three years, the enterprise of the company is apparent. It is certain that no company could make such a record, unless its apparatus possessed merit.

During the first year of the railway business 92 roads were put into operation on this company's system, and in the second year the number had been increased to 145, showing that the increase is steady.

The number of cars at present in use is 2,769, as against 701 the first year and 1,532 the second.

This record shows an extremely healthy growth of the business, and there is every reason to believe that it will continue to expand.

ELECTRIC RAILROADS AND THEIR EFFECTS ON SOCIETY.

BY OTIS K. STUART.

If any one will reflect for a moment he will see that the general adoption of electric lighting in cities and towns has necessarily had deep effects on society in those places. And the general adoption of electricity as a motive-power for street cars must likewise have important sociological effects—effects which are due not only to decreased cost of operation, but also to the time saved and to the novelty and relative efficiency of the system. There are in operation daily in this country alone nearly 34,000 street cars, all kinds included. Each of these cars travels on an average about 40 miles a day, or nearly 14,600 miles a year; so that the total yearly service of the street cars of these United States is not far from 500,000,000 miles.

Now experience with something like 400 electric street railways has proven that a trifle less than five cents per car mile is saved by using electric instead of horse power. Let us assume that five cents could be saved on every mile a street car travels if electricity were to take the place of horses entirely, and if electricity has ever done anything, it has proven thoroughly, proven beyond all question, that it is not only cheaper but also better than horses for street railways, and that the horse is bound to go.

We will suppose that this change will be made, and that a dollar and a quarter is the money value of a man's labor for one day on street railways, which is certainly not too high. We would then save about five cents on each of 500,000,000 car-miles, or $25,000,000 per annum. This means that 20,000,000 man-days, of the value of one dollar and a quarter each, would actually be saved to the people.

Now, 20,000,000 man-days means the work of 20,000,000 men for one day, or of about 55,000 men for a year; so that if electricity were to become the sole power used on street railways, 55,000 men could stop work, and the world would go on just as it does now; we should have just as good things to eat, just as good clothing to wear, just as many amusements, just as many books and newspapers. In fact, these very 55,000 men would be just as happy and just as well off as ever! Of course, it is not at all likely that 55,000 men really would stop working, and as this money would be saved let us see where some of it might go.

Those most directly benefited would undoubtedly be the stockholders of the various railway companies. If we knew the number of stockholders in the street railways of the country, we could easily tell how much increased income each one would have on the average as the result of the introduction of electricity; but such information is not easy to get. So far as I am able to ascertain, the average number of stockholders of such companies in Pennsylvania is 114; in Massachusetts the average number is about 106, and it is probable that this latter figure is not far wrong, taking in the whole country. As there are about 1,200 roads in the United States, we see that more than 120,000 stockholders would be directly benefited by the change. If the whole sum of $25,000,000 was to be distributed to these stockholders, each would receive over $200 per year increase to his income, without a single extra stroke of work, or one additional effort or worry. And as the greater economy of electric as compared with horse power renders it practicable to successfully operate street cars in localities where horse cars could not begin to be even self-supporting, this number of benefited stockholders will doubtless be swelled into an army of vast proportions. We shall then have hundreds of thousands of men, with increased means of doing good; of endowing colleges; establishing free schools; encouraging sculpturing, painting, and other forms of art; of advancing our knowledge of the sciences, and all of this will have been done without making any one poorer, without the expenditure of a single extra foot-pound of energy.

Speaking of energy reminds me that coal must be burned in order to generate steam, with which to get electric power, and that men are necessary to mine and transport and handle this coal. A conservative estimate places four pounds of coal as the amount necessary to run a car one mile. Therefore about one million tons of coal will be required to make the total of 500,000,000 car-miles. To bring this from the earth's depths will take the work of nearly 1,500 miners for 300 days, and to load it on freight-cars, haul it to destinations, and place it under boilers will require the labor of a vast army of workmen. If the coal is worth an average of $2.50 per ton when delivered under the boilers, then the total labor for coal may be represented by 3,000,000 man-days per year, or by the labor of nearly 6,000 men per day. These 6,000 men are, of course, simply drawn from some other sort of work to that of mining, freighting, firing, etc.

Mr. O. T. Crosby has shown that about 80,000 men are in fact thus to be diverted from their ordinary or previous callings to the work of installing and maintaining the electric railways of this country. He says: "As to just how this total of 80,000 will be divided among the various occupations, we may judge from the actual distribution of the total population of this country as reported in our census. Not having at hand the figures for 1890, I find from the census of 1880 that out of 17,500,000 people, men and women, engaged in the various occupations, 7,600,000 are reported as agriculturists; 3,800,000 in mechanics and mining; 1,800,000 in trade and transportation; 4,000,000 in professions and other personal services. [This last item covers all individual personal services, from the high-priced lawyer to the humble domestic.] Some such distribution as this would doubtless follow for the 80,000 whom we have discussed above.

"The forces which are supplanted we may estimate about as follows: There are 4½ horses per car on all horse railways throughout the United States, or a total of about 115,000 horses. The average life of these in service is five years, which requires a supply of 23,000 per year. To feed and groom the total number engaged, at the rate of 50 cents per day, costs $57,500 daily, while the supply of 23,000 horses per year, at the rate of $150 each, requires daily $9,500. Thus 67,000 man-days are then substantially diverted from their original use for simply maintaining the horse as a motive power." *

Thousands of these men are, of course, merely to do the work of supplying clothing, food, etc., to the machinists and others mentioned above. It is the agricultural class that will be, as it always is, the most vitally affected. "A large part of those now engaged in raising grain and horses are now to be drafted into machine-shops to make motors or, on a smaller scale, are drafted into coal-mining, etc."

But these are not the only economies and effects which the universal adoption of electricity for the motive power of street railways would bring about. By abolishing the oil lamp and substituting the incandescent for it; by banishing the coal stove and using the electric heater instead; by avoiding huge, bad-smelling stables; by lessening the amount of manure in public highways—in all of these, and in a thousand other ways, the health of the whole community will be improved; and by increasing the speed of the cars thousands of days will be added to the total yearly life of the nation. Nor is it difficult to show just *how* much time can be saved. As the average speed of a horse car has been found to be less than six miles per hour, and the average speed of electric cars to be over nine miles per hour, the gain in time is at least 3½ minutes per mile. As our street railways carry nearly 2,000,000,000 passengers annually, and as each passenger can be assumed to travel three-quarters of a mile, it is clear that something like five and a quarter billion man-minutes, or nearly a hundred million man-hours, equivalent to ten million man-days per year, would be saved. This time is about equal to the total lives of nearly six hundred men, or the useful working time of about 2,500 men! That is, electric railways give us the power of granting to the entire working population of this country, every man and woman of them, a whole holiday from their present employment each year without cost to any one—not even to themselves!

* The value of a man-day, as estimated by Mr. Crosby, is $1.00.

MECHANICAL EFFECTS OF MAGNETIZATION.

When a steel or iron bar is powerfully magnetized it grows a little longer than before; and, since its volume is the same as before, it at the same time contracts in thickness. Joule found an iron bar to increase by $\frac{1}{12000}$ of its length when magnetized to its maxium. This phenomenon is believed to be due to the magnetization of the individual particles, which, when magnetized, tend to set themselves parallel to the length of the bar. This supposition is confirmed by the observation of Page, that at the moment when a bar is magnetized or demagnetized a faint metallic clink is heard in the bar. Sir W. Grove showed that when a tube containing water rendered muddy by stirring up in it finely divided magnetic oxide of iron was magnetized, the liquid became clearer in the direction of magnetization, the particles apparently setting themselves end-on, and allowing more light to pass between them. A twisted iron wire tends to untwist itself when magnetized. A piece of iron when powerfully magnetized and demagnetized in rapid succession grows hot, as if magnetization were accompanied by internal friction.

AN EARLY CONCEPTION OF THE MAGNETIC FIELD.*

BY PROF. EDWIN J. HOUSTON.

It may interest the members of the electrical section to know, that as early as 1668, Robert Boyle, the eminent physicist and chemist, published, concerning the magnetic field, exceedingly advanced ideas which closely resembled the modern ideas of magnetic flux and lines of magnetic force.

Boyle's publication, so far before the time of Faraday, shows the exceedingly advanced position he must have occupied at that early date, as a thinker and investigator in physical science.

Boyle was an indefatigable worker and a voluminous writer, both in the domain of physics and chemistry, as well as in that of medicine. He taught that absolute rest had practically no existence even in bodies in apparent rest, since there existed in such bodies what is called an intestine motion of their particles. He also had original notions of what was called, in his time, effluvia, and it was in connection with these so-called effluvia that he advanced an explanation concerning the magnetic action of the loadstone, which bears a remarkably close resemblance to the modern ideas of a magnetic field and lines of magnetic force.

The quotation referred to is from the second of two essays "Concerning the Unsuccessfulness of Experiments," published in 1668. In these essays he has been pointing out the necessity for care in conducting scientific experiments, and urges that the failure to experimentally reproduce any natural phenomenon should not necessarily call in question the accuracy of the first observer of such phenomenon, until all the sources of error that might have led to obscuring or vitiating it had been eliminated. In this connection he cites, in a quaint manner, some of the numerous experiments that he had been led to try on the assertion of well-known scientific men, but in which he failed to obtain the results alleged to have been observed. He describes in this connection the magnetization produced by touching a steel knife-blade to the armed pole of a loadstone, as resulting in different polarities according to whether the point of the blade is drawn towards or from the equator of the loadstone.

I will quote Mr. Boyle's remarks in full in this connection:

"If on either of the Extremes or Poles of a good armed Load-stone, you leisurely enough, or divers times, draw the back of a Knife, which has not before received any Magnetick influence, you may observe, that if the point of the blade have in this affriction been drawn from the middle or Æquator of the Load-stone towards the Pole of it, it will attract one of the Extremes of an equilibrated Magnetick Needle; but if you take another Knife that has not yet been invigorated, and upon the self-same Extremity or Pole of the Load-stone, thrust the back of the Knife from the Pole towards the Æquator or middle of the Load-stone, you shall find, that the point of the Knife has, by this bare difference of Position in the blade whilst it past upon the Extreme of the Load-stone, acquired so different a Magnetick property, or Polarity, from that which was given to the former Knife by the same Pole of the Load-stone, that it will not attract, but rather seem to repel or drive away that end of the Magnetick Needle which was drawn by the point of the other Knife. And this improbable Experiment not only have we made trial of, by passing slender Irons upon the Extremities of armed Load-stones, the breadth of the whose Steel-caps may make the Experiment somewhat less strange, but we have likewise try'd it by affrictions of such Irons upon the Pole of a naked terella, and we have found it to succeed there likewise. How strange soever it may seem, that the same point or part of the Load-stone should imbue Iron with contrary Properties, barely as they are, during their passing over it, drawn from the Æquator of the Load-stone, or thrust towards it. But whether, and how far this Observation insinuates the operations of Load-stone to be chiefly performed by streams of small particles, which perpetually issuing out of one of its Poles, do wheel about and re-enter at the other; We shall not now examine (though this seem one of the most likely Phænomena we have met with, to hint a probable Magnetickal Hypothesis) contenting ourselves to have manifested by what plainly appears, how much influence a circumstance, which none but a Magnetick Philosopher would take notice of, may have on an Experiment."

* Read at the stated meeting of the Electrical Section, Franklin Institute, January 5, 1892.

Mr. Boyle had obtained an insight into the actions which occur during magnetization far beyond that of his contemporaries. This fact appears to be clearly indicated by the above statement as to what he believed to be the actual operation of the load-stone; namely, that it produced magnetization by means of streams of small particles coming out of one pole and re-entering at the other pole. Change the phraseology but a trifle and leave the ideas as expressed, and we have at this early date a fair idea of the modern notion of magnetic flux.

Boyle's notion seems to have been that when other bodies were brought into this magnetic stream, they became endowed with magnetic properties by the particles or corpuscles forming the stream, passing through them, just as we now explain magnetization by the passage through a magnetizable substance of the lines of magnetic force.

In a later paper, published in 1669, on "The Absolute Rest of Bodies," he asserts that the particles even in exceedingly dense substances that are apparently at rest, are, in reality, in rapid motion. He urges that although such motions cannot be seen, yet they must exist, and cites as a proof of such assertion the following experiment, which I will give in Mr. Boyle's language:

"I briefly answer (for I would not here repeat what I have elsewhere said on this point) by this clear Experiment, that though your Eye can discern no change in the outward and visible, much less in the more latent and internal Corpuscles of Iron: a vigorous Load-stone by passing along its Axis from one Pole of the Stone to the other, and back again, yet the Texture of the Iron is by that action of the Load-stone so changed, that it acquires, and then loses those admirable Qualities we call the Attractive and Directive virtue or faculty peculiar to Magnetick Bodies."

And further on, in the same paper, in speaking of the well-known fact that a mass of steel when allowed to stand in an upright position for some time on the earth, is endowed with magnetic properties, he ascribes these properties to the action which the streams of corpuscles exert on it.

"To this purpose I shall only observe to you, that though a Bar of Iron having one of its ends held perpendicularly, and at a fit distance to the Lily or Northern point of the Mariner's Compass (I mean that which points towards the North), it will, as I elsewhere mention, drive it away towards the East or West: and if this same lower end of the Bar of Iron be put into a contrary posture, it will presently lose its temporary magnetism, as I elsewhere declare. Yet if this Bar be very long kept upright in a Window or other convenient place, then, as some late Magnetickal Writers will tell you, it will have acquired a constant and durable Magnetick power. Which is a phenomenon which makes exceedingly for our present purpose, since it hence appears both that the Air together with the magnetickal effluvia of the Earth that it receives in its Pores, is able without outward force to work durable changes in so solid a Body as Iron, and that the motions of the internal Parts, for these are requisite to change the Metal's Texture, are performed with a wonderful slowness, since the Bar must be very long exposed to the air, perhaps before it acquires any durable magnetism at all but at least before it acquires so vigorous and fixt a magnetism as by this means it may attain to."

In another paper on "The Nature, Properties and Effects of Effluvia," reproduced by Shaw at a later date, in vol. I., p. 411, of the Philosophical Works of the Honorable Robert Boyle, Esq., 1725, Boyle writes as follows:

"To clear this matter, I caused some needles to be hermetically sealed up in glass pipes, which being laid on the surface of the water, whereon they wou'd lightly float, the encluded needles did not only readily answer to the load-stone externally applied, tho' a weak one, but comply'd with it so well that I cou'd easily lead, without touching it, the whole pipe to what part of the surface of the water I pleased. I also found that by applying a better load-stone to the upper part of the seal'd pipe, with a needle in it, I cou'd make the needle leap up from the lower part, as near to the load-stone as the interposed glass wou'd give it leave. But I thought it more considerable to manifest, that the magnetickal effluvia, even of such a dull body as the globe of the earth, wou'd also penetrate glass. And this I attempted after the following manner. I took a cylindrical piece of iron, about the bigness of one's little finger, and between half a foot and a foot long; having formerly found that the quantity of unexcited iron forwards its operation upon excited needles; and having hermetically seal'd it up in a glass pipe, but very little longer than it, I suppos'd that if I held it in a perpendicular posture, the magnetickal effluvia of the earth, penetrating the glass, wou'd make the lower extrême of the iron answerable to the North Pole; and, therefore, having applied this to that part of the needle, in a dial or sea-compass, which looked towards the North, I presum'd it would drive it away, which accordingly it did. And having, for further trial, inverted the included iron, and held it in a perpendicular posture, just under the same point, that extreme of the iron rod, which before had driven away this point, being, by inversion, become a South Pole, attracted it; from which sudden change of the poles, merely upon the change of the situation, it also appeared that the iron owed its virtue only to the magnetism of the earth; not that of another load-stone which would not have been thus easily alterable."

I need not call your attention to the marked similarity between the manner in which Boyle conceives magnetic induction to take place, and our modern notions concerning the same phenomenon. His streams of magnetic effluvia correspond exactly in direction and action to our present conceptions of magnetic flux and lines of magnetic force.

Coming now to the time of Faraday, we find in a paper published by Faraday in the *Philosophical Transactions*, in 1852, the following:

"From my earliest experiments on the relation of electricity and magnetism, I have had to think and speak of lines of magnetic force as representations of the magnetic power, not merely in the points of quality and direction, but also in quantity. * * *

"A line of magnetic force may be defined as that line which is described by a very small magnetic needle, when it is so moved in either direction correspondent to its length, that the needle is constantly a tangent to the line of motion. * * *

"These lines have not merely a determinated direction recognizable as above, but because they are related to a polar or antithetical power, have opposite qualities or conditions in opposite directions. These qualities, which have to be distinguished and identified, are made manifest to us either by the position of the ends of the magnetic needle, or by the direction of the current induced in the moving wire."

As to the direction of the lines of magnetic force, Faraday, as is well-known, regarded them as coming out of one pole of the magnet and passing in at the other pole, and referred to this in a paper printed in the *Proceedings of the Royal Institution*, on the 23d of January, 1852, as follows:

"The lines of force already described will, if observed by iron filings or a magnetic needle or otherwise, be found to start off from one end of a bar-magnet, and after describing curves of different magnitudes through the surrounding space, to return to and set on the other end of the magnet."

There is, of course, a danger in quoting from an early writer, of reading into the quotation a significance that it could not have had, save by the light of subsequent researches. It is far from my purpose or desire to belittle the researches of Faraday. I merely desire to show by comparison of the writings of these two philosophers, the remarkable advance that Boyle had made as to the manner in which a magnet acts.

In the above quotation from Boyle it must be remembered that Boyle referred to certain effluvia which he believed were given off by the magnet. His conception, however, of these particles coming out at one pole and re-entering the other, and his mentally endowing streams of such particles with polarity, or the possession of opposite properties in opposite directions, was certainly a remarkable advance for his times, and shows how far he was beyond his contemporaries.

It is possible that other writers before the time of Boyle, or between his time and that of Faraday, may have expressed somewhat similar ideas. I merely call your attention to the quotations from Boyle as showing the remarkable grasp of magnetic phenomena possessed by this early philosopher.

OVERHEAD WIRES IN WASHINGTON.

In the National House of Representatives on April 12, the bill providing for an extension of time to the Metropolitan Street Railway Company, for the purpose of changing its motive power from horses to some other system in accordance with a previous act of Congress, was taken up and provoked a great deal of discussion as to the wretched service rendered by the company, which resulted in the offering and adoption of an amendment by Mr. Outhwaite, of Ohio, providing that hereafter no fare should be collected of a passenger not furnished with a seat. The adoption of this amendment created a surprise, which was still further increased when, on motion of Mr. Washington, of Tennessee, another amendment was adopted granting the company permission to use overhead electric wires.

In view of the fact that in 1888 Congress enacted a law providing that from and after the date mentioned in the act no overhead wires should be erected within the limits of the city of Washington, and it was further ordered that all overhead wires then in existence should be removed, the reason for the surprise may be well understood.

At the present time there is but one surface road operating its lines by overhead wires, and arrangements have been made to substitute the storage battery system within the time specified by the act. Congress followed this law with another passed a year or two ago, providing that on or before July 1, 1892, every surface railroad in the District of Columbia should abolish horse-power, and that no road should hereafter be chartered with authority to use horses for the movement of cars. Acting in accordance with this law, the two largest street car lines in the city prepared to change their motive-power. One of these lines began in June, 1891, to lay a cable system from the Navy Yard to Georgetown, and from Pennsylvania avenue along Fourteenth street to Mount Pleasant, in the suburbs, a distance of about eight miles, and the work has just been completed. An immense power-house is building on Pennsylvania avenue at Fourteenth street, and the company expects to have cable cars running on the entire system on August 1 next. The total cost of the change is $3,000,000. The other of the two extensive lines made preparations for adopting the storage battery system. The company has erected an immense plant in Georgetown, at the western end of its line, and had practically demonstrated the utility of the storage battery cars. It was unable, however, to complete its arrangements within the time specified in the law, and so it came to Congress for an extension.

It is said that even the officials of the company were surprised at the adoption of the amendment, because the last official document sent to Congress on the subject of the proposed change of motive-power states that the engineer of the road has reported that the storage battery has been demonstrated to be a complete success, and that the company has spent a very large sum of money in erecting one of the largest storage battery plants in existence, and that it is ready to put it into operation if it can have a few months more for perfecting details.

As the Senate is strongly adverse, and public sentiment unanimously opposed, to the use of overhead wires of any description in the District of Columbia, it is not at all likely that the bill will become a law.

RESISTANCE STANDARDS: THEIR MANUFACTURE AND ADJUSTMENT.*

BY ELMER G. WILLYOUNG.

I shall speak to you for a very brief time this evening on the subject of electrical standards of resistance. The standard of resistance is, to my mind, by far the most valuable standard with which we have to do in actual work. Considering only the quantities involved directly in Ohm's law, which are about the only quantities of any particular value or meaning to four electricians out of five, the standard of resistance is almost the *only material* standard which we can possess. The unit of current is a standard, but it is a standard which only exists by definition and is not an actual tangible and physical thing, while the standard of E. M. F., which shall give an exact unit or multiple of a unit, is yet to be discovered; a standard cell, to be sure, giving a definite E. M. F. at a definite temperature and whose rate of variation with temperature is accurately known, is now a comparatively easy thing to secure, but the care necessary in its use together with the decimal value of its E. M. F. are both considerably against its being rated as high, practically, as the standard of resistance. It must also be borne in mind that, having a standard of resistance, we may obtain the value of any E. M. F. by the solving of $E = CR$ where C is known from the amount of electrolytic deposition taking place in a given time out of a suitable solution; the amount of copper, silver or other metal deposited out of such a solution in a given time by a given current being always a definite and exact one to be found in any text-book upon the subject.

The standard of resistance, as generally known, is a length of wire of one kind or another, wound upon a spool, mounted in a convenient case to protect it from injury and moisture, and having its resistance at some given temperature definitely determined; a true standard also has its rate of variation of resistance for change of temperature accurately known. Sometimes one coil is mounted up alone and sometimes many coils of different values are put up in the same mounting.

In the manufacture of standards of resistance a great many qualities are required of the resistance-wire which shall be used. It should have high

* Read before the Electrical Section, Franklin Institute, Philadelphia, November 3, 1891.

specific resistance, in order that the standard may not have too much bulk; it should have as small a temperature coefficient of resistance as possible, in order that its value may be easily obtained at any reasonable temperature without the making of troublesome calculations; it must not change its resistance in time; it must not be oxidizable by the air or by the medium in which it may be enclosed, since this would change the constitution and hence the resistance of the wire; and it must be of a hardness suitable for handling in manufacture and adjustment without injury. The requirement of high specific resistance immediately compels us to reject copper, iron, aluminum, silver and all other pure metals except lead, antimony and bismuth. The softness, difficulty of working and high temperature coefficient as well as many other reasons would throw these last three out of the account. The matter of temperature coefficient alone, in fact, would compel us to reject all pure metals since they all increase roughly about 25 per cent. in resistance between 0° and 100° C., except iron, which increases about 40 per cent. We are, therefore, led to try alloys. Dr. Matthiessen, chairman of the sub-committee (of the Committee on Electrical Standards of the British Association), from 1862–65, having in charge the investigation of the properties of wires with reference to the selection of a suitable one to be used in the standard of resistance, decided upon by the British Association and now known as the B. A. Ohm, examined very exhaustively a large number of wires, among which were pure iron, silver, copper, thallium and other metals, and a great many alloys; he finally concluded that silver alloyed with 33.4 per cent. of platinum was the best alloy obtainable. This alloy, known as platinum-silver, is still used by English makers; it has a specific resistance of twenty-four microhms and a per cent. variation per degree C, of $\frac{3}{100}$. In selecting this alloy we see that the requirements of high specific resistance and low temperature coefficient have both been observed, the resistance of platinum silver being about sixteen times that of copper and its temperature coefficient less than $\frac{1}{100}$ that of copper.

With reference to the constancy of resistance in wires it may be well to mention that many metals and alloys seem to alter in electrical resistance with time, or on being subjected to change of temperature. In an investigation carried on by J. Bergmann, a German electrician, in the latter part of 1889, he reports that, after raising to and maintaining at 300° C, for one hour and then cooling, the resistance of several substances changed as follows:

	Per Cent.
Copper decreased,.....	2.4
Aluminum "	5.0
Magnesium "	6.8
Zinc "	2.4
German-silver increased.....	$\frac{8}{10}$

Mr. Tomlinson, a little earlier, found a somewhat similar result in the case of iron wire, which decreased in resistance about one-quarter per cent. after several heatings to 100° C., and subsequent cooling. Dr. Matthiessen, in the investigations previously alluded to, found a considerable time change in a number of the alloys and wires which he experimented upon. It may be of interest to state here that three of the original platinum-silver coils determined by the British Association through Dr. Matthiessen and his colleagues at the time of the adoption of the B. A. Ohm were found last year, when carefully examined, to have developed an increase of resistance of about six parts in 10,000, or about $\frac{6}{100}$ per cent., quite an appreciable amount as standards go. The committee having these last comparisons in charge suggested that this change in resistance was only temporary, and due to strains in the wire produced by lowering it to 0° C., at which temperature the measurements were made; they have, however, not yet been able to verify this idea. A time change is, however, to be noted in a large number of metals and alloys where strains are not taking place. This time change in resistance, as Dr. Matthiessen suggested, is probably very largely due to a gradual annealing effect, as it is particularly noticeable in hard-drawn wires. It has also been observed to be in a marked degree a property of wires containing zinc and to be lacking, except to a very small extent, in wires free from zinc; here it is possible that zinc may gradually crystallize out, since it does easily crystallize, and the homogeneity of the wire thus being altered, the change in resistance may be accounted for.

It is almost self-evident that the resistance of a metal or alloy is a function of its density; hence, all causes tending to change the density of the resistance metal will also tend to change its resistance. It is quite reasonable to expect, therefore, that an increase of resistance should be observed after a wire is wound upon a spool. A wire wound upon a spool not over eight times its own diameter will increase from $\frac{1}{2}$ to 2 per cent. in resistance; a part of this increased resistance is due to the increased hardness caused on the inside of each turn, by the bending stress, and hence gradually falls away as the wire slowly anneals. For this reason, it is unsafe to send out a resistance standard as correct until several months have elapsed after winding.

Several years ago a wire was brought out in England known as "platinoid." It was said to be an alloy composed of ordinary German-silver with one or two per cent. of metallic tungsten added. It has a specific resistance of about thirty-two microhms and a temperature coefficient of $\frac{22}{100}$ per cent. per degree Centigrade. I have analyzed this several times but have never been able to detect any tungsten; two or three friends have done the same with the same result. Whether or not any tungsten is used as the wire is now made, is, therefore, not certain. During the week since reading this paper, I have been informed by an electrician that the tungsten "burns out" in the process of manufacture. The properties of this alloy are, however, about as reported. It is nearly as cheap as German-silver, and during the time over which my own observations have extended shows no time change; at least if any change has taken place in the coils in our possession, it has been by less than $\frac{1}{100}$ per cent. The wire is hard, practically non-oxidizable and easily handled. It is now being used in all the standards sent out by Queen & Co., and proves satisfactory in every way. I have here in my hand a wire recently sent me by the Aluminum Brass and Bronze Company, of Bridgeport, Conn., and claimed by the manufacturers to have thirty-five times the resistance of copper together with an extremely small temperature coefficient, less than $\frac{1}{10}$ that of German-silver. I have not had an opportunity to test the accuracy of these statements as yet, having been too busy with other work, but hope soon to be able to do so. According to the *Electrical Engineer*, of Oct. 21, 1891, there is also claimed for this wire a tensile strength of 70,000 to 100,000 pounds per square inch, with eighty twists in six inches, and with a lower resistance, a tensile strength up to 140,000 pounds per square inch. You see it is of a pale-rose color and looks as if it might contain considerable copper. I suspect it is a variety of manganese copper made up of about 70 per cent. of copper and 30 per cent. of manganese, with perhaps a small percentage of nickel. Mr. Edward Weston experimented on some of these alloys a couple of years ago and found one of them to have a negative temperature coefficient; his statement to that effect was received with considerable incredulity at the time, but has since been thoroughly verified. According to Drs. Feusner and St. Lindeck, in *Zeitschrift für Instrumenten Kunde*, February, 1891, an alloy composed of 70 per cent. copper, and 30 per cent. manganese had a resistance of about five times that of German-silver and a temperature coefficient of but $\frac{4}{1000}$ per cent. per degree Centigrade, while an alloy of 73 per cent. copper, 3 per cent. nickel, and 24 per cent. manganese had a specific resistance a little less than three times that of German-silver, and a *negative* temperature coefficient of $\frac{8}{1000}$ per cent. We see, hence, that it ought to be entirely possible to obtain a wire having a zero coefficient, *i.e.*, not changing resistance at all for change of temperature by properly combining the constituent metals of this alloy. The obtaining of such an invariable standard is a "consummation devoutly to be wished" in electrical work, as accurate work is very troublesome and tedious where long decimal coefficients have to be applied, and this becomes particularly the case where several sets of coils are used in the same investigation having different temperature coefficients. Dr. E. S. Nichols, of Cornell University, and others have made successful attempts to obtain resistances having a zero coeffieient working along another line; they have taken a rod of carbon and soldered to its extremities a length of wire of some metal or alloy; since carbon decreases and wires increase their resistance with rising temperature, it is evident that by using a suitable wire and proper proportions a combination might be found which when placed in a circuit in parallel would remain of the same resistance at any temperature. The difficulty of soldering to carbon as also the care necessary in adjusting prevent, however, such resistances from becoming commercial possibilities; the carbon is also too sensitive to changes of pressure and to strains.

A strictly standard resistance is, according to the practice of the best makers, adjusted to anything within from $\frac{1}{10}$ to $\frac{1}{100}$ per cent. of absolute accuracy. A *single* coil would not be considered a "standard coil" unless it were accurate within from $\frac{1}{10}$ to $\frac{1}{100}$ per cent. absolute accuracy. To obtain this high accuracy of adjustment it is easily seen that very exact methods of measurement must be employed; should we attempt to measure an inch within this limit of error, the error could not be over $\frac{1}{10000}$ inch, an exceedingly small quantity. Various methods have been suggested and employed by different parties at different times. An apparatus designed by Prof. Fleeming Jenkin, and used somewhat by the British Association Committee of 1862, consisted of essentially, an ordinary Wheatstone's Bridge with the connection between two adjacent arms, consisting of a short, straight length of resistance wire. If, now, one galvanometer contact be on this straight wire and the other at the junction of the two opposite arms of the bridge, and S, one of these opposite arms, be the coil to be adjusted to R, the other of the opposite arms, and the arms adjacent to the straight wire be designated C and A we will have

$$\frac{C}{A} = \frac{R}{S}$$

we now interchange R and S and have

$$\frac{C}{A} = \frac{S}{R}$$

this will demand a new position of the galvanometer contact upon the straight wire and the distance moved over on the straight wire is a measure of the difference in resistance between R and S.

Suppose that C and A each have 100 inches of the same wire as the straight wire and that we have had to move over one inch in reversing R and S, then R and S agree within one per cent. Now we adjust S closer to R and substitute for C and A two new coils C' and A' each of 1,000 inches wire. If now we again adjust so as to move over one inch in reversing we are within $\frac{1}{10}$ per cent. of accuracy; and so by continually adjusting S to R we may obtain gradually closer approximations to accuracy if we, at the same time, substitute other coils for C and A. But this process is, at the best, but a cut-and-try one and exceedingly tedious. A complete description of this method and convenient apparatus will be found on p. 38 of *Reports of Electrical Standards*, published by Spon.

I have here a piece of apparatus first designed several years ago during my student days. It is a modification of an arrangement devised by Prof. S. P. Thompson, and described in "Stewart & Gee," 2d vol., p. 160. The one I have here was first suggested to me by Prof. H. S. Carhart, of Michigan University, and has since been somewhat modified by myself. If we take an ordinary slide-wire bridge having four openings for coils at the back and (the slide wire being in front) fill these spaces, beginning at the left, with coils designated P, R_1, R_2 and Q, respectively, connect the battery from between P and R_1, to between R_2 and Q and the galvanometer from between R_1, and R_2 to a point on the slide wire, we have substantially the method which is known as the Carey-Foster method. Designating the resistance of copper connector at the left by r_1, and of copper connector at the right by r_2, and letting P be the resistance of unit division of the wire,

$$\frac{R_1}{R_2} = \frac{P + r_1 + X_1 \rho}{Q + r_2 + (L - X_1)\rho} \qquad (1)$$

where X_1 is the reading on the bridge wire and L the total number of divisions. Reverse the position of P and Q and we have

$$\frac{R_1}{R_2} = \frac{Q + r_1 + X_2 \rho}{P + r_2 + (L - X_2)\rho} \qquad (2)$$

From (1) we have

$$\frac{R_1}{R_1 + R_2} = \frac{P + r_1 + X_1 \rho}{P + Q + r_1 + r_2 + L\rho} \qquad (3)$$

and from (2) we have

$$\frac{R_1}{R_1 + R_2} = \frac{Q + r_1 + X_2 \rho}{P + Q + r_1 + r_2 + L\rho} \qquad (4)$$

From (3) and (4) we get

$$Q + r_1 + X_2 \rho = P + r_1 + X_1 \rho$$
$$Q - P = \rho (X_1 - X_2)$$

which is an expression independent of the resistance of the end pieces of the bridge, being merely the resistance of that portion of the wire over which we must move in obtaining our two balances. Thompson's device is merely for quickly and conveniently interchanging coils P and Q; with it we must change the position of four copper connectors in four mercury cups; this is tedious and increases the danger of a change of temperature between the adjustments. The modification which I have here has reduced these changes to two which can be almost instantly made. With this device and a carefully calibrated bridge wire it is an extremely simple matter to attain an accuracy of $\frac{1}{100}$ per cent., while much higher percentages of accuracy may be gotten with care. Of course, in this method the coils P and Q must be at a definitely known temperature which shall not change during the taking of the two readings; hence the two coils are placed in well-stirred water or oil baths. The other coils R and S are wound together and left in the open air, as if they change at all, they will probably change about equally and the result be of no appreciable importance. This device is also the best thing to use in determining temperature coefficients of wires; a

length of wire is wound upon a spool, immersed in oil at a definite temperature and compared with a standard. The temperature of the oil is then raised and the resistance of the wire again determined; knowing the difference of temperature and the change of resistance, the temperature coefficients follow.

THE GENERAL ELECTRIC COMPANY.

Governor Flower, of New York, with his approval of the Senate bill, entitled "An Act to Incorporate the General Electric Company," filed a memorandum the substance of which is, that the approval of the bill must not be considered as a precedent for future legislation of similar character. The cause for approving the bill was due to the representation that it would keep within the State a corporation ready to invest a large amount of capital which, without the concessions granted by its proposed charter, would be incorporated under the laws of New Jersey. A reduction of incorporation tax from one-eighth of one per cent. to one-twentieth of one per cent. was therefore provided for to coincide with the laws of that State.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

"Dead Wire" on Armatures.

Although the modern dynamo is very nearly perfect in its construction, both scientifically and mechanically, yet there exists in certain machines some dead or inert material, which cannot be avoided. We refer to what is known as the "dead wire" on drum armatures.

As may be inferred, this "dead" wire is dead as far as practical results are concerned, and is simply a dead load to carry.

This "dead" wire is located at the end of the armature opposite the commutator, and consists of the continuation of the windings of the conducting wire from one side of the armature to the other. It is "dead" because it produces no practical results for the reason that it does not come within the influence of the magnetic field; it is therefore a sort of necessary evil, because it is, as far as known at the present time, the only practicable means of carrying the current from one side of the core to the other.

In the case of large armatures, when the conductors are of large diameter, or of such form and mass as to render them comparatively inflexible, it is impracticable to continue the windings over the end of the core in the manner adopted on ordinary sized armatures. Some special devices are employed; such as half-circle segments, discs, etc. In any case the cross-diameter connections cannot be dispensed with, hence the necessity of making them as short as possible so as to reduce the resistance. This is necessary in order that as little energy as possible may be consumed, because the greater the resistance of a wire the more the current strength will be expended in passing through it.

The active wire on drum armatures is located parallel to the axis, and the more wire we can pass through the magnetic field at right angles the better.

The percentage of active wire of the total length varies greatly—from 30 to 60 per cent. That portion of the wire which is wound over the end of the core is not wholly inactive, however, but the electromotive force produced therein is so slight that it has little effect on the general result; what little electromotive force is produced is due to the fact that these portions of the wire cut the magnetic lines obliquely. (The electromotive force varies inversely as the obliquity of the wire with reference to the field of force.) The greatest electromotive force is produced when the wires cut the magnetic lines at right angles, and none is produced when the conductors pass through the field of force parallel to the lines.

THERMO-ELECTRIC CURRENTS.

In 1822 Seebeck discovered that a current may be produced in a closed circuit by heating a point of contact of two dissimilar metals. Thus if a piece of bismuth and a piece of antimony be soldered together, and their free ends be connected with a short-coil galvanometer, it is found that if the junction be warmed to a temperature higher than that of the rest of the circuit, a current flows whose direction across the heated point is from bismuth to antimony, the strength of the current being proportional to the excess of the temperature. If the junction is cooled below the temperature of the rest of the circuit a current in the opposite direction is generated. The electromotive force thus set up will maintain a constant current so long as the excess of temperature of the heated point is kept up, heat being all the while absorbed in order to maintain the energy of the current. Such currents are called thermo-electric currents, and the electromotive force producing them is known as thermo-electromotive force.

In 1834 Peltier discovered a phenomenon which is the converse of that discovered by Seebeck. He found that if a current of electricity from a battery be passed through a junction of dissimilar metals the junction is either heated or cooled according to the direction of the current. Thus a current which passes through a bismuth-antimony pair in the direction from bismuth to antimony absorbs heat in passing the junction of these metals, and cools it; whereas, if the current flow from antimony to bismuth across the junction, it evolves heat, and the junction rises in temperature.

This phenomenon of heating (or cooling) by a current, where it crosses the junction of two dissimilar metals (known as the "Peltier effect," to distinguish it from the ordinary heating of a circuit where it offers a resistance to the current, which is sometimes called the "Joule effect"), is utterly different from the evolution of heat in a conductor of high resistance, because (1) the Peltier effect is reversible, the current heating or cooling the junction according to its direction, whereas a current meeting with resistance in a thin wire heats it in whichever direction it moves; and (2) because the amount of heat evolved or absorbed in the Peltier effect is proportional simply to the strength of the current, not to the square of that strength as the heat of resistance is.

The complete law of the heat developed in a circuit will therefore require to take into account any Peltier effects which may exist at metal junctions in the circuit. If the letter P stands for the difference of potential due to the heating of the junction, expressed as a fraction of a volt, then the complete law of heat is

$$H = 0.24\,4\,(C^2Rt+PCt).$$

The quantity called P is also known as the coefficient of the Peltier effect; it has different values for different pairs of metals, and is numerically equal to the number of ergs of work which are the dynamical equivalent of the heat evolved at a junction of the particular metals by the passage of one ampère of electricity through the junction.

THEORY OF CONTINUOUS-CURRENT DYNAMO.

The electromotive force of a dynamo depends (1) on the number of magnetic lines N which the field-magnet forces through the armature core, passing into it from the north pole of the field-magnet on one side, and out of it into the south pole of the field-magnet on the other; (2) on the number of conducting wires or bars wound upon the armature; (3) on the speed of rotation. If we use the symbol C for the number of armature conductors counted all round the periphery, and n for the number of revolutions per second, then the electromotive force of the dynamo (in absolute units) will be given by the rule

$$E = nCN;$$

but since one volt is taken as 10^8 absolute C. G. S. units, the electromotive force as expressed in volts will be

$$E\ (\text{volts}) = nCN \div 10^8.$$

The number N of magnetic lines through the armature can be calculated by the rule for the magnetic circuit, proper allowance being made for inevitable leakage of some of the magnetic lines.

All and any of the continuous-current magneto-electric and dynamo-electric machines can be used as electromotors, the armature rotating and exerting power when a current from an independent source is led into the machine.

LAWS OF ELECTROLYSIS.

Faraday's Quantitative Laws of Electrolysis are important in their bearing on the art of depositing metals by electrolysis. They are as follows:

1. The amount of chemical action is equal at all points of a circuit.

2. The amount of an ion liberated at the electrode in a given time is proportional to the strength of the current.

3. The amount of an ion liberated at an electrode in one second is equal to the strength of the current multiplied by the "electro-chemical equivalent" of the ion.

In addition to these laws the following are important:—

1. Every electrolyte is decomposed into two portions, an anion and a cathion, which may be themselves either simple or compound. In the case of simple binary compounds, such as fused salt (Na Cl), the ions are simple elements. In other cases the products are often complicated by secondary actions. It is even possible to deposit an alloy of two metals—brass for example—from a mixture of the cyanides of zinc and of copper.

2. In binary compounds and most metallic solutions, the metal is deposited by the current where it leaves the cell, at the cathode.

3. Aqueous solutions of salt of the metals of the alkalies and alkaline earths deposit no metal, but evolve hydrogen, owing to secondary action of the metal upon the water. From strong solutions of caustic potash and soda Davy succeeded in obtaining metallic sodium and potassium, which were before unknown. If electrodes of mercury are employed, an amalgam of either of these metals is readily obtained at the cathode. The so-called ammonium-amalgam is obtained by electrolyzing a warm, strong solution of sal ammoniac between mercury electrodes.

4. Substances can be arranged in a definite series according to their electrolytic behavior; each substance on the list behaving as a cathion (or being "electro-positive") when electrolyzed from its compound with any other on the list. In such a series of oxidizable metals, potassium, sodium, zinc, etc., head the list, after which come the less oxidizable or "electro-negative" metals; then carbon, oxygen, phosphorus, iodine, chlorine, sulphur, and lastly ozone.

5. From a solution of mixed metallic salts the least electro-positive metal is deposited first, unless the current be very strong.

6. The liberated ions appear only at the electrodes.

7. For each electrolyte a minimum electromotive force is requisite, without which complete electrolysis cannot be effected.

8. If the current be of less electromotive force than the requisite minimum, electrolysis may begin, and a feeble current flow at first, but no ions will be liberated, the current being completely stopped as soon as the opposing electromotive force of polarization has risen to equality with that of the electrolyzing current.

9. There is no opposing electromotive force of polarization when electrolysis is effected from an anode of the same metal that is being deposited at the cathode. The feeblest cell will suffice to deposit copper from sulphate of copper if the anode be a copper plate.

10. Where the ions are gases, pressure affects the conditions but slightly. Under 300 atmospheres acidulated water is still electrolyzed; but in certain cases a layer of acid so dense as not to conduct collects at the anode and stops the current.

11. The chemical work done by a current in an electrolytic cell is proportional to the minimum electromotive force of polarization.

12. Although the electromotive force of polarization may exceed this minimum, the work done by the current in overcoming this surplus electromotive force will not appear as chemical work, for no more of the ion will be liberated; but it will appear as an additional quantity of heat (or "local heat") developed in the electrolytic cell.

13. Ohm's law holds good for electrolytic condition.

14. Amongst the secondary actions which may occur the following are the chief: (*a*) The ions may themselves decompose; as SO_4 into SO_3+O. (*b*) The ions may react on the electrodes; as when acidulated water is electrolyzed between zinc electrodes, no oxygen being liberated, owing to the affinity of zinc for oxygen. (*c*) The ions may be liberated in an abnormal state. Thus oxygen is frequently liberated in its allotropic condition as ozone, particularly when permanganates are electrolyzed. The "nascent" hydrogen liberated by the electrolysis of dilute acid has peculiarly active chemical properties. So also the metals are sometimes deposited abnormally; copper in a black, pulverulent film; antimony in roundish, gray masses (from the terchloride solution) which possess a curious explosive property, etc.

ELECTRIC OSMOSE.

Porret observed that if a strong current is led into certain liquids, as if to electrolyze them, a porous partition being placed between the electrodes, the current mechanically carries part of the liquid through the porous diaphragm, so that the liquid is forced up to a higher level on one side than on the other. This phenonenon, known as electric osmose, is manifest when badly conducting liquids, such as alcohol and bisulphide of carbon are used. The transfer through the diaphragm takes place in the direction of the current; that is to say, the liquid is higher about the cathode than round the anode.

THEORY OF THUNDERSTORMS.

Solids and liquids cannot be charged throughout their substance with static electricity; if charged at all, the electricity is upon their surface. But gases and vapors being composed of myriads of separate particles, can receive a bodily charge. The air in a room in which an electric machine is worked is found afterwards to be charged. The clouds are usually charged more or less with electricity, derived probably from evaporation going on at the earth's surface. The minute particles of water floating in the air being better conductors than the air itself become more highly charged. As they fall by gravitation and unite, the strength of their charges increases. Suppose eight small drops to join into one. That one will have eight times the quantitity of electricity distributed over the surface of a single sphere of twice the radius of the original drops; and its electrical potential will therefore be four times as great. Now a mass of cloud may consist of such charged spheroids, and its potential may gradually rise, therefore, by the coalescence of the drops, and the electrification at the lower surface of the cloud will become greater and greater, the surface of the earth beneath acting as a condensing plate and becoming inductively charged with the opposite kind of electrification. Presently the difference of potential becomes so great that the intervening strata of air give way under the strain, and a disruptive discharge takes place at the point where the air offers least resistance. This lightning spark, which may be more than a mile in length, discharges only the electricity that has been accumulating at the surface of the cloud, and the other parts of the cloud will now react upon the discharged portion, producing internal attractions and internal discharges. The internal actions thus set up will account for the usual appearance of a thunder cloud, that it is a well-defined flat-bottomed mass or cloud which appears at the top to be boiling or heaving up with continual movements.

ANSWERS TO INQUIRIES.

Editor Electrical Age: I am just beginning to post myself on electricity, and what limited facilities I have for acquiring electrical information are not the best. Will you please tell me what is meant by magnetic saturation; also, if a straight magnet can be made as strong magnetically as one of the horse-shoe type? D. P. L.

Lima, Ohio.

Answer.—Magnetic saturation means the maximum amount of magnetism that the magnet is capable of holding or retaining. All things being equal, the horse-shoe magnet is stronger than a straight-bar magnet, the reason of this being that the lines of force have a less air space to act through in the case of a horse-shoe magnet than in a straight-bar magnet. Air space offers resistance to the flow of the magnetic lines of force just as a small conductor offers a resistance to an electric current.

Editor Electrical Age: Please explain why, on closing an electric telegraph circuit, the current does not rise to its full strength at once, but does so gradually? J. H. G.

Tacoma, Wash.

Answer.—The current does not rise to its full value at once on account of the extra current which is induced on closing the circuit. This extra or induced current is in the opposite direction to the main current, and acts as a resistance or counter-electromotive force, which retards the development of the main current. This phenomenon is very noticeable on lines where there are many magnets (relays) in circuit. The close proximity of the windings of wire on the relay magnets magnifies this phenomenon.

WENT ON A STRIKE.

Three hundred electric wiremen in this city recently went on strike, demanding that they be paid $3.00 per day hereafter, instead of $1.50 and $2.50, which they have been getting. The men are employed in wiring buildings and houses for incandescent lights, electric bells, burglar alarms, etc., and are members of the Electric Wiremen's Union. About 200 gained their demand without trouble, and it was expected that the remaining 100, principally employed by small firms, would also succeed.

REPORTED RESIGNATION.

A rumor from Chicago has it that Mr. John P. Barrett, the city electrician and chief of the World's Fair Electrical Department, intends to resign these positions to accept an appointment as director-general of the National Board of Underwriters at New York at a salary of $50,000 per year.

NEW PUBLICATIONS.

The March and first number of *Electrical Progress and Development*, successor to *Modern Light and Heat*, of Boston, has been received. It is a neat looking and well printed journal. Mr. R. F. Ross is the editor and proprietor.

DESTRUCTIVE FIRE.

The buildings and machinery of the Altham Motor Company, in Swansea, Mass., were totally destroyed by fire on the night of April 12. Loss, $12,000 to $15,000; insurance, $5,000. In the shops was an Altham motor nearly completed, and which was expected to produce phenomenal results in the development of power.

BIG CANADIAN CONTRACT.

The Edison General Electric Company, of New York, has secured the largest electrical contract ever awarded in Canada. It was received from the syndicate which controls the Toronto and Montreal street railways, and is for 170 motors of fifteen horse-power each, which will be used in the operation of the Toronto roads. The Edison Company also expects to secure the contract for the Montreal service. The contract now awarded covers, it is believed, $1,500,000, and will probably be succeeded by others. Last year the Edison people did nearly $800,000 of the business in Canada, and in Peterboro they employ 600 men in their factories.

MAGNETIC VANE METERS.

Queen & Co., Philadelphia, Pa., have recently received an order for more than 200 magnetic vane volt and ampère meters from a large manufacturing concern, which instruments are to be installed with the light and power plants put up by this company. The transaction is especially satisfactory to the makers, as a sort of competitive examination was instituted and the magnetic vane type was adopted after the most careful comparison with other types.

NEW INCORPORATIONS.

The Lawrenceville and Schenly Park Street Railway Company, Pittsburg, Pa., incorporated April 6, with a capital stock of $100,000, to operate an electric railway. Incorporators: S. J. Wainwright, M. F. Leslie, P. C. Byrne, of Pittsburg, Pa.

Gallatin Light, Power and Railway Company, Bozeman, Mont., was incorporated April 5, with a capital stock of $150,000, for generating and using electricity for any purpose to which it is adapted. Incorporators: W. G. De Celle, S. M. Houghton, Helena, Mont.; W. H. Clark, St. Paul, Minn.; C. J. Clark, Minneapolis, Minn.

Citizens Electric Company, Green Bay, Wis., was incorporated April 8, with a capital stock of $25,000. Incorporators: J. H. Ebeling, H. W. Hart, F. B. Warren.

The Denver Electric Company, Denver, Col., was incorporated April 7, with a capital stock of $500,000. Incorporators: Job A. Cooper, Charles L. McIntosh, George W. Trinible, Absolam V. Hunter, Charles Boettcher, all of Denver, Col.

Patterson Electric Light Company, Mifflintown, Pa., incorporated April 4, with a capital stock of $3,500. Incorporators: Ezra C. Doty, John J. Patterson, Jr., B. F. Burchfield.

Mifflintown Electric Light Company, Mifflintown, Pa., incorporated April 4, with a capital stock of $2,500. Incorporators: Ezra C. Doty, John J. Patterson, Jr., B. F. Burchfield, all of Mifflintown, Pa.

The Waldron Electrical Company, Berwick, Me., incorporated April 6, with a capital stock of $50,000. Incorporators: Charles H. McIntire, Ezra C. Pratt, Jesse J. Smith, all of Lowell, Mass.

Eastern Compound Wire Company, Jersey City, N. J., incorporated April 5, with a capital stock of $100,000, to manufacture and sell electrical conductors of all sorts. Incorporators: C. Stewart, W. F. Pascoe, Easton, Pa.; C. H. McIntire, Newark, N. J.

Electrical Advertising and Display Manufacturing Company, Camden, N. J., incorporated April 4, with a capital stock of $500,000. Incorporators: B. E. Tifft, T. W. Snowder, W. A. Prissinger, J. W. Jennings, Philadelphia, Pa.; S. H. Morrison, Camden, N. J.

The Rocky Mountain Electric and Power Company, Pueblo, Col., incorporated April 4, with a capital stock of $500,000. Incorporators: Moses L. Stern, David B. Urmy, George H. Hobson, E. C. Humphrey, George W. Robinson, all of Pueblo, Col.

The Metropolis Water Co., Metropolis City, Ill., incorporated April 11, with a capital stock of $5,000. Among other things it will furnish electric light heat and power. Incorporators: George C. Morgan Arthur M. Morgan, Henry A. Gardner.

Interior Wiring and Fixture Co., New York, N. Y., incorporated April 7, with a capital stock of $20,000, to wire and equip for electric lighting. Incorporators: Phil. H. Klein, Charles F. Duffy, James F. Doyle, all of New York, N. Y.

Independent Plumbing and Electrical Co., San Antonio, Tex., incorporated April 5, with a capital stock of $10,000. Incorporators: William Schuwirth, Ad. Wagner, John Zadich.

The Hart & Cooley Manufacturing Co., Chicago, Ill., incorporated April 9, with a capital stock of $40,000. Among other things it will do annealing and electro-plating. Incorporators: Norman P. Cooley, Howard S. Hart, George P. Hart.

The Marseilles Electric Street Railway Co., Marseilles, Ill., incorporated April 9, with a capital stock of $12,000. Incorporators: Frank Montgomery, Richard Hughes, S. J. Gum.

The Bryan Heights Railway Company, Bryan, Tex., has been incorporated with a capital stock of $25,000, to operate a street railway by electric, steam or horse-power. Incorporators: J. P. Bryan, Fred. S. Robbins, Guy M. Bryan, Jr.

The Omaha Thomson-Houston Electric Light Company, Omaha, Neb., was incorporated March 31, with a capital stock of $1,100,000. Incorporators: E. S. Wiley, H. E. Chubbuck, John L. Martin, Omaha, Neb.

The Palestine Water and Power Company, Palestine, Tex., has been incorporated with a capital stock of $100,000, to supply water, manufacture electricity and furnish the same for light, heat and power. Incorporators: Carlos S. Greeley, Dwight Treadway, Melvin L. Gray, Samuel G. Kennedy, N. Oscar Gray, St. Louis, Mo.

Fulton and Montgomery County Electric Railroad Company, Johnstown, N. Y., was incorporated March 28, with a capital stock of $75,000. Incorporators: Robert Wemple, Fultonville, N. Y.; M. B. Northrup, Johnstown, N. Y.; J. E. Sitterly, Fonda, N. Y.

The Winona Electric Light Company, Winona, Minn. Incorporated April 12, with a capital stock of $50,000. Incorporators: T. T. Hayden, J. H. Jenkins, R. T. Dond, of Winona, Minn.; C. L. Bonner, of Minneapolis, Minn.

The Egg Harbor City Water, Electric Light and Power Co., of New Jersey, Camden, N. J. Incorporated April 11, with a capital stock of $30,000. Incorporators: W. W. Taylor, J. M. Mays, W. R. Cason, Philadelphia, Pa.

THE LARGEST TURBINE.

The James Leffel & Company are building at their works in Springfield, O., what, it is believed, will be the largest turbine ever manufactured, either in this country or abroad.

It measures about fifteen feet in diameter, and the height of its casing, with its surmounted iron bridge-tree arrangement for carrying a huge pair of gears, and the short horizontal shaft, will reach twenty-two feet. The wheel will be of the strongest and most substantial construction, and condensed in the smallest and most practical space. It will give, when in operation, 600 H. P., under a comparatively low head. It is expected to weigh, when completed and ready for shipment, forty-five tons, and will require four cars for its transportation. This wheel is intended to drive a large lumbering and house-furnishing manufacturing plant.

The James Leffel & Company have recently greatly enlarged and improved their works; the buildings have been extended, and extensive additions have been made in several departments, including new and heavy machinery for handling the heaviest class of work in the company's line.

They have very nearly completed the shipment of nineteen large James Leffel water-wheels (five carloads), sold to one company in Wisconsin, to drive a mammoth wood-pulp and paper mill. This transaction comprises the largest order that was ever given for water-wheels, and was obtained, we are informed, under exceedingly close competition, at a handsomer figure than was proposed by others.

DETROIT NOTES.

The Electrical Fibre Carbon Company, manufacturers of carbon specialties, 1228 to 1234 Michigan avenue, Detroit, Mich., manufactures and handles various specialties of which the following are a few: Carbon plugs, for the production of aluminum; round, square and fluted carbons; solid, hollow and cored commutator brushes; carbon cups; carbon buttons; rheostat carbons of any resistance, and all requisites for the manufacture of primary batteries. This firm makes a specialty of the manufacture of primary carbon batteries, of which it has different styles, viz.: the "Eureka," "Paragon," "La Grand," "Unique" and "Referee"—the latter two having screw-cap tops. The company is having a great run on these batteries, having made 68 shipments last week, the orders for which were from the principal cities of the United States. In addition to the above orders it filled one from Russia.

Mr. Robert B. Watson, late travelling salesman for the Detroit Electrical Works, has recently been appointed to the position of vice-president and general manager of the same company. It would be hard to find a better man for the position. Mr. Watson is a thorough gentleman, good business man, and has a large acquaintance among the electrical people.

N. D. W.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, April 16, 1892.

The Clark Electric Company, 192 Broadway, has issued an illustrated and descriptive pamphlet of its system of arc-lighting, which it claims to be the cheapest illumination in the world.

M. Alexander von Bobo, representative of Siemens & Halske, Berlin, Germany, will on May 1 next remove his office from the Times Building, this city, to the Monadnock Block, Chicago, Ill.

The Fire Commissioners of this city have made a contract with the Standard Underground Cable Company, of Pittsburg, for placing fire alarm electrical conductors underground at a cost of $63,895.38.

Mr. H. W. Seller, of the Seller Water Tube Boiler Co., 136 Liberty street, has secured an order for two boilers from the United States Naval Observatory, Georgetown Heights, Washington, D. C., for running the electric light plant. This order was secured in a competitive bid.

McLeod, Ward & Co., 91 Liberty Street, have moved to the first floor of the same building. They have enlarged their factory facilities, and are making a specialty of ventilating fans, electric motors and blowers for factories and large rooms. They also make ceiling and column fans.

B. W. Payne & Sons, 45 Dey street, are making preparations to move on May 1 to 41 Dey street, where they have secured more commodious quarters. They will occupy the entire front portion of the main floor and intend to have an engine running electric lights in the show window. A full line of their various sizes of engines will be exhibited on the floor.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
American Dist. Tel., N. Y.	3,825,000	100 00	60 00
American Engineering Co., N.Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	85 00
Ashley Engineering Co	200,000	10 00	6 00
Bell Telephone	17,000,000	100 00	199 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	110 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	14 50
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	155 50
Cons. Gas Co., N. Y.	35,430,000	100 00	114 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	81 00
Edison General	15,000,000	100 00	100 75
Edison General Receipts		100 00	10 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N.Y.	50,000	50 00	45 00
Hickory Electric Co., N. C.	12,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	20 50
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	93 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N.Y.	500,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	96 00
North American Railway Co	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	55 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*98
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	80
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	60 00
Thomson-Houston pref	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston	500,000		*100
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Western Union	86,188,852	100 00	90 57
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	28 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	43 00
Westinghouse Ass. Rects		50 00	16 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Just at the moment, with the exception of less than half a dozen securities, probably the dullest spot in the United States is the New York Stock Exchange. In swinging around the circle something must of necessity be on top; new stocks are created frequently or combinations perfected by which a new name is given to an old stock and a blind pool formed of more or less magnitude; the new baby is discovered all of a sudden, its merits extolled, and the price goes way up in the air before it is fairly christened; then the possibilities of its immediate future are mysteriously explained by the tape-chaser, and thus proving the old saying that "every little helps," dealings increase. The public is loaded, and the newcomer is either absorbed by a standard corporation or literally abandoned by the market, in which case it sinks into utter oblivion, leaving the lambs to hold their purchases with no possible chance of realizing anything in reason. Meanwhile new enterprises are whipped into shape. One of those to have its day before the end of the current year, and with the extraordinary good chances of staying, is Tin. The miners have found it from Idaho and Dakota clear down into Mexico; they have learned more of its nature in the past year than was known before, and being found, more capital stands ready to develop it as is shown by the following list of tin-plate works in process of construction, or running in whole or part in the United States: The American Tin and Terne Plate Company, Philadelphia, Pa.; American Tin Plate Company, Elwood, Ind.; Anderson Tin Plate Company, Anderson, Ind.; Apollo Iron and Steel Company, Apollo, Pa.; Blairsville Rolling Mill and Tin Plate Company, Blairsville, Pa.; The Britton Rolling Mill Company, Cleveland, Ohio; Cincinnati Corrugated Company, Piqua, Ohio; Coates & Co., Locust Point, Baltimore, Md.; Cleveland Tin Plate Company, Cleveland, Ohio; Columbia Tin Plate Company, Piqua, Ohio; Falcon Iron and Nail Company, Niles, Ohio; Fleming & Hamilton, Pittsburg, Pa.; Griffiths & Cadwallader, Twenty-third ward, Pittsburg, Pa.; P. H. Laufman & Co., Apollo, Pa.; Marshall Brothers & Co., Philadelphia, Pa.; Matthai, Ingram & Co., Baltimore, Md.; McKinley Tin Plate Company, Limited, Philadelphia, Pa.; New Philadelphia Iron and Steel Company, New Philadelphia, Ohio; Norton Brothers, Chicago, Ill.; Pioneer Tin Plate Company, Joliet, Ill.; Pittsburg Electro-Plating Company, Limited, Pittsburg, Pa.; Pittsburg Tin Plate Works, Strawbridge & Beaver, Kensington, Pa.; Record Manufacturing Company, Cincinnati, Ohio; W. T. Simpson, Cincinnati, Ohio; Somerton Tin Plate Works, Brooklyn, N. Y.; Strauss, J. E., Philadelphia, Pa.; Scott, J. B., & Co., Pittsburg, Pa; Summers Brothers & Co., Struthers, Ohio; N. & G. Taylor, Philadelphia, Pa.; Union Tin and Terne Plate Company, Allegheny Pa.; United States Iron and Tin Plate Manufacturing Company, Demmler, Pa.; Wallace, Banfield & Co., Irondale, Ohio; Western Tin Plate Company, Joliet, Ill. When in full operation these works will have a capacity of 50,000 boxes per week.

I had the pleasure of an interview with an expert who has examined for capitalists several of the mines, and he — a man I have known intimately for nearly thirty years — assured me that there was sufficient tin being developed to supply the whole market, the lack of experienced management at the mines being the only trouble. The stocks are all low, and now is the time to invest in as much as you can afford to law away until fall or next year.

Notwithstanding the great desire of the investing public to know before the long summer stagnation sets in what the result of the consolidation of the Thomson-Houston Electric Company with other large interests will be, and under what guise or disguise they will be allowed to participate, the company met in solemn conclave in Middletown, Conn., on the 11th inst. and elected the following Board of Directors: T. J. Coolidge, S. E. Peabody, E. Griffin, S. A. Barton, C. H. Newhall, B. S. Spinney, J. L. Smith, H. A. Pervear and C. A. Coffin. It would have been exceedingly satisfactory to the thousands of investors all over the country who are interested either in the parent company, subcompanies or company-customers of the Thomson-Houston corporation to have had a full report of this (probably their last) annual meeting as a separate company in the financial column of the Electrical Age. Publicity is strength, aided by conscious knowledge; it holds a bond firm, be it a general government or a business corporation, and I long for the day when a silent mentor of the press shall record, condense and publish without fear or favor, the uncolored facts as stated by the chairmen of public companies at their annual meetings. I have heard this publicity approved of by such men as Sir Edward Watkin, Sir John Lubbock and a host of equally well-known and accepted chairmen, when presiding at their several meetings. It gives strength to your enterprise, and through the press only can you reach the people. If Mr. Gould's name were dropped by the newspapers for ninety days he would be forgotten and correspondingly happy. The Thomson-Houston Company did an immense business during the past year, amounting to $10,340,000. The company's assets are $20,263,417. The capital stock amounted to $10,000,000, surplus $6,022,333, profits $2,760,780. The company claims 2,364 miles of street railway run by its electric system. When we look back and remember that it was but yesterday that the first electric motor was attached to a car, and that a single company has accomplished so much with many competitors, we wonder how men can keep their surplus money in the bank practically idle. There are bushels of unimpeachable electric bonds in this market to-day seeking capital, and which pay from 5 to 8 per cent., and equally safe stock which pays 6 to 8 per cent., with certain improvement year by year.

PERSONALS.

Mr. E. J. Hall, vice-president of the Bell Telephone Co., of Buffalo, N. Y., is taking a rest at Nassau, N. P., accompanied by his family.

W. A. Giles, contracting engineer, of Pittsburg, Pa., was in town last week.

WESTERN NOTES.

Mr. W. R. Mason has resigned the position as president and general manager of the Electric Merchandise Company, of Chicago, and Mr. W. L. Adams has resigned as secretary and treasurer of the same company. Mr. Mason has opened a temporary office until May 1 at 617-619 Pullman Building, Chicago.

ELECTION.

The annual meeting of the Electric Club, New York, will be held at the Club's quarters April 21, at which officers and a board of managers will be elected for the ensuing year.

A franchise has been granted to Messrs. J. H. Wilson and G. C. Rogan, of Mobile, Ala., for the construction and operation of an electric-light plant in that city. Work will be commenced immediately after a meeting, which will be held on April 23.

The Wilmot & Hobbs Mfg Co., Bridgeport, Conn., manufactures a very unique rule out of the cold rolled etched steel made by it. On the back of it will be found several interesting rules for figuring the weight of sheet steel, weight of sheet brass, weight of sheet copper, wire gauges, etc.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

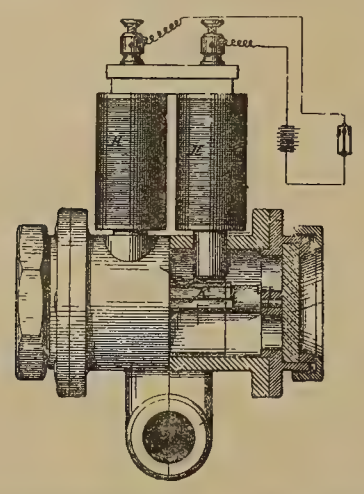
Issued April 12, 1892.

472,524. Motor for Propelling Cars. Walter L. Davis, Chicago, Ill. Filed May 16, 1891.

472,529. Insulator-Support. Dennis Doren, New York, N. Y. Filed July 20, 1891.

472,579. Electro-Magnetic Valve-Controller. Olof E. Lundstedt, Brooklyn, N. Y., assignor, by mesne assignments, to the New York Electrical Device Company, of Virginia. Filed Aug. 6, 1890. Renewed Oct. 14, 1891.

472,610. Electric Switch. Lucius T. Stanley, Brooklyn, N. Y., assignor to the Cutter Electric and Manufacturing Company, Philadelphia, Pa. Filed Nov. 7, 1890.



472,579.—ELECTRO-MAGNETIC VALVE-CONTROLLER.

472,611. Flexible Supporting-Arm for Electric Lamps. Lucius T. Stanley, Brooklyn, N. Y., assignor to the Cutter Electric and Manufacturing Company, Philadelphia, Pa. Filed Oct. 17, 1891.

472,623. Electric-Lighting System. John M. Lockwood, San Francisco, Cal. Filed June 22, 1891.

472,628. Dynamo-Electric Machine. Lazarus S. M. Pyke and Harry T. Barnett, London, England, assignors to said Pyke and Edward Stephen Harris, same place. Filed Feb. 5, 1892. Patented in England.

472,634. Bracket for Electric Heaters. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed June 26, 1891.

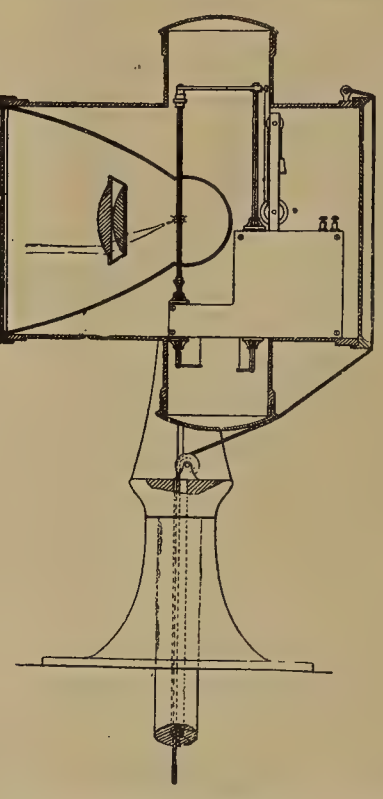
472,643. Electric Conductor. William R. Patterson, Chicago, Ill. Filed Aug. 31, 1891.

472,708. Electric Motor or Generator. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 12, 1891.

472,721. Electric Search-Light. Barton B. Ward, New York, N. Y., assignor, by mesne assignments, to the Scott Electrical Manufacturing Company, of New Jersey. Filed Jan. 13, 1890.

472,747. Electric-Arc Lamp. Royal E. Ball, New York, N. Y. Filed Oct. 10, 1891.

472,772. Circuit for Multiple-Switchboard Systems of Telephone-Exchanges. John A. Seely, New York, N. Y, and Charles E. Scribner, Chicago,



472,721.—ELECTRIC SEARCH-LIGHT.

Ill., assignors to the Western Electric Company, Chicago, Ill. Filed Nov. 15, 1886.

472,784. Safety Attachment for Overhead Electric Wires. Charles D. Brown, Minneapolis, Minn. Filed Jan. 8, 1891.

472,800. Incandescent Electric Lamp. George C. Baillard, New York, N. Y. Filed Sept. 22, 1891.

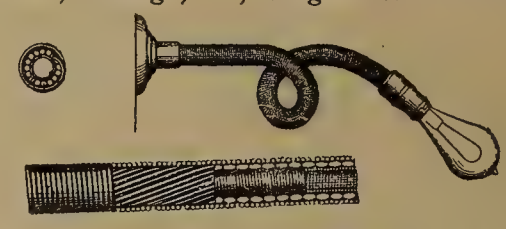
472,801. Incandescent Electric Lamp. George C. Baillard, New York, N. Y. Filed Sept. 22, 1891.

472,909. Electric Elevator. Charles R. Pratt, New York, N. Y. Filed April 8, 1891.

472,933. Joint for Electric Conductors. Thomas F. O'Connor, New York, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Jan. 2, 1892.

472,935. Arc-Light Hanger. Charles A. Pfluger, Chicago, Ill., assignor, by direct and mesne assignments, to the Standard Electric Company, of Illinois. Filed May 11, 1891.

472,943. Dynamo-Electric Machine. George E. Dorman, Chicago, Ill., assignor to the Standard



472,611.—FLEXIBLE SUPPORTING-ARM FOR ELECTRIC LAMPS.

Electric Company, of Illinois. Filed Dec. 17, 1890. Patented in England.

472,947. Cable-Rack. William M. Goodridge, Highland Park, assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 30, 1888.

472,956. Canopy Telephone-Exchange Switchboard. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 22, 1889.

472,968. Electric Surgical Instrument. Stephen R. Bradley, Nyack, N. Y. Filed Feb. 4, 1892.

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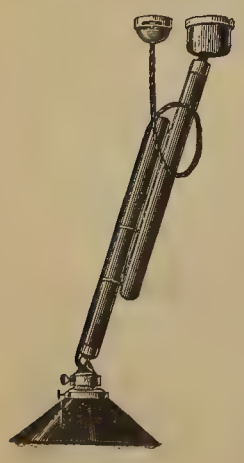
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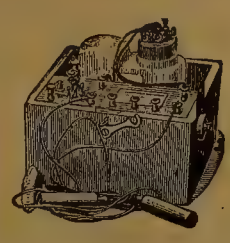
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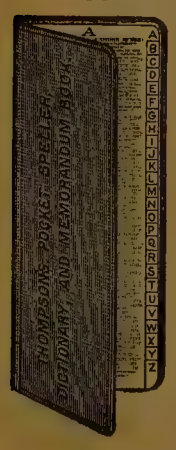


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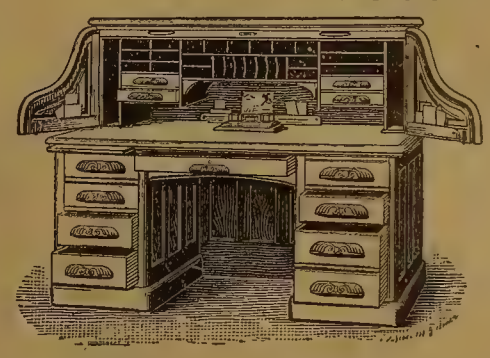
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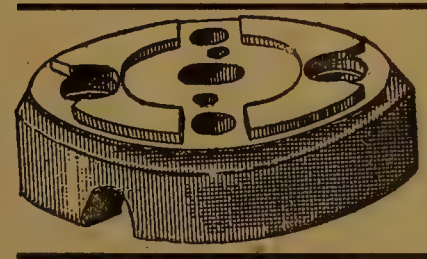
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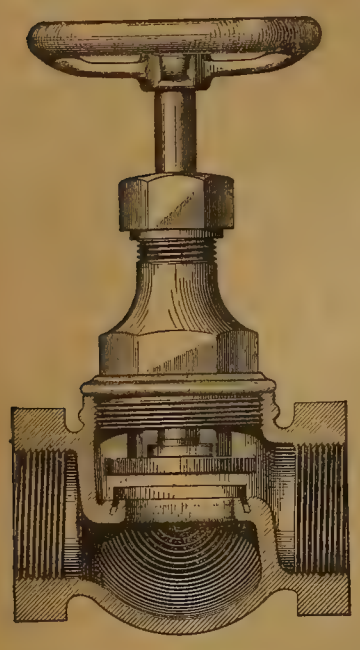
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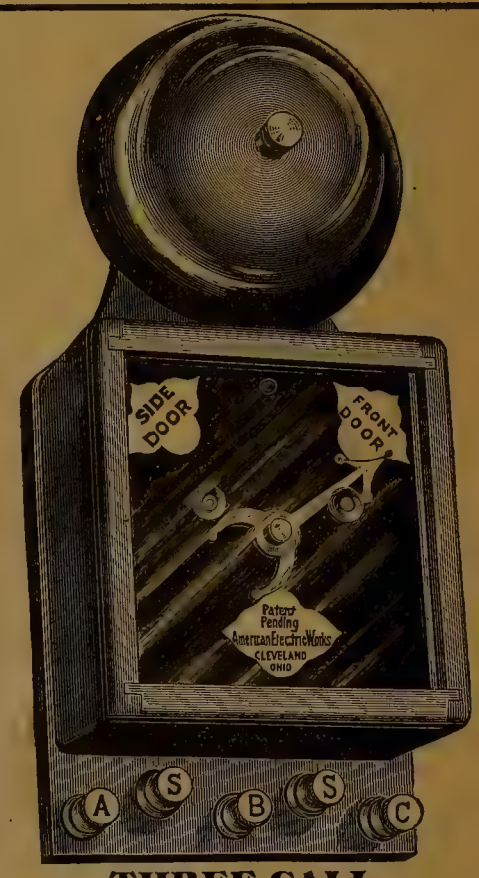
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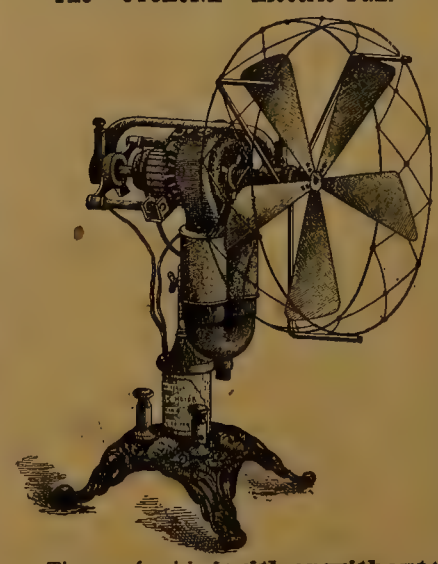
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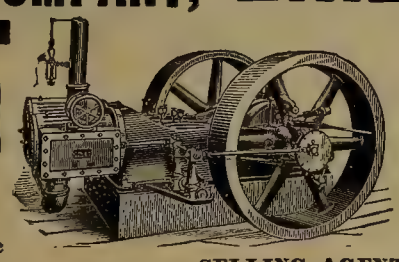
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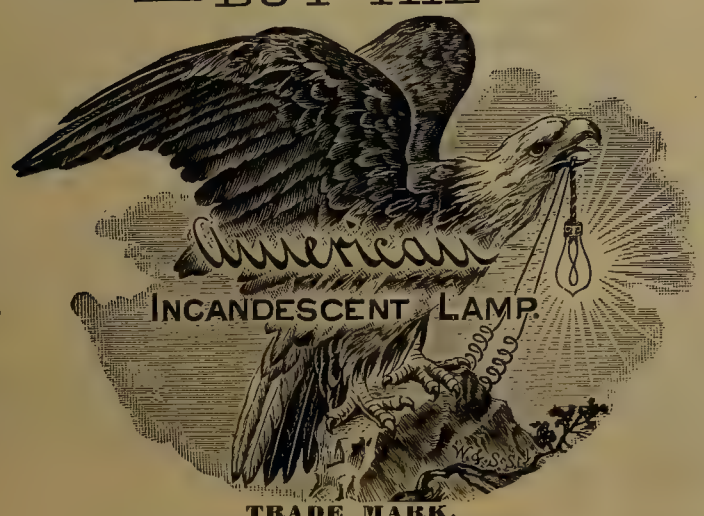
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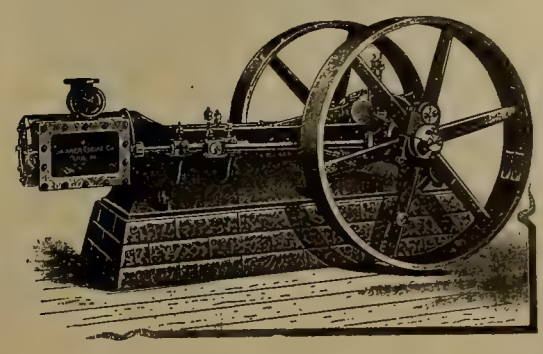
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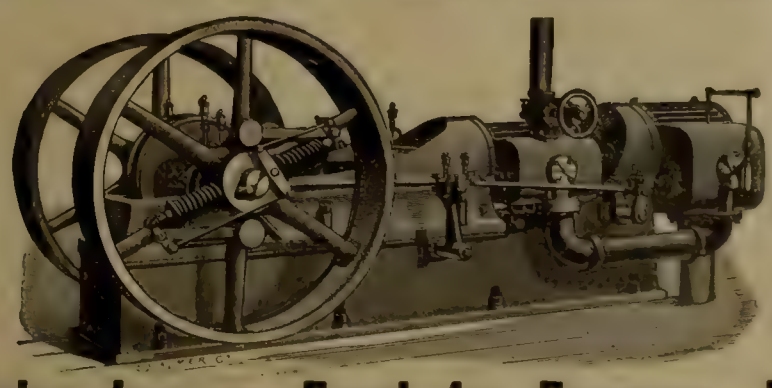


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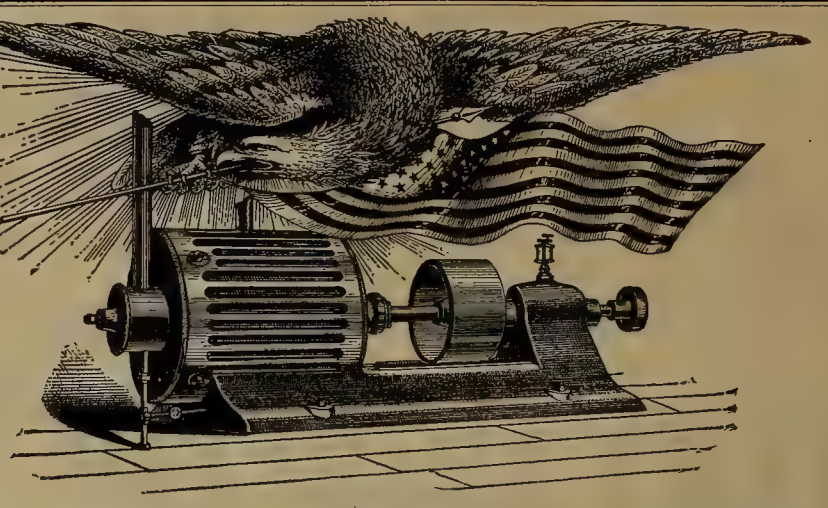
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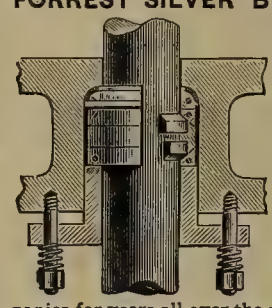
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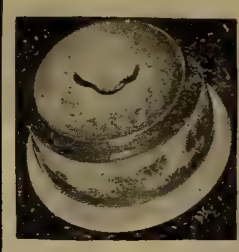
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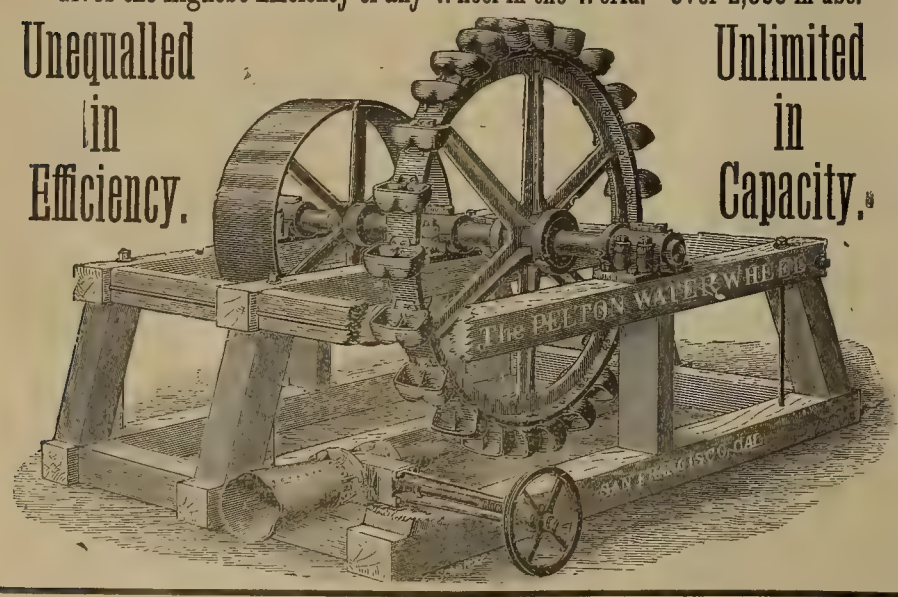
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San Francisco, Cal., U. S. A.
225 CENTRAL BUILDING,
Liberty and West Sts., New York, U. S. A.

PELTON WATER MOTORS.

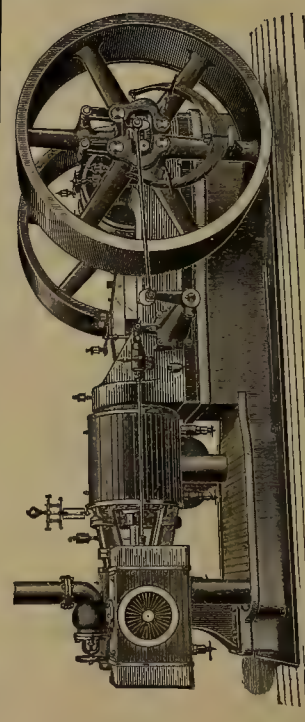
Varying from the fraction of 1 up to 100 horse-power unequalled for all light-running machinery. Warranted to develop a given amount of power with one-half the water required by any other.

☞ Send for Motor Circular. Address as above.

Deliveries made from San Francisco or New York, as may afford the most favorable freight rates.

It having come to the notice of the undersigned that their patent rights are being infringed upon, intending purchasers are hereby warned that all such infringements will be vigorously prosecuted.

Signed, THE PELTON WATER WHEEL CO.



ELECTRICAL ENGINEERING AND CONTRACTING

Metropolitan Electrical Corporation,
415-16-17 Whitney Bldg. Kansas City, Mo.

Plans, Specifications and Supervision furnished for complete steam and electrical equipment. Agent McIntosh & Seymour compound and single-cylinder railway and electric light engines. Correspondence solicited.

HARRISBURG FOUNDRY AND MACHINE WORKS,

HARRISBURG, PA.,

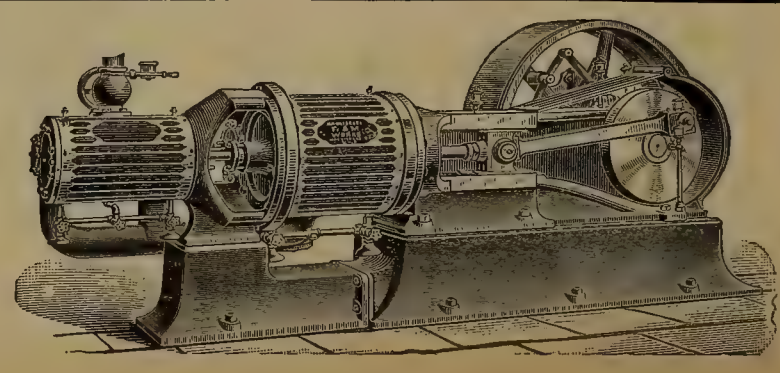
MANUFACTURERS OF THE

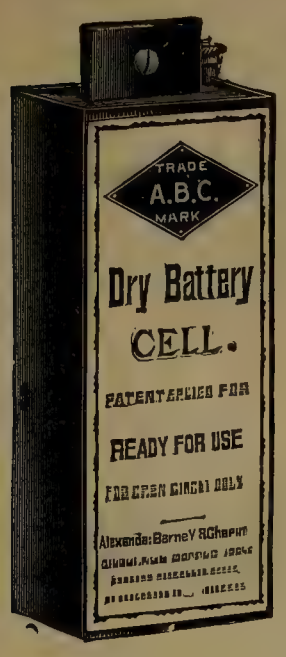
HARRISBURG SIMPLE, TANDEM AND CROSS COMPOUND ENGINES,

IDE AND IDEAL.

BOILERS and Complete Steam Power Plants.

SELLING AGENTS: *W. R. FLEMING & CO., 174 Fulton Street, New York.*
POST ENGINEERING CO., 70 Kilby Street, Boston.
FRANK JOHNSTON, 24 S. 7th St. (Builders' Exchange), Philadelphia.





THE "A. B. C." DRY BATTERY

Has no Equal for

STRENGTH AND LIFE.

Size 4 x 2¼ x 1¼ in., - - - -	$0.75
" 6¾ x 2¾ x 2¼ in., - - - -	.85
" 6¾ x 3¾ in. (cylindrical), - -	1.25

DISCOUNT FOR QUANTITIES.

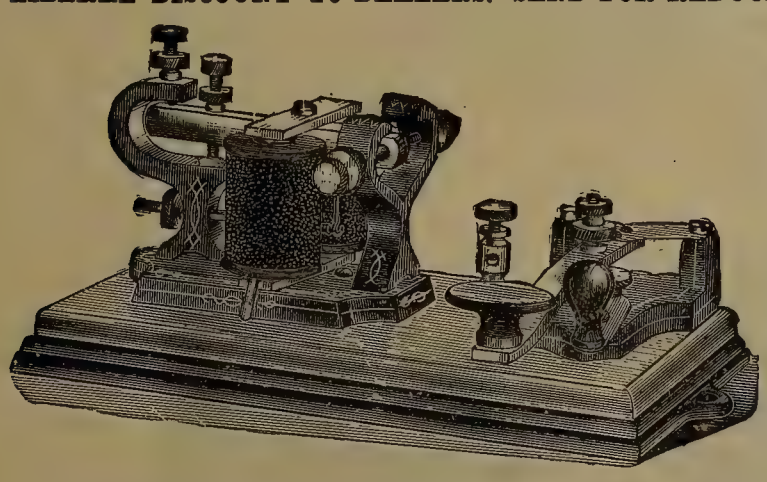
ALEXANDER, BARNEY & CHAPIN,

GENERAL ELECTRICAL SUPPLIES,

Telephone Building,

20 Cortlandt St., NEW YORK.

LIBERAL DISCOUNT TO DEALERS. SEND FOR REDUCED PRICE LIST.



No. 2 O.K. Outfit

With Sounder & Key

On same base, or separate, as ordered.

Complete Outfit,	$3.75
Sounder, - -	2.25
Key, - - -	1.00
Sounder and Key on one Base, -	3.25

The above Outfit consists of a beautiful Sounder wound to 20 ohms, and one of my unrivalled Nickel-Plated, Legless, Steel Lever Keys; One Cell 5 x 7 Battery (or 6 x 8 Battery, 10 cents extra); 15 feet Insulated Office Wire, 1 lb. Vitriol, 1 Instruction Book, all safely packed and will be shipped on receipt of price, or sent C. O. D., subject to inspection, if you send me $1.00 with order. State whether you wish Key and Sounder on same Base or separate. Write your address plain and full, also state by what Express Co. wish goods shipped. Address

A. B. LYMAN & CO., 34 and 36 South Water Street, Cleveland, Ohio.

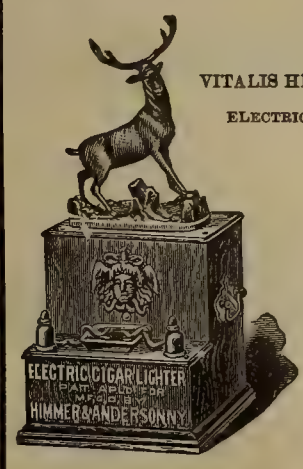
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OUR PROCESSES — WE DO FINE PRESS WORK

We have every facility Engraving, Electtrotyping and Printing, and will Consider it a Favor if We are Permitted to Estimate on any Work of this Kind.



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DR. ANDERSON,
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HIMMER & ANDERSON
DRY BATTERY COMPANY,
123 CHAMBERS ST., **NEW YORK.**

Manufacturers of Dry Galvanic Cells.

The Only Battery That Has Ever Received An Award.

1.8 volts E. M. F. 14 ampere. ohms int resist.

Electric CLOCKS and NOVELTIES.



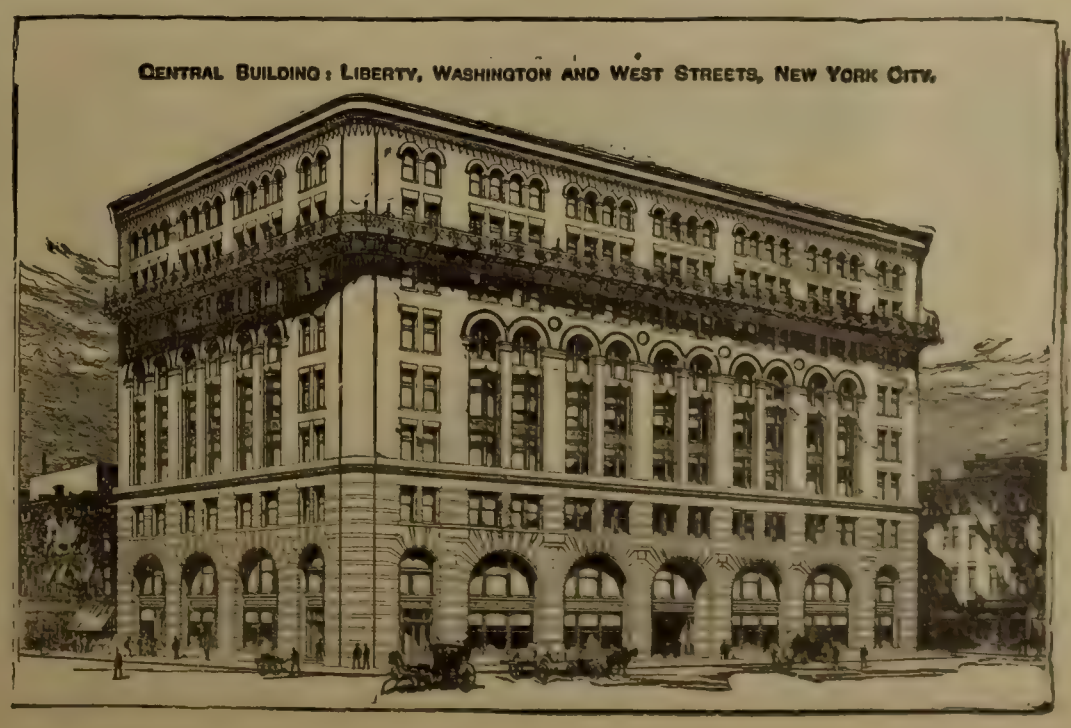
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RESERVED FOR

THE EDISON LA LANDE BATTERY.

A few desirable offices can now be let in this modern fire-proof building.

All modern improvements. Five Otis Elevators, Steam Heat and Electric Light. Sanitary conditions perfect. No dark rooms.



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CENTRAL BUILDING

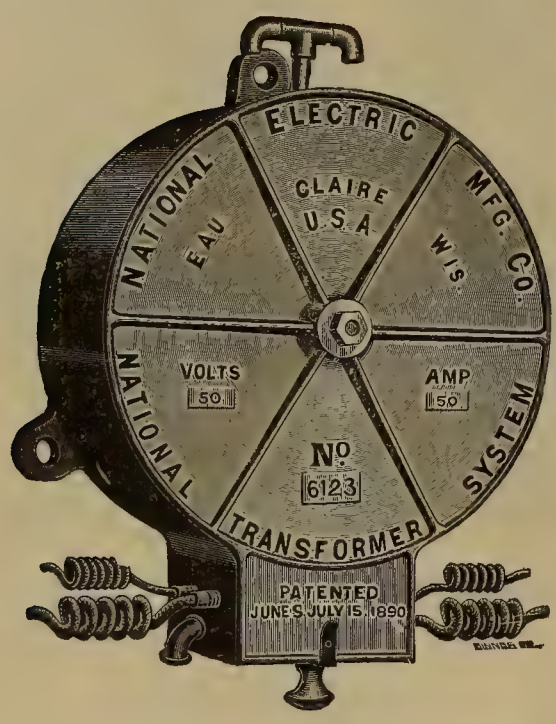
NEW YORK.

THE NATIONAL TRANSFORMER SYSTEM

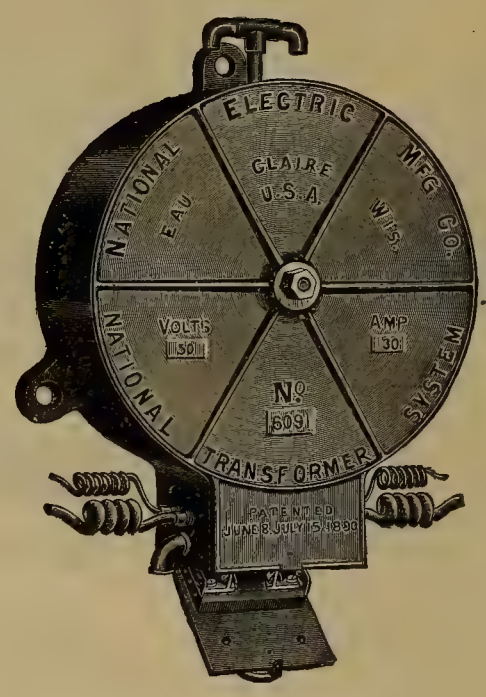
Of Incandescent Lighting.

The Most Efficient, Simple and Reliable Lighting System

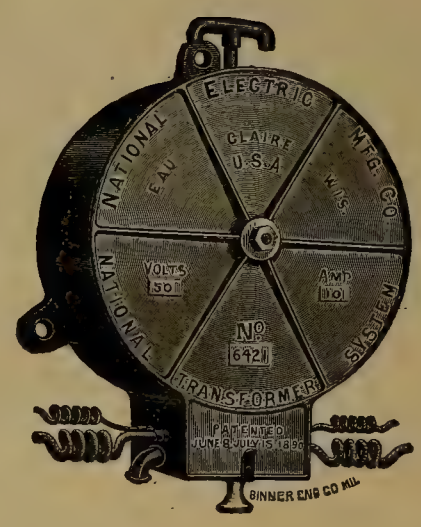
ON THE MARKET.



50-Light Transformer.
In Circuit.



30-Light Transformer.
Circuit Broken.



10-Light Transformer.
In Circuit.

THE NATIONAL SAFETY TRANSFORMER.

COMPLETE

CENTRAL STATION EQUIPMENTS

—FOR—

LIGHT OR POWER

DISTRIBUTION.

OUR APPARATUS IS OF THE

HIGHEST EFFICIENCY,

Mechanically and Electrically.

WE GUARANTEE ITS OPERATION AND PROTECT OUR CUSTOMERS.

COMPLETE,

DIRECT-CURRENT SYSTEM

—FOR—

ISOLATED

LIGHTING.

National Electric Manufacturing Co., Eau Claire, Wis.

AGENTS:

NEW YORK, N. Y., - Nat. Electric Mfg. & Const. Co., Elect'l Exchange Bldg.	ST. PAUL, MINN., - The Electrical Eegineering & Supply Co
WASHINGTON, D. C., - L. N. Cox, 16 Fifth St., S. E.	DETROIT, MICH., - Commercial Electric Co.
PHILADELPHIA, PA., - Penna. Electric Engineering Co., Penn. Mutual Bldg.	DENVER, COL., - The Mountain Electric Co.
LINCOLN, NEB., - Lincoln Electrical Mfg. & Supply Co.	WINNEPEG, MAN., - Simpson-Davis Electrical Construction Co.
SEATTLE, WASH., - Chas. H. Baker & Co.	SAN FRANCISCO, CAL., - National Elecric al Development Co.
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NEW ORLEANS, LA., - Enterprise Construction Co.

Competitive Spring Price-List.

Sawyer-Man Style Porcelain Main Line Cut-Outs,	10	Ampere,	$0.12
" " " " " " "	25	"	0.18
" " " " " " "	50	"	0.25
" " " " " " "	100	"	0.40
" " " " Branch "	10	"	0.12
" " " " " " "	25	"	0.20
" " " " " " "	50	"	0.40
No. 1563. Edison Style Main Line Covered "	75	"	0.50
" 1463. " " " " " "	30	"	0.25
" 1487. " " Branch " "	50	"	0.50
" 2835. " " " " "	30	"	0.30
Schaefer Style Ceiling Cut-Outs (Porcelain).			0.12
Plain Rosettes		"	0.07
Horseshoe Cut-Outs		"	0.13

Sockets and Switches Correspondingly Low.

Orders Promptly Filled. Correspondence Solicited.

THE STAR ELECTRIX COMPANY,

639, 641, 643 North Broad Street,

PHILADELPHIA, PA.

NOVELTY ELECTRIC CO., 50, 52, 54 N. Fourth St., Philadelphia.



FRONT.

These cuts represent in full size, the two sides of our recently perfected **PATENT POCKET WIRE GUAGE.** It is finely finished and graduated with extreme accuracy.

Electricians, Linemen and all having occasion to use wire for any electrical purpose, will find this guage invaluable.

PRICE, $1.00.

HOW TO USE IT PLACE the wire in the V-shaped opening between the movable rm and the edge of the Guage, and move the arm around until the wire is tightly bound against the edge of the Guage. The short square shoulder near the centre of the arm, and its radial line will indicate:

1st.—The American (B. & S.) guage of the wire.

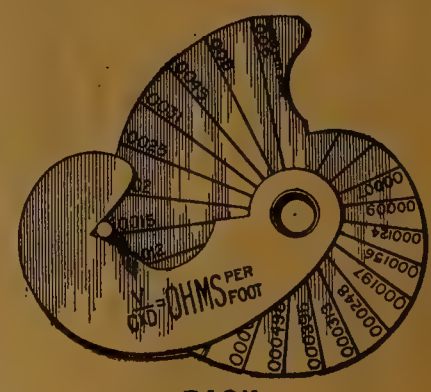
2d.—The Safe Current the wire will carry in amperes.

3d.—The Ohms resistance per foot of copper wire, from which the resistance of iron or German silver wire can be found.

4th.—The number of lamps a wire will carry

Having this valuable information, by formula as stamped on the arm, the size of wire required to carry any number of lamps, any distance, with any loss, can be readily obtained, and by other simple formula, many problems that are met in erecting and maintaining Electric Lighting Systems can be solved.

If you are in want of any description of Electric Work or Supplies, favor us with your orders. As large manufacturers of our own extensive line of Electrical goods, and as Agents for other Electrical manufacturers of valuable specialties, we are prepared at all times to offer the best Electrical goods in the market at the lowest going prices.



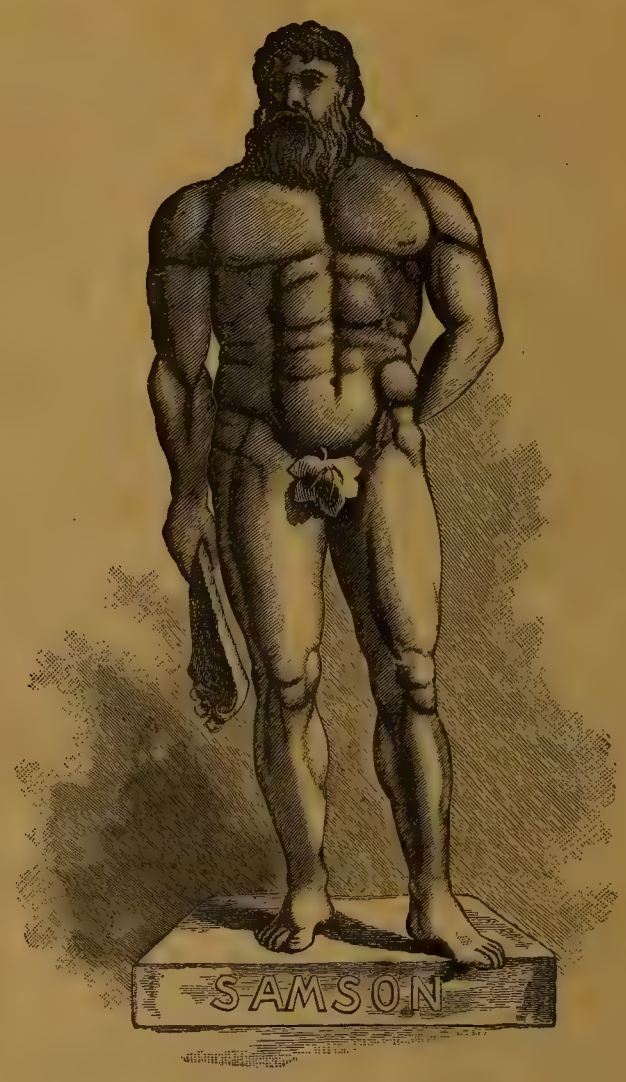
BACK.

IT IS INDEED A SAMSON IN STRENGTH!

Practical Electricians Enthusiastically Adopt The SAMSON.

No higher praise could be accorded it than the **continued and constantly increasing orders** received from those who early ventured to try it. Indeed, it is now quite the conservative thing to use the SAMSON Battery.

After all, this selection of batteries **is simply a matter of dollars and cents.** As for instance, if one style of cell costs 65 cents, and the SAMSON costs 75 cents, but lasts **three times as long,** and requires only half the care and attention, you don't need higher mathematics to help you to determine which it will pay you best to use.



'AND YET SOME HESITATE!

As there are yet some battery users who hesitate to use the great SAMSON Cell, and as we would benefit them all in our power, we continue to publish **fresh evidences of its great superiority over all other open-circuit cells.** If we could afford it, we would ship each doubter a dozen cells gratis. Indeed, we have thought perhaps this would be the cheapest way to secure their patronage, since all who once try **the SAMSON continue to use it.** We will consider the matter, though doubtless the surest way to obtain the SAMSON will be to **send in your orders,** as hundreds of others are wisely doing, to

RESPECTFULLY,

The ELECTRIC GAS LIGHTING COMPANY,

195 Devonshire Street, BOSTON, MASS.

E. P. Gleason Manufacturing Co.,

181-189 Mercer St., New York, N. Y.

MANUFACTURERS —OF— CUT-OUTS.



HOLDERS, FITTINGS, GLOBES AND SHADES.





Reflectors and General Appliances —FOR— ARC AND INCANDESCENT ELECTRIC LIGHTING.

SEND FOR CATALOGUE E.



New Combined Pull Switch and Ceiling Pendant Cut-Out.

A SLIGHT PULL ON THE CORD TURNS ON AND OFF THE LIGHT.

Simple, Neat and Thoroughly Reliable.

No. 670.

Interior Conduit and Insulation Co.,

EDWD. H. JOHNSON, Pres.

42 and 44 Broad Street, NEW YORK.

An Old Friend in a New Dress.



The more you see of the "Ward" Lamp the more you become interested. Mechanical and electrical perfection. It is all that. Are you aware that we are combining these features with a line of ornamental lamps that surpass in beauty of finish and design any arc lamp ever offered to the trade, and equal to the handsomest electrical fixtures manufactured?

You need such lamps for interior lighting and decoration. They increase the output of your Station and delight the consumer. How about prosperity? Of course you're through with experiments. Why need you injure your business and add personal worry by the purchase of any other style of lamps which are so imperfect that they will have to be changed every month and brought out as a "New Lamp."



The "Ward" Lamp, in all cases, is specially designed to meet the varying conditions demanded, and had passed the experimental stage when first offered to the public by this Company. The thousands of "Ward" Lamps in use prove it to be the only lamp that works satisfactorily on an incandescent circuit.



SPECIAL APPLICATIONS:

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THEATRICAL

SEARCH LAMPS

Electric Construction & Supply Co.

PHENIX BUILDING, CHICAGO

TELEPHONE BUILDING, NEW YORK,

ORGANIZED 1881.

A. L. BOGART'S

Multiple Electric Gas Lighting Specialties.

THE

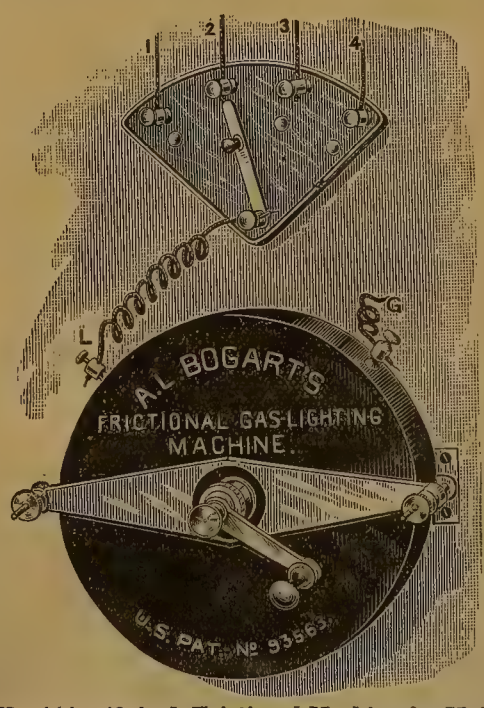
Only Practical and Efficient Gas Lighting Apparatus, as Demonstrated by its universal use in Every American City, in Theatres, Churches, Public and Private Halls.

Architects Demand it. Theatrical Gas Engineers will Use No Other.

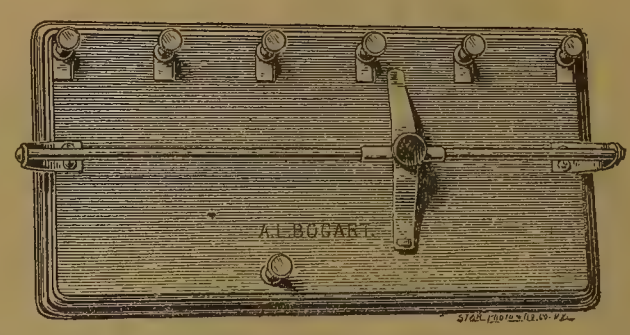
Do not be imposed upon by TRASHY and FEEBLE IMITATIONS OF A STANDARD ARTICLE under the COSTLY GUISE OF CHEAPNESS.



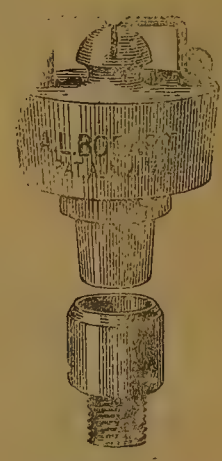
No. 18. Multiple Porcelain Burner.



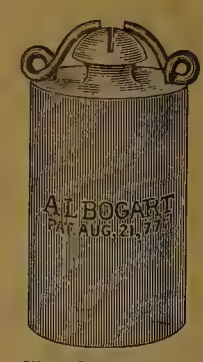
No. 111. 12-inch Frictional Machine for Multiple Lightning and No. 106, Four-Point Switch.



No. 107. Multiple Slide Switch.



No. 23a. Lava Tip Burner.



No. 26a. Lava Pillar Burner.

The Bogart Frictional Machine

IS THE ONLY SURE GENERATOR.

The Bogart Multiple Porcelain Burner,

THE ONLY SAFE ONE FOR DANGEROUS POSITIONS.

Multiple Electric Gas Lighting Burners of all Descriptions, Plain, Argand, Imitation Candle and Special Gasoline Burners. All requisite supplies for fitting buildings, as Insulators, Glass and Rubber Tubes, Switches, Special Wires, etc., etc., etc.

ALSO PATENTEE AND MANUFACTURER OF THE

Pendant, Ratchet and Automatic Systems of Electric Gas Lighting.

Electrical Supplies, Bells, Annunciators, Burglar Alarms, etc., etc.



No. 9 Bartholdi Automatic!

WITH LAVA TIP:

ARGAND OR CANDLE.

AS PER ORDER.

40,000 IN USE,

AND NO FAILURE.

SMALLEST! CHEAPEST! BEST!

This instrument includes in itself a complete electric Gas Lighting Apparatus applicable to the ignition of every gas jet in a building; all condensed into a simple device which can be employed by a child without training.

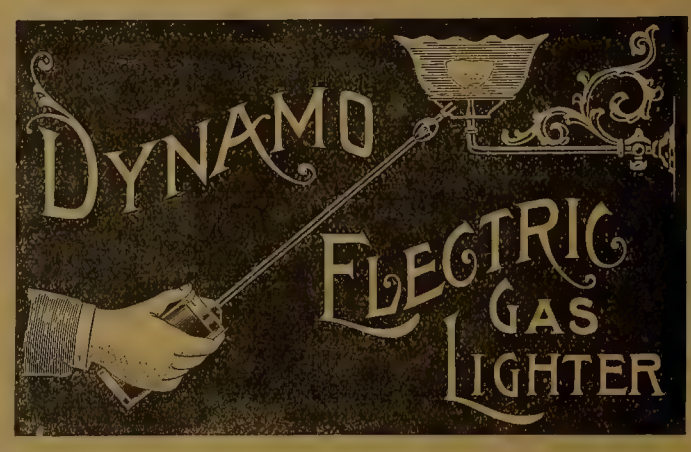
No Battery, Acids, or Liquids.
No Wires or Special Apparatus on Fixtures.
Entirely Mechanical in Construction.
Always in Order and Ready for Use.
You Push the Button and the Torch Does the Rest.

Absolute safety from risk of fire. Obviates entirely the dangerous use of matches or the torch. Endorsed by fire underwriters, and reduces premiums where exclusively used for lighting.

Not only a blessing, but an absolute necessity in Hotels, Theatres, Halls, Warehouses, Factories, Stores, Railway Depots and Dwellings.

Can be introduced into the most closely stocked show-windows, or amongst the most inflammable combustibles without the least danger. For this reason the Bogart Torch has been adopted exclusively for gas lighting by all of the principal DRY-GOODS HOUSES, as well as SILK AND COTTON MILLS in the UNITED STATES.

The cut shows the improved straight stem lighter.
The curved stem lighter shown in advertisement on front cover.



A. L. BOGART,

Manufacturer Electrical Supplies,

22 UNION SQUARE, NEW YORK CITY.

EDISON GENERAL ELECTRIC CO.,

EDISON BUILDING, BROAD STREET, NEW YORK.

EDISON SYSTEM OF LIGHT AND POWER.

SAFEST! BEST! CHEAPEST!

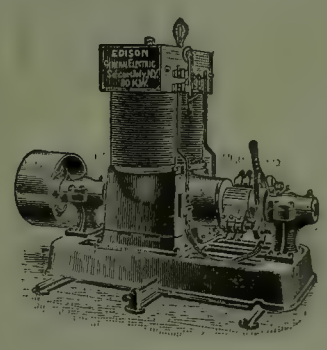


EDISON
LAMP AND SOCKET.

Incombustible Appliances.

Dynamos.

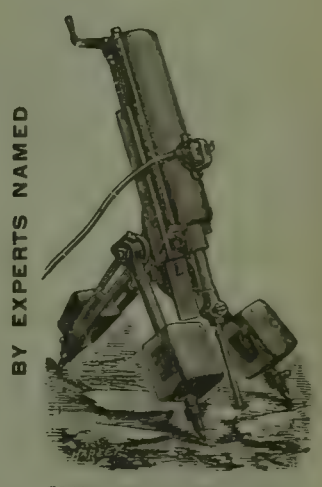
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Motors.

Wire, Cables.



EDISON PERCUSSION DRILL.

TRANSMISSION OF POWER.

FOR PRICES, ADDRESS NEAREST DISTRICT OFFICE.

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PACIFIC NORTHWEST: Fleischner Building, Portland, Oregon.
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MEXICAN AND SOUTH AMERICAN DEPT.: Edison Building, Broad St., New York.
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The Safety Insulated Wire and Cable Co.,

MANUFACTURERS OF

SAFETY UNDERGROUND CABLES,

SAFETY WHITE CORE INSULATION.

SAFETY SOLID RUBBER INSULATION,

ALL MADE WITH A VIEW TO PERFECT

SAFETY FOR ELECTRIC LIGHTING.

Insulated Cables and Wires for Electric Power, Telegraph and Telephone Purposes.

The White Core and Solid Rubber is covered with an absolutely fire-proof braid, which has been approved by the underwriters of New York, Boston and Baltimore, and is now used in the new main offices of the Western Union, new Mail and Express Building, Madison Square Garden and many of our largest buildings. The new United States Cruiser "New York" is being equipped throughout with SAFETY NAVAL CORE.

Nearly FOUR HUNDRED MILES OF SAFETY UNDERGROUND CABLES now in use in the New York Subways, and used by every electric light company using currents of high electro-motive force.

ARCHITECTS AND CONTRACTORS PLEASE NOTE AND SEND FOR SAMPLES.

The Safety Insulated Wire and Cable Co.,

Office: 234 WEST 29th STREET, NEW YORK.

L. F. REQUA, General Manager.

Crocker-Wheeler Electric Company,



¼ H.P. 500 Volt Armature. Ventilated, Constant Speed, 1,500.

SLOW SPEED MOTORS.

These Motors are made with the best appliances and material obtainable, and embody every improvement of merit, with the intention that they shall be the standards of their class.

430-432 West 14th Street, New York.

H. SENIOR & CO. 10 SPRUCE ST. NEW YORK

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ELECTRICAL WORK A SPECIALTY.

T. J. MURPHY ELECTRIC SLATE

ITALIAN & AMERICAN MARBLE

FOR SWITCHES, SWITCHBOARDS &C.

ELECTRICAL EXCHANGE BUILDING. 136 LIBERTY ST. NEW YORK.

DAY'S PERFECTION

WIRES AND CABLES,

FOR AERIAL, UNDERGROUND AND SUBMARINE USE.

The Oldest! The Best! The Cheapest!

Illustrated Catalogue on Application.

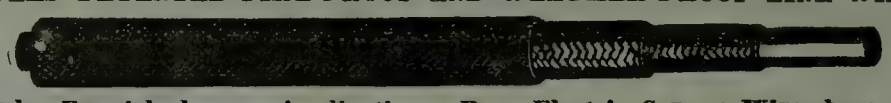
WILLIAM H. ECKERT, Genl. Agt., 16 Dey St., New York.

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ANSONIA BRASS AND COPPER CO.

SOLE MANUFACTURERS OF

COWLES PATENTED FIRE-PROOF AND WEATHER-PROOF LINE WIRE.



Samples Furnished upon Application. Pure Electric Copper Wire, bare and covered, of every description. Tobin Bronze Rods, Plates and Sheets.

Warerooms: 19 & 21 Cliff Street, New York. Factories: Ansonia, Conn.

W. A. ROSENBAUM,

Electrical Expert and Patent Solicitor,

177 TIMES BUILDING, N.Y. CITY.

Former Manager, now successor to the Patent Business heretofore conducted by "The Electrical World."



Overloaded and disordered Batteries are a common and painful sight. Why? Because they are not built to work, but to sell. Are you a sufferer? Then substitute the Law Battery and suffer no more.

SOLE MAKERS:

Law Telephone Co.,

85 John St., New York.



YOU MAKE A MISTAKE if you don't buy Electrical Supplies from F. & F. Cleveland, Ohio. Send for the latest "List of Bargains for Bell Hangers," and rock bottom on **Medical Batteries.** We undersell all. Address

Fletcher & Fletcher Electric Co.,

Cleveland, Ohio.

Mention this paper if you want bottom prices

THE PIONEER LOW SPEED HIGH GRADE MACHINES.

Perret Electric Motors.

ALL SIZES FOR ALL PURPOSES. THOUSANDS NOW IN USE.

Perret Electric Light System.

COMPLETE APPARATUS FOR ISOLATED PLANTS.

THE ELEKTRON MANUFACTURING CO., SPRINGFIELD, MASS.

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Philadelphia, Pa., Pennsylvania Machine Co., 29 North 7th St.
Cleveland, O., C. P. Nicholson, 513 Society for Savings Building.

Standard Electrical Measuring Instruments.



We make a great variety of Testing Instruments, such as Ammeters, Voltmeters, Galvanometers, Resistance Boxes, Photometers—in fact, everything that an electrician requires in making measurements of current, E. M. F., resistance, insulation, efficiency, etc.

Correspond with us before placing your orders, and send for our illustrated catalogue No. 1-66.

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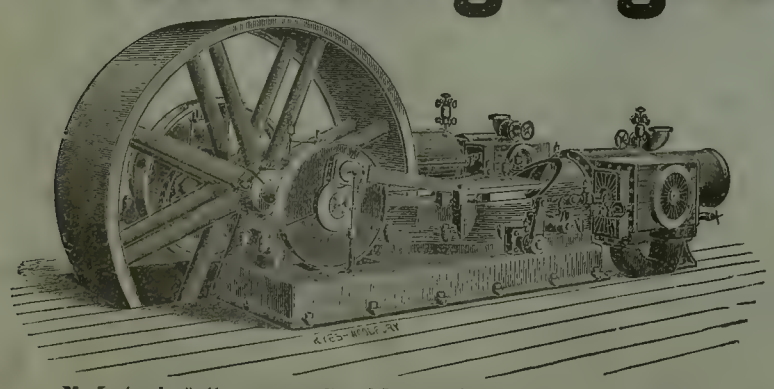
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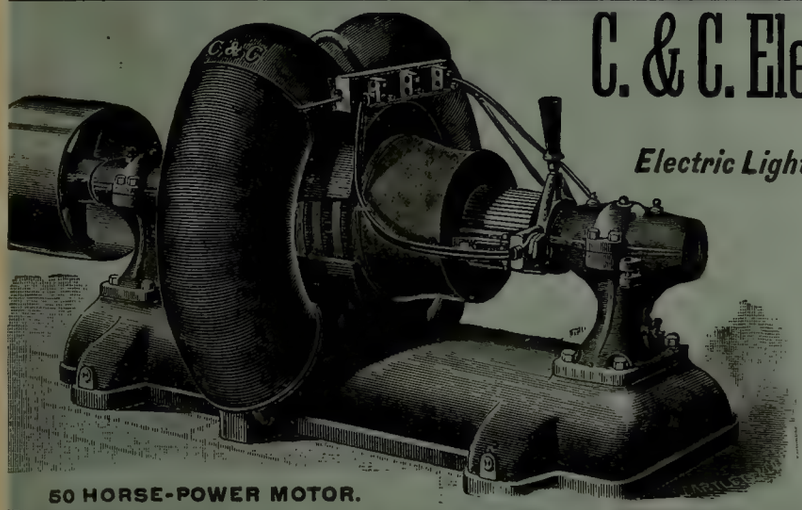
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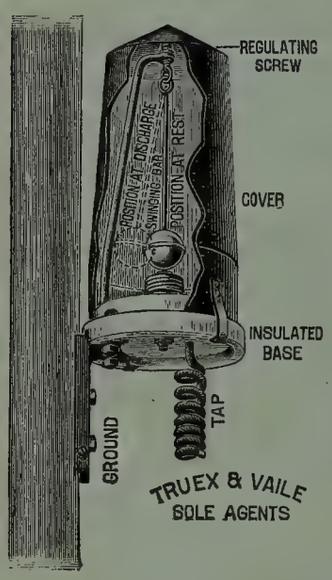
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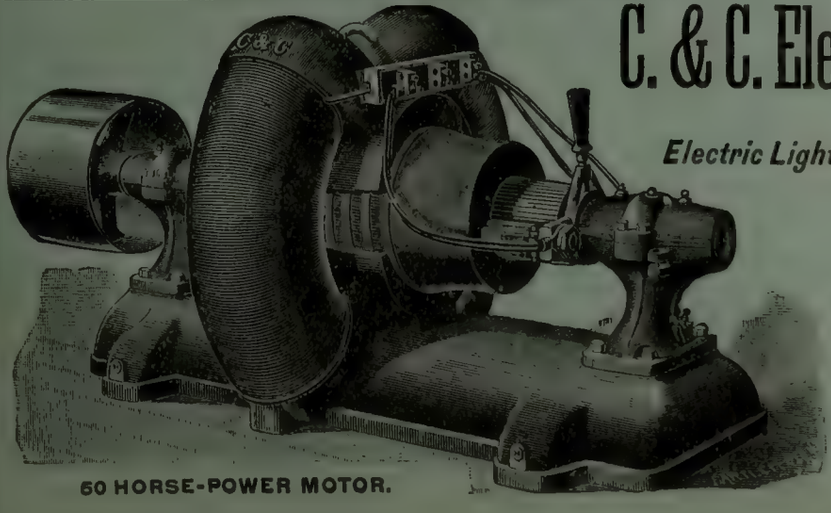
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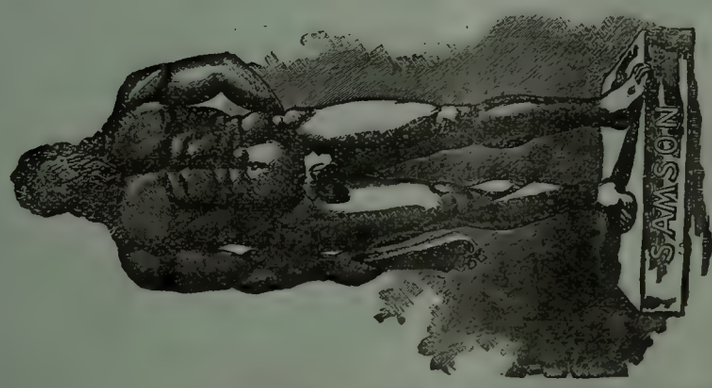
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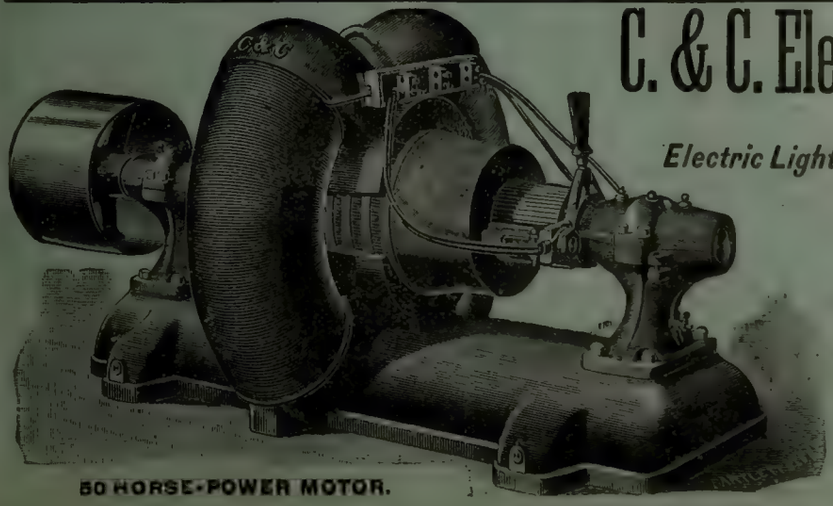
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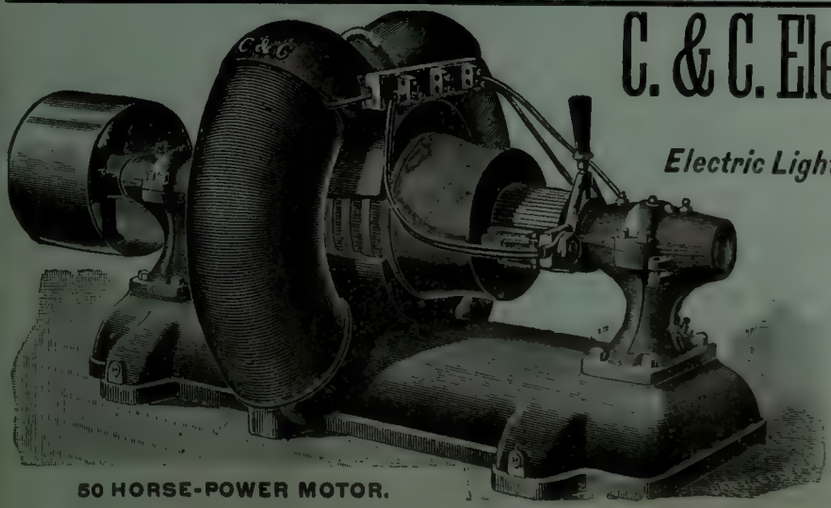
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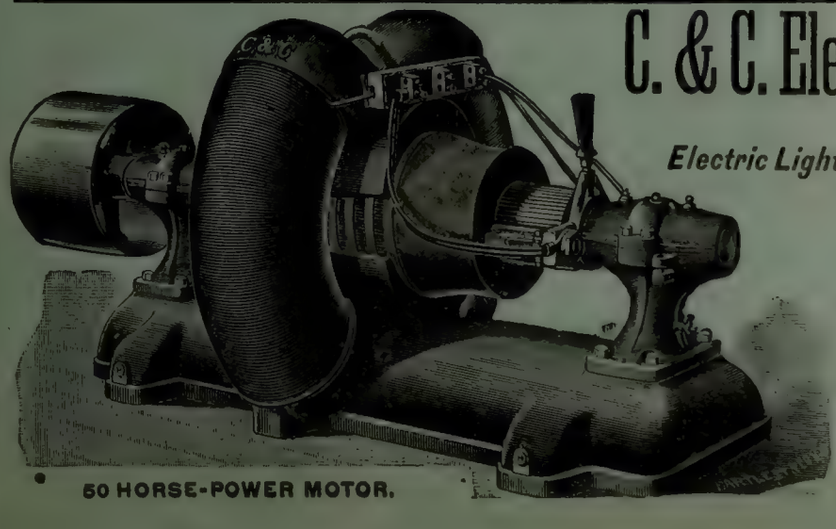
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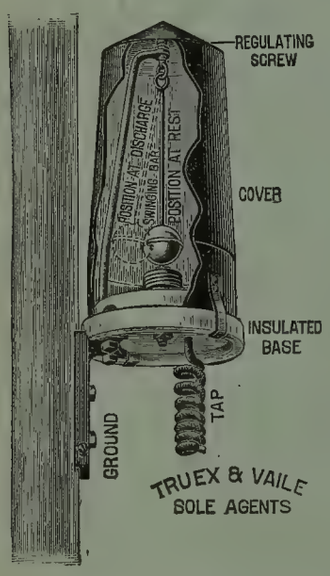
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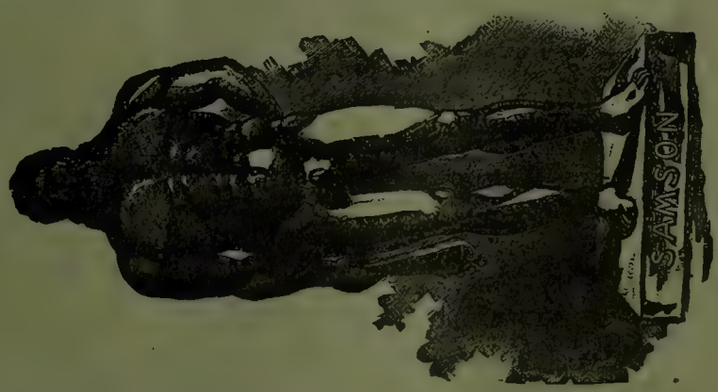
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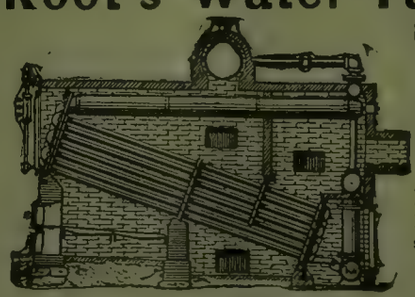
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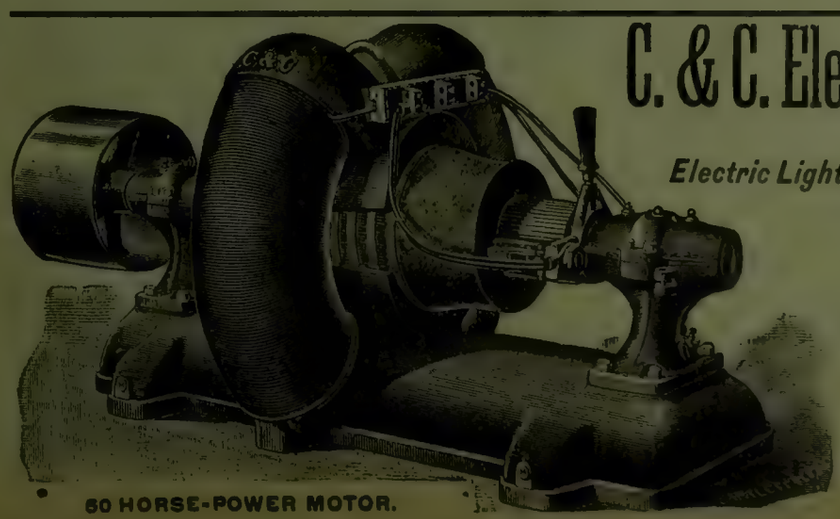
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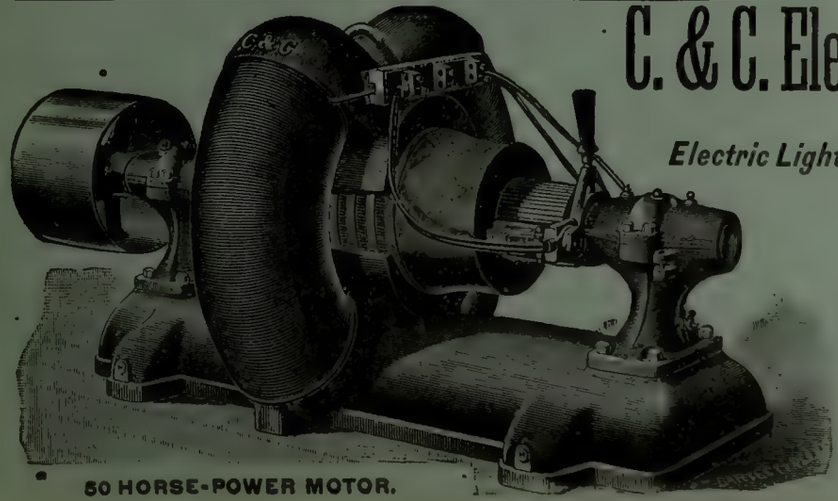
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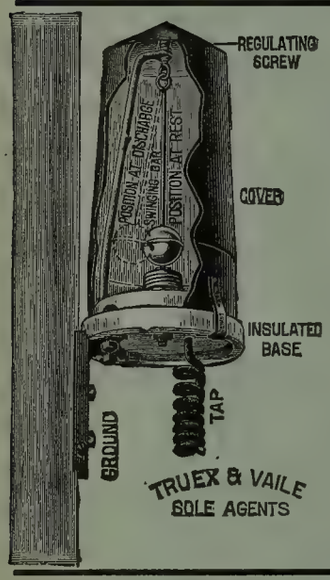
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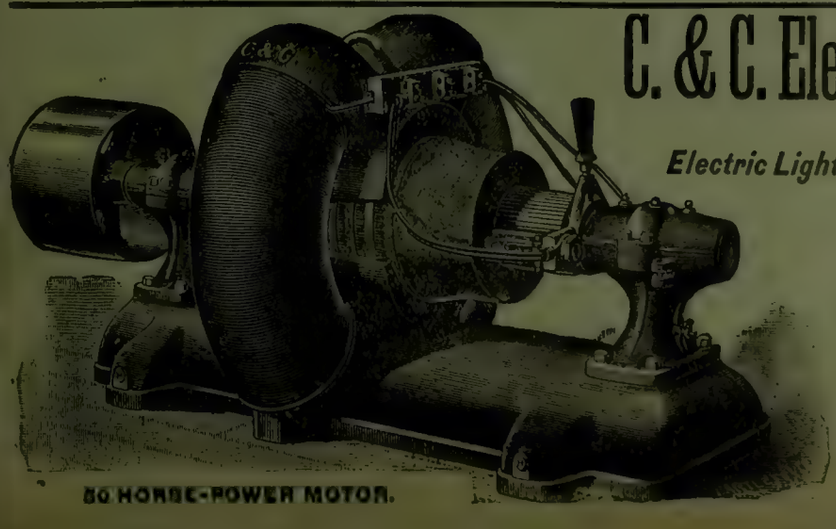
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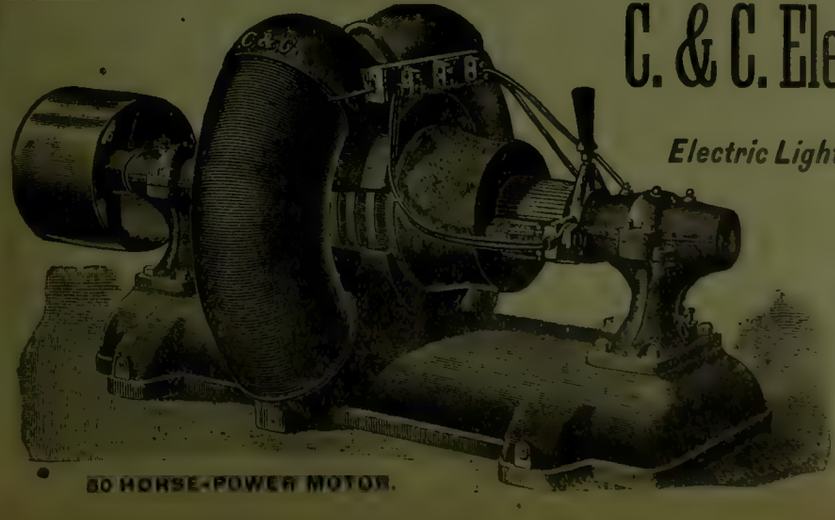
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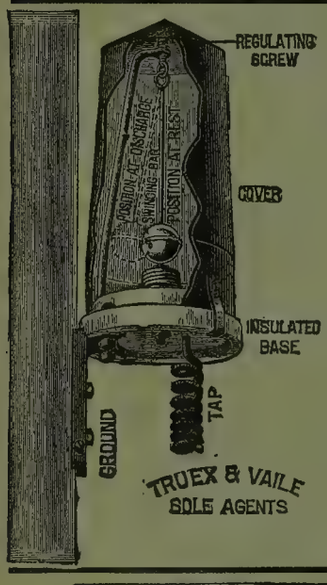
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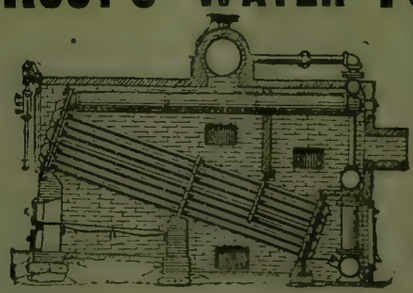


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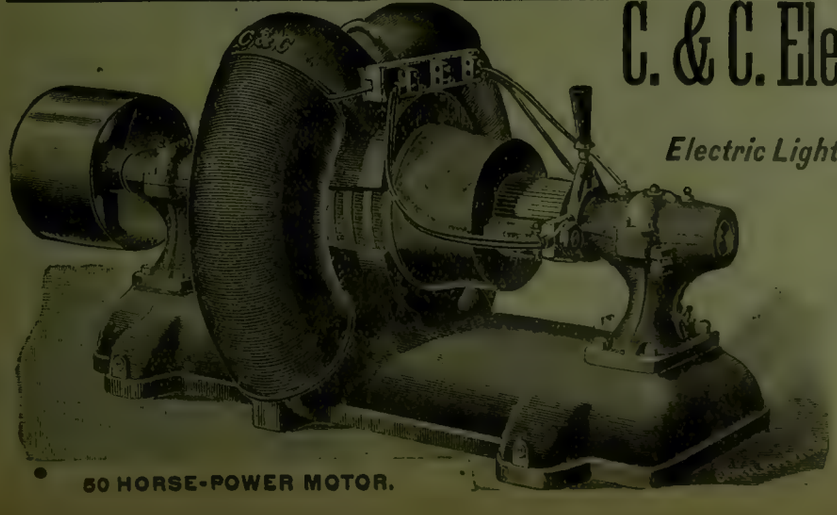
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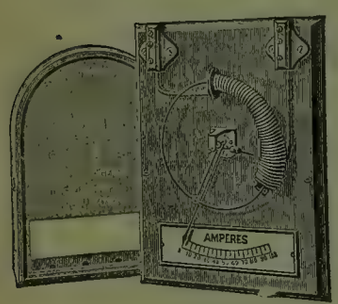
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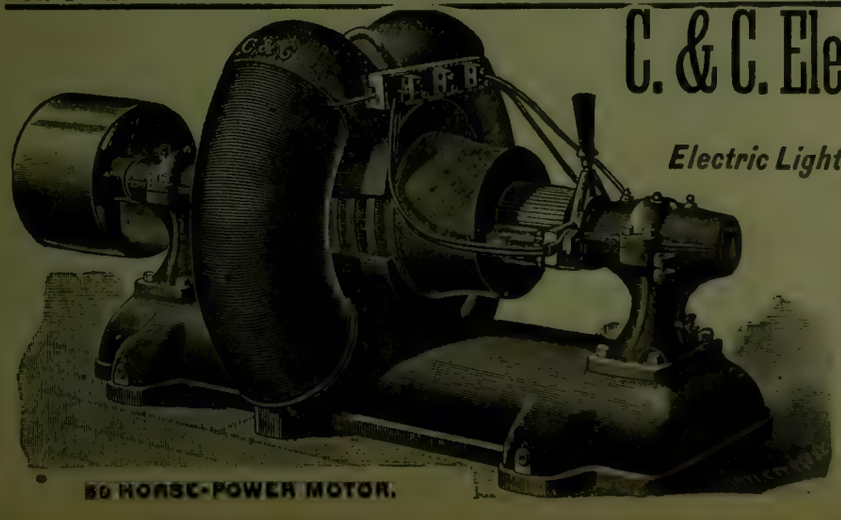
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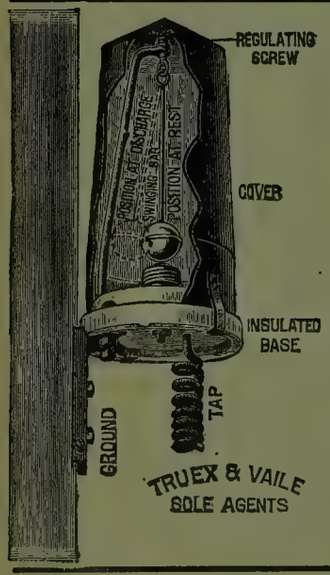
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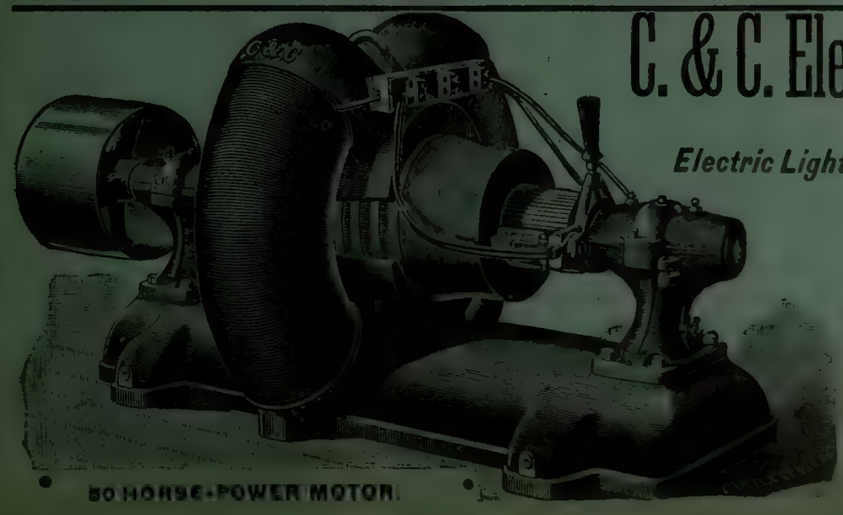
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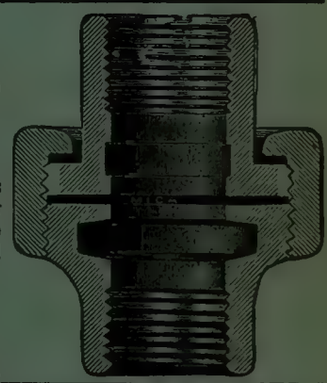
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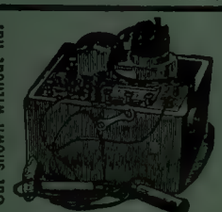
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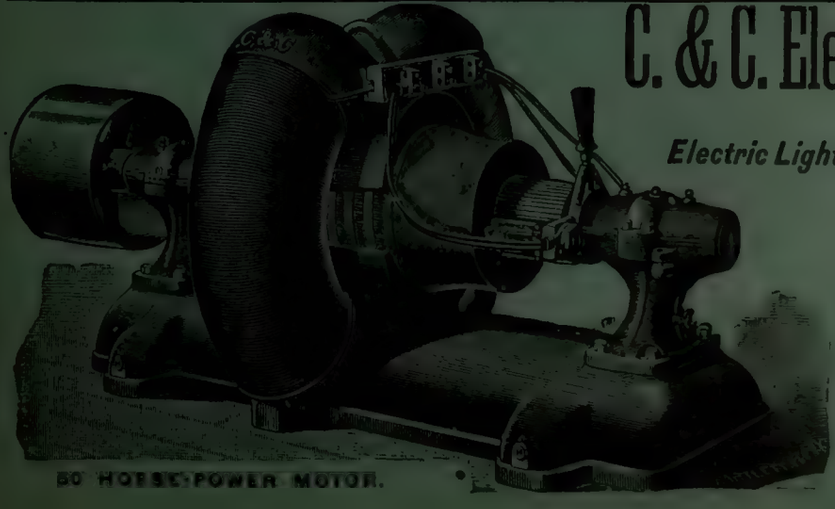
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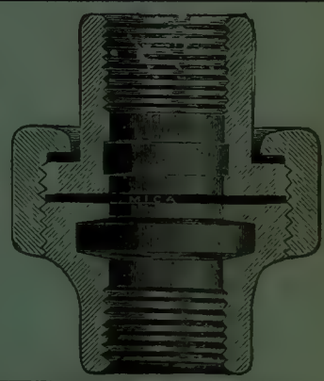
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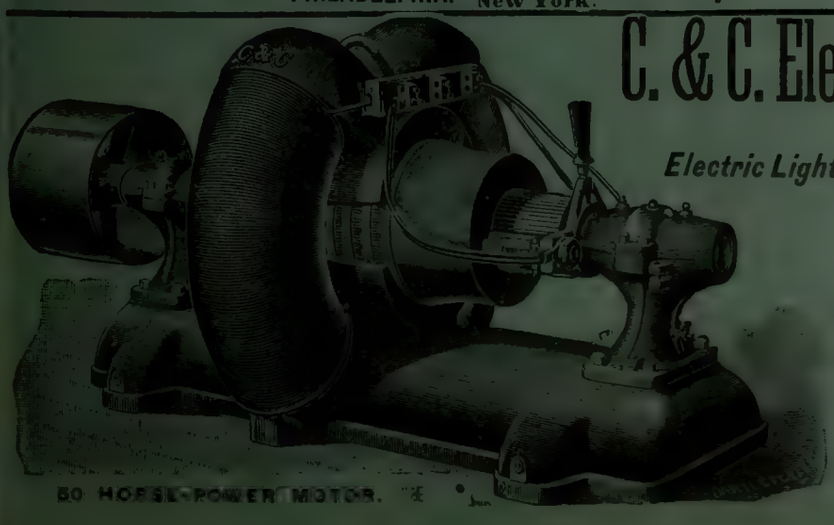
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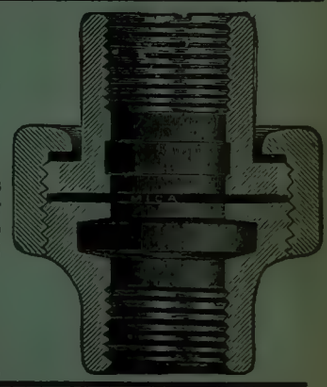
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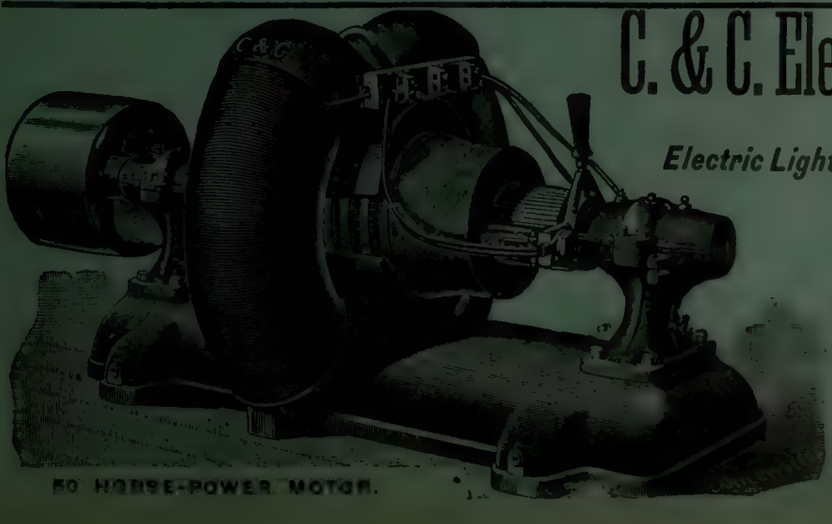
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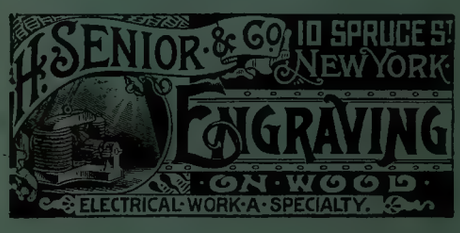
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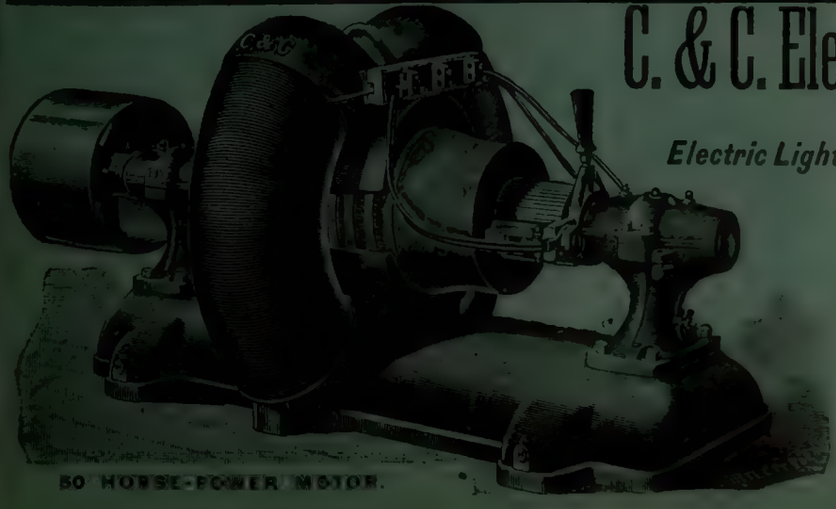
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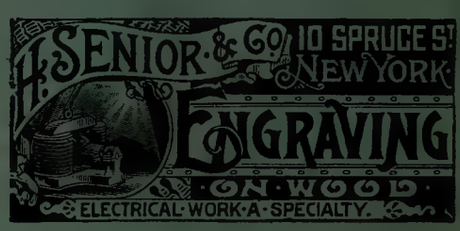
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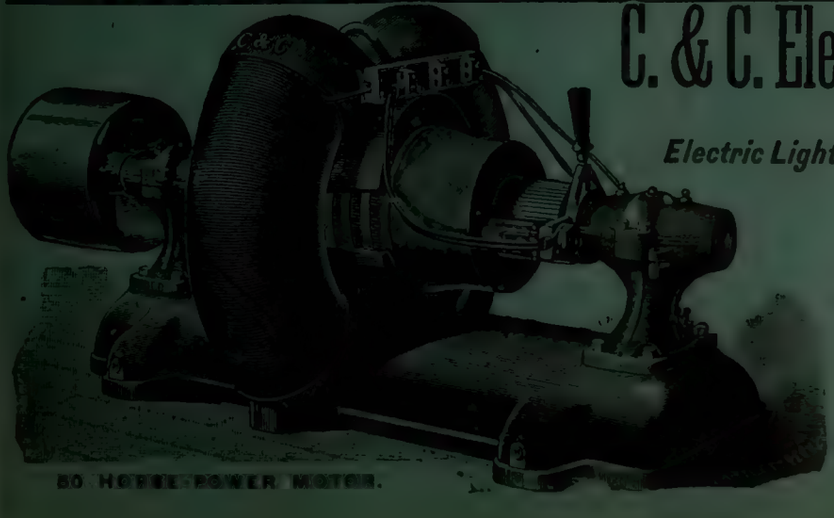
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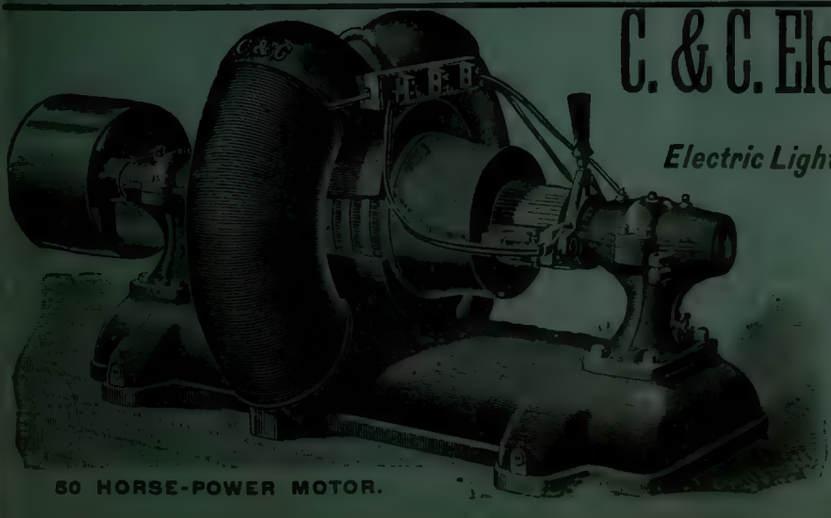
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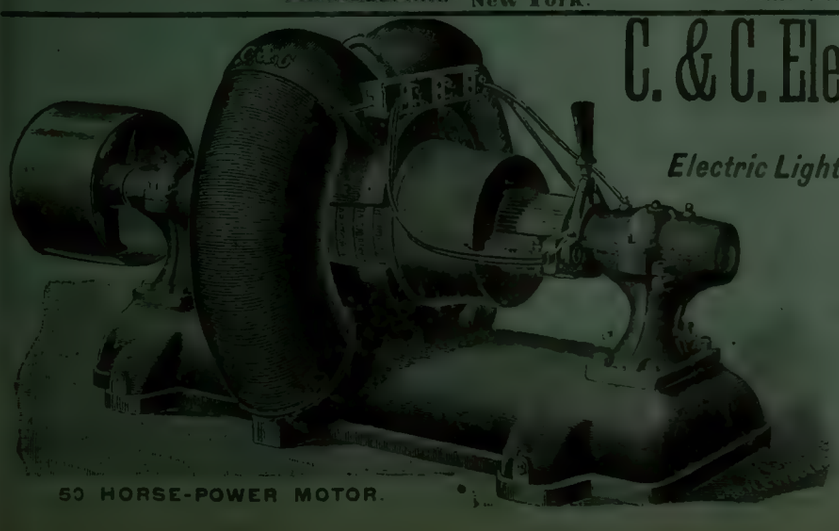


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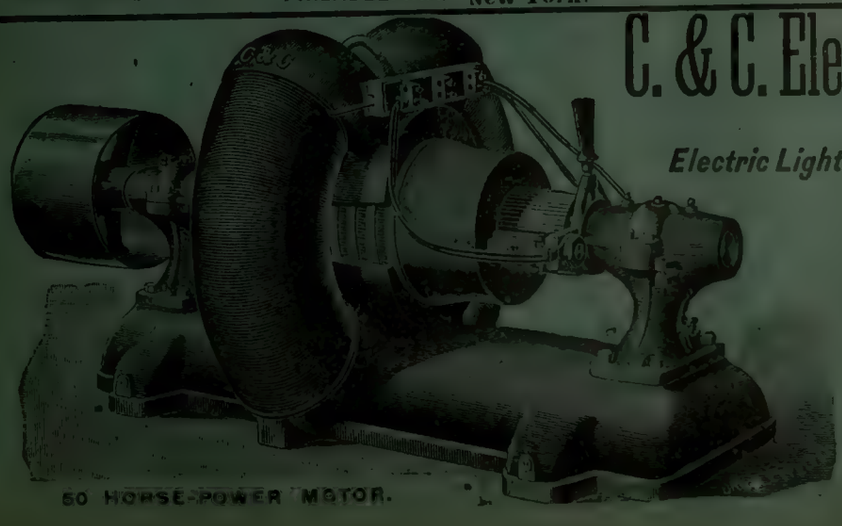
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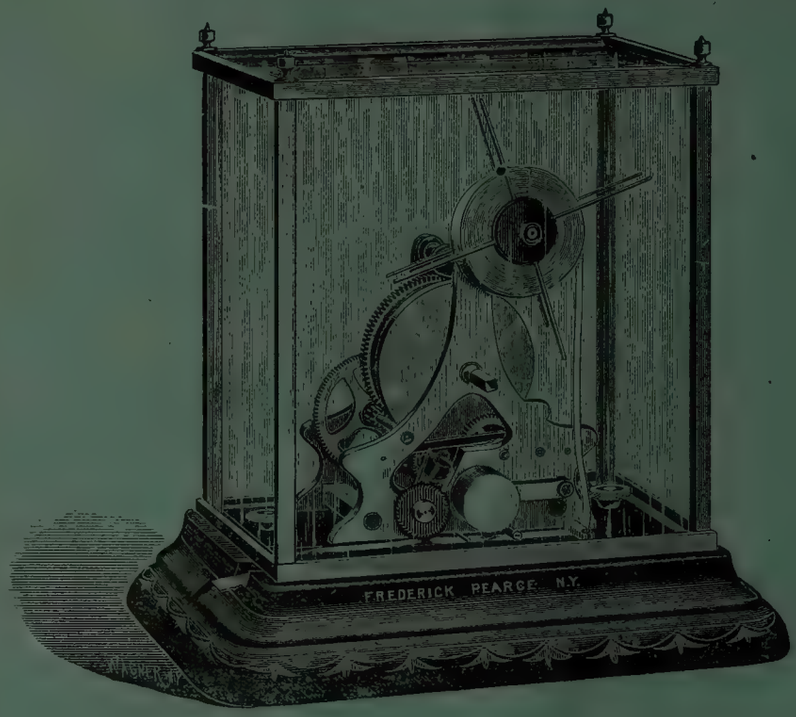
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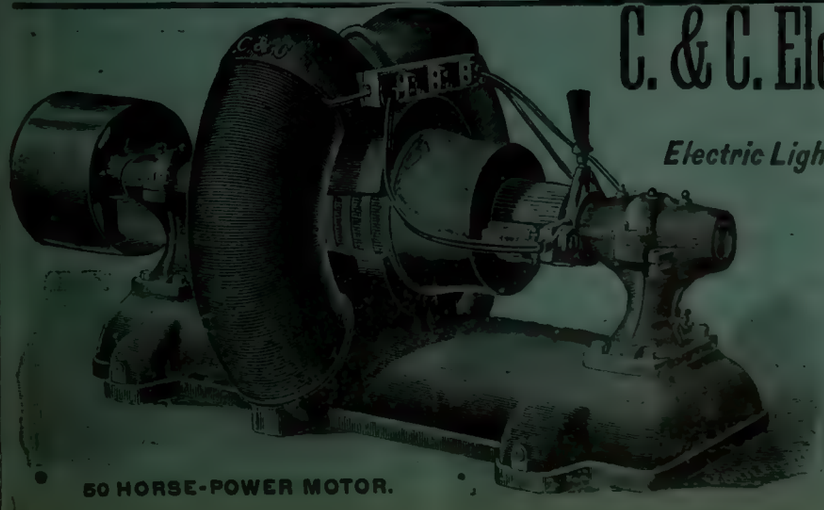
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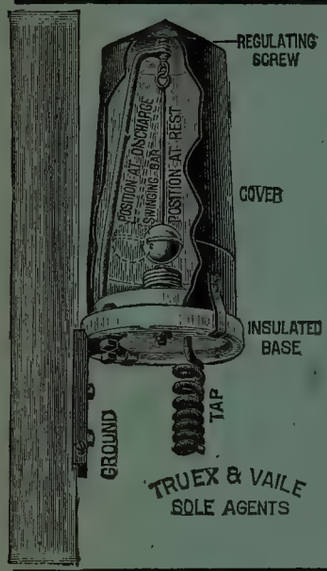
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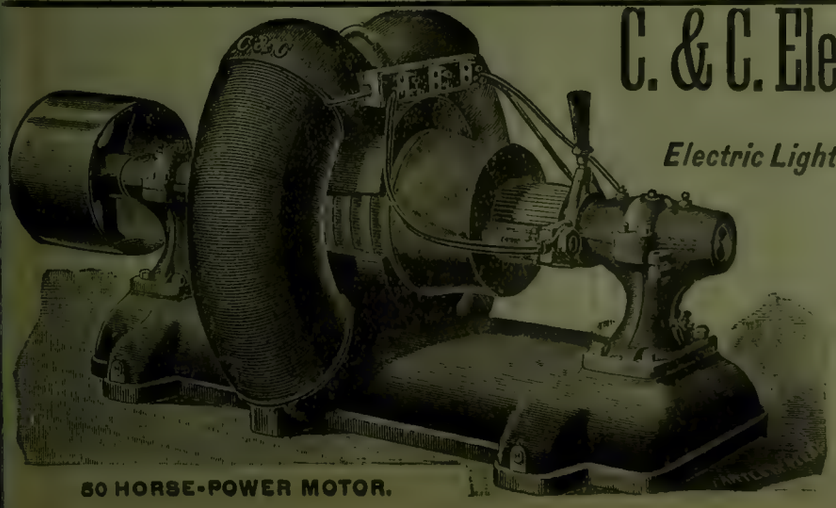
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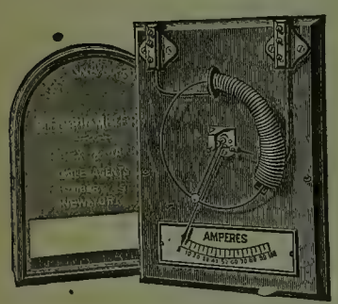
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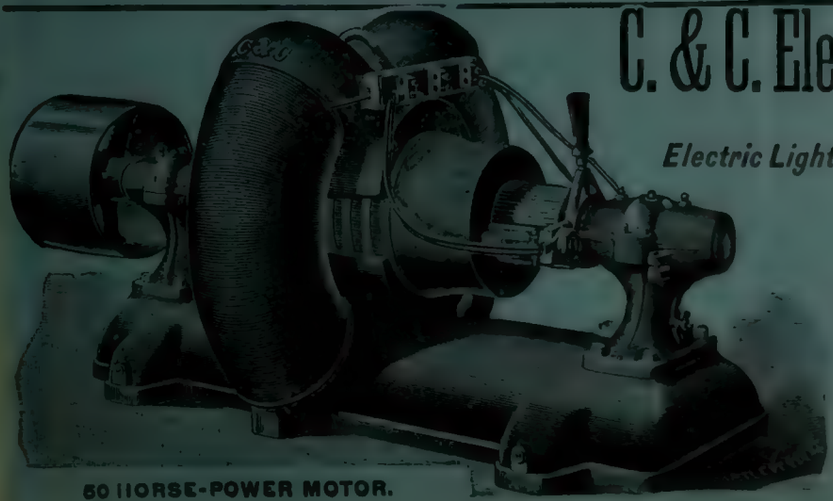
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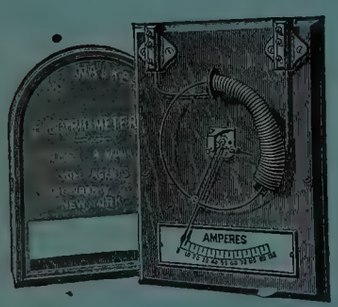
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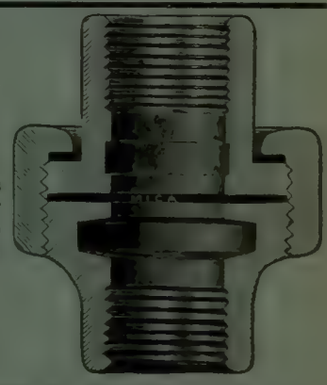
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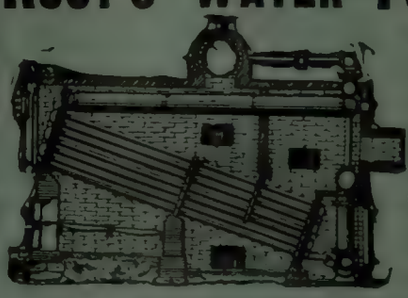
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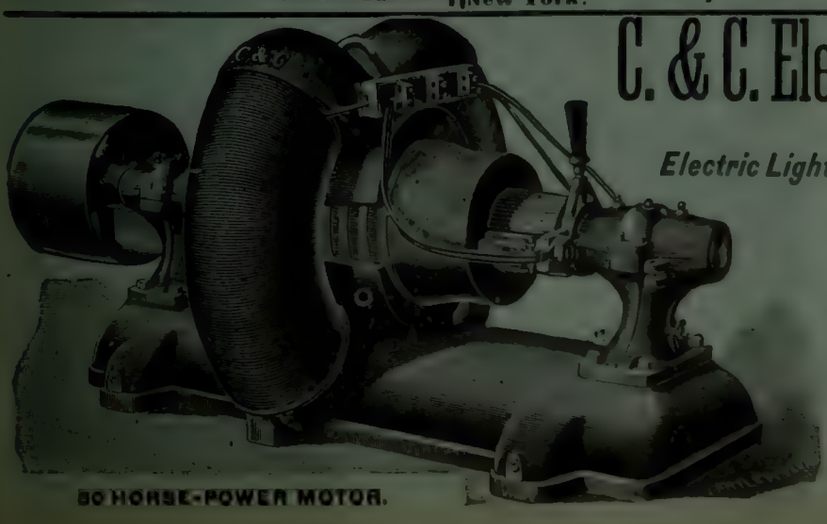
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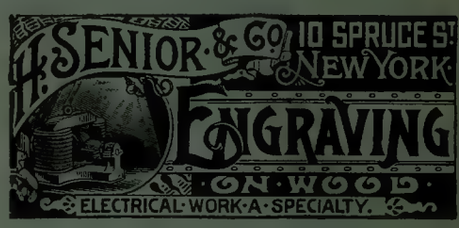
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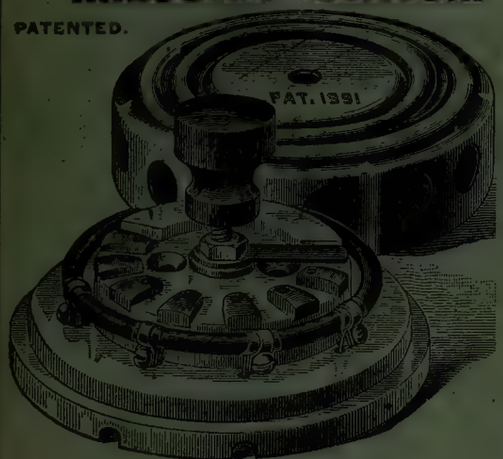
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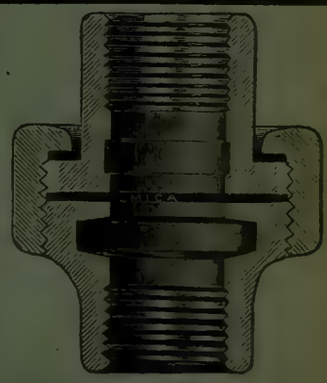
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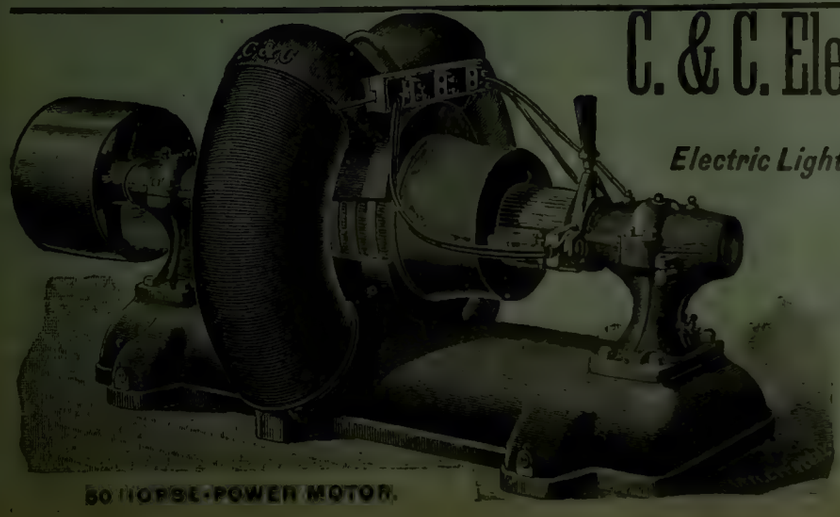
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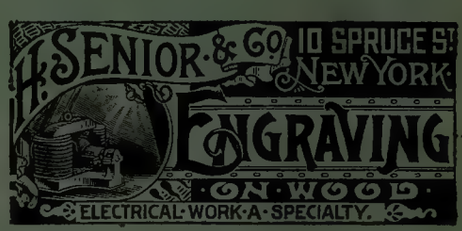
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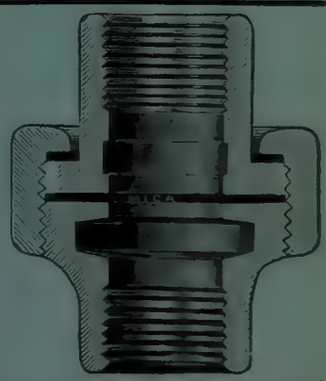
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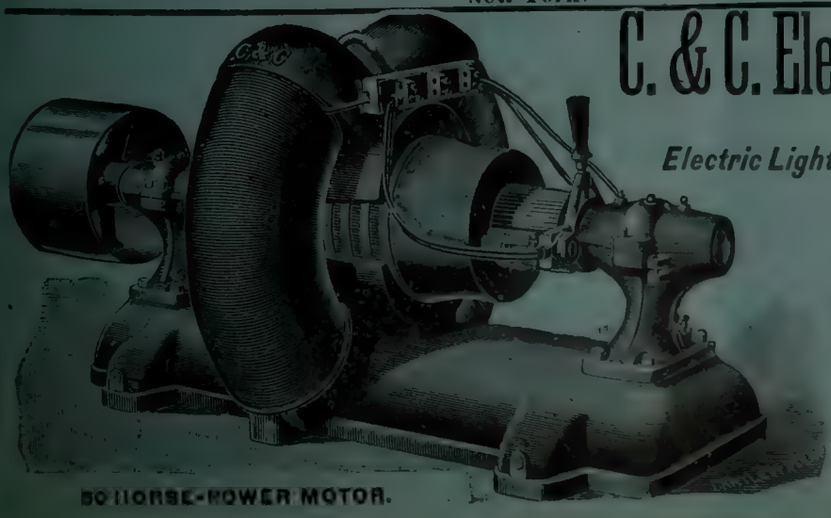
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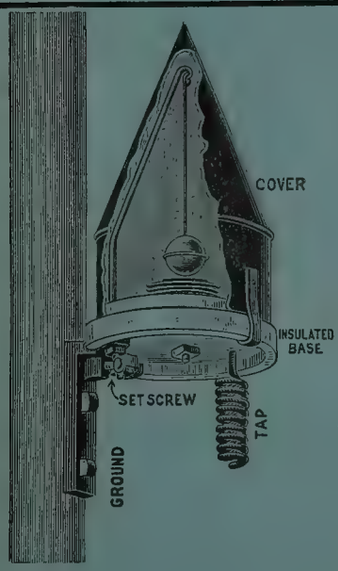
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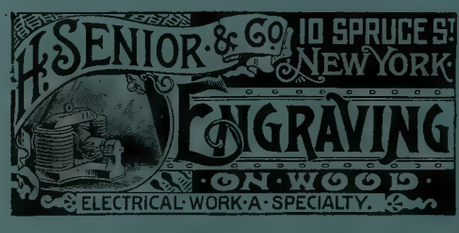
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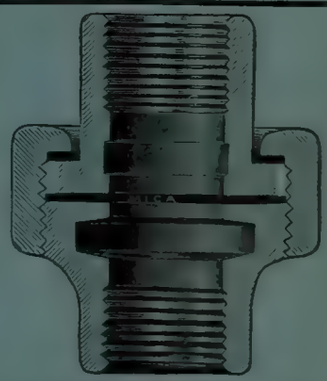
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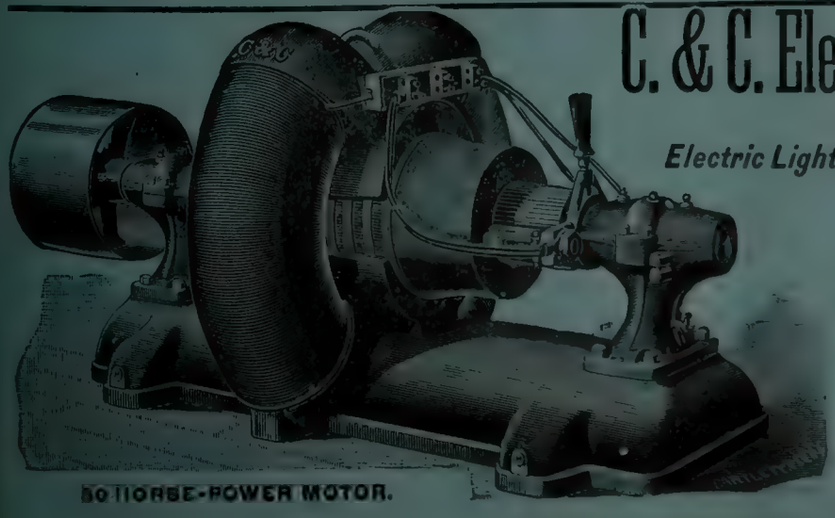
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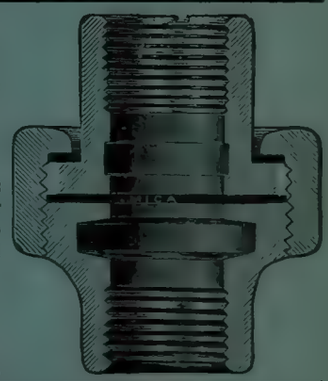
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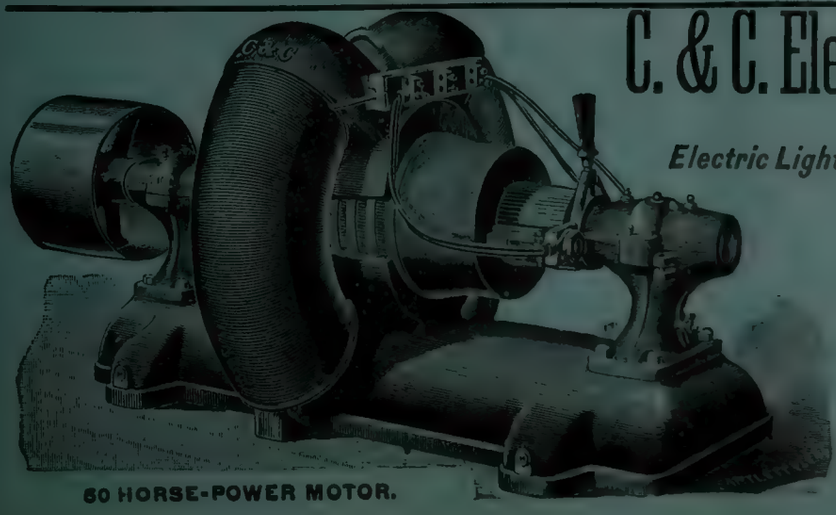
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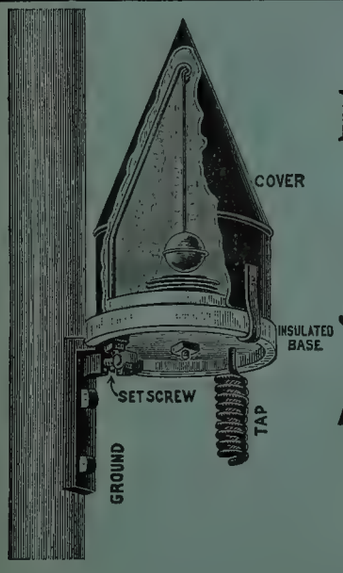
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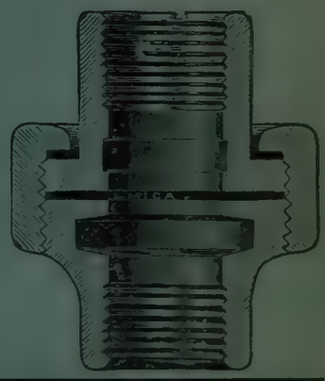
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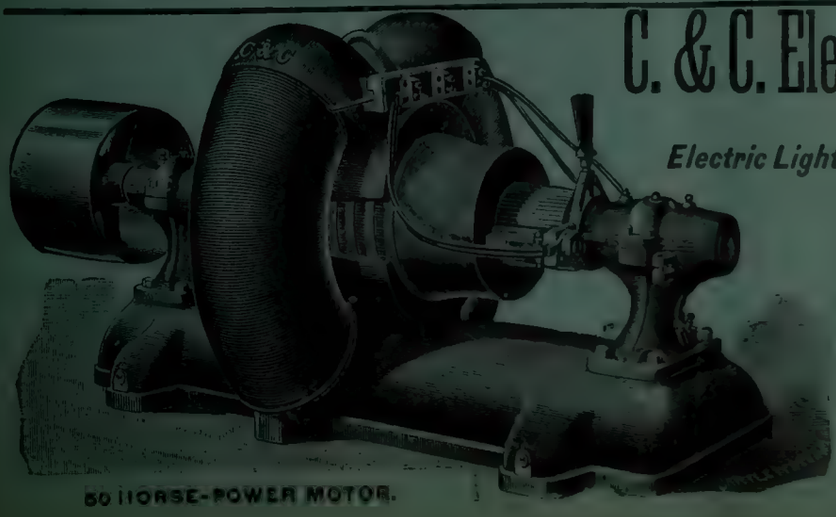
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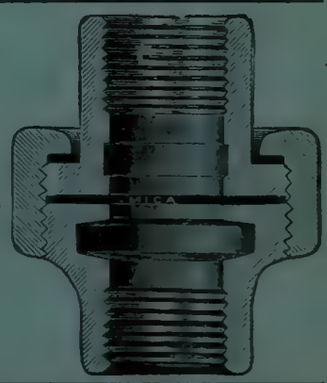
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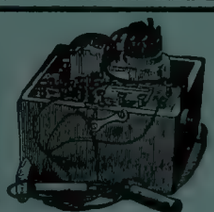
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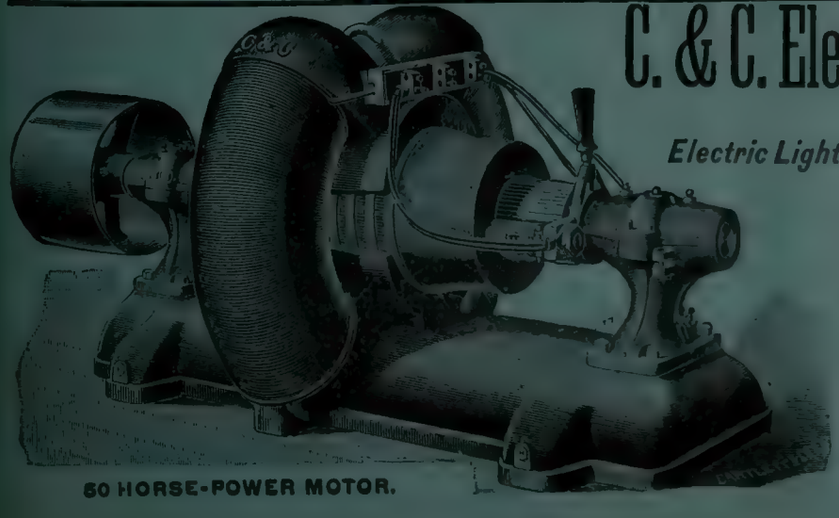
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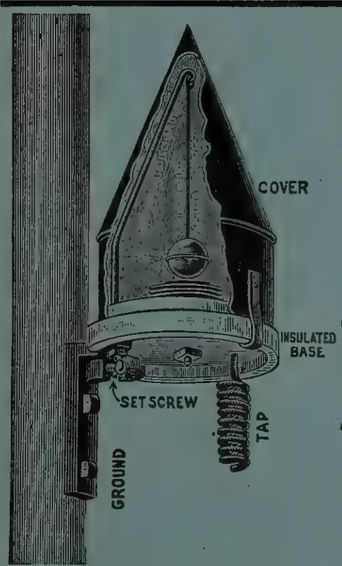
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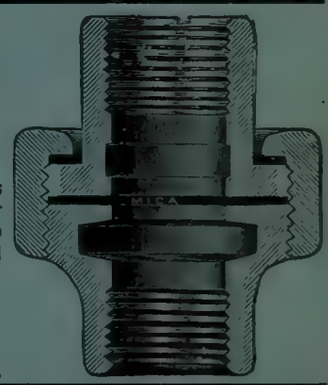
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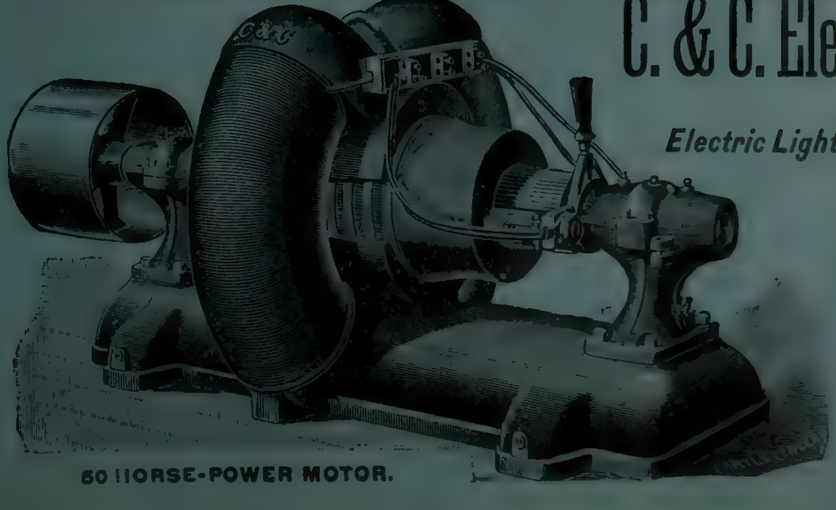


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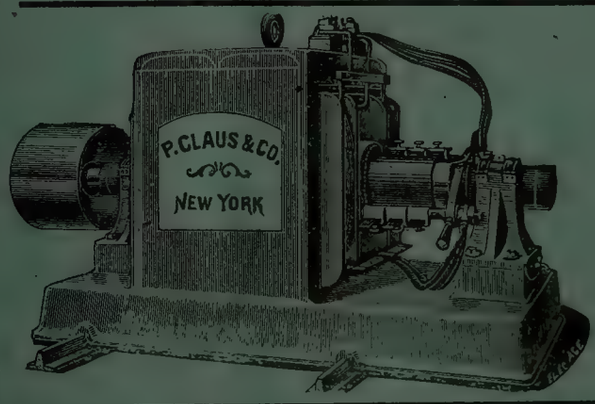
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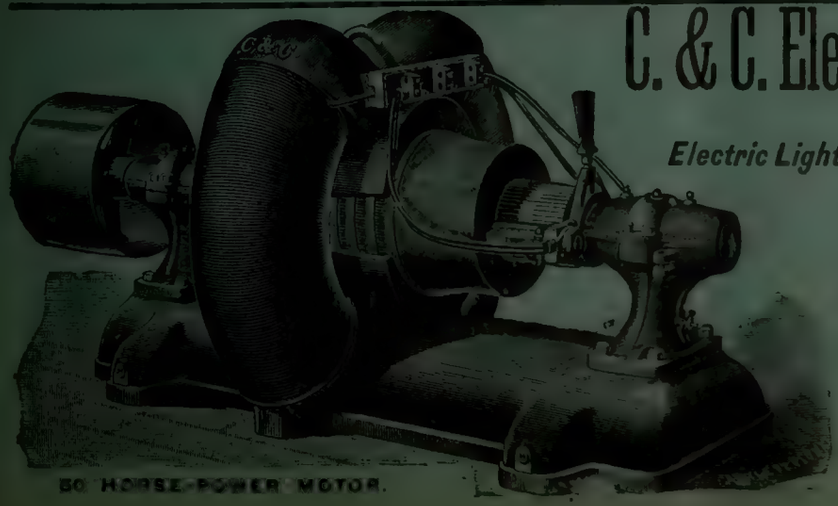
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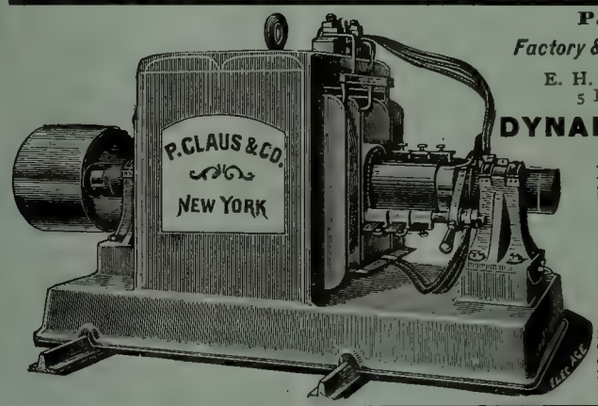
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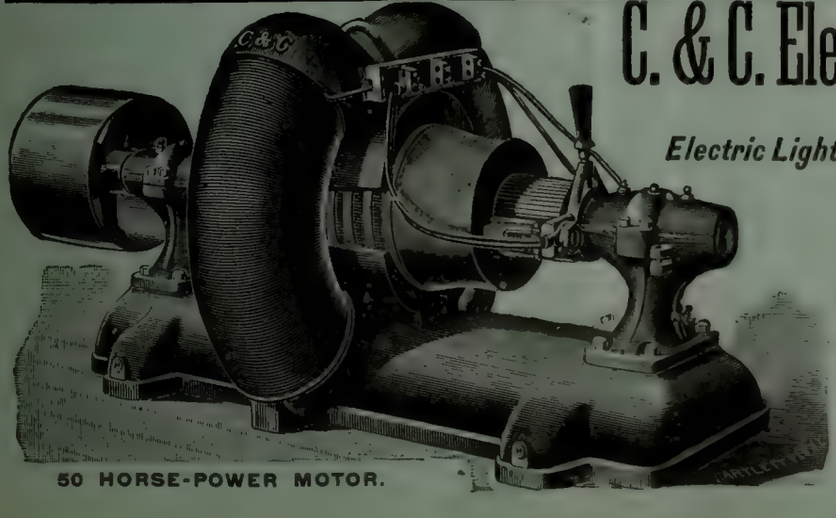
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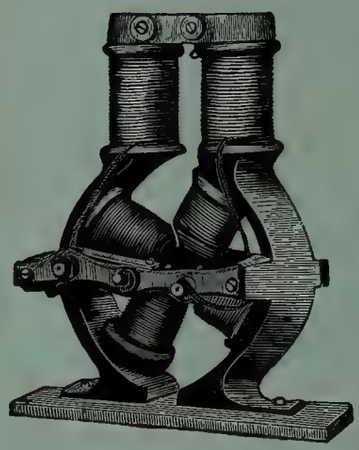
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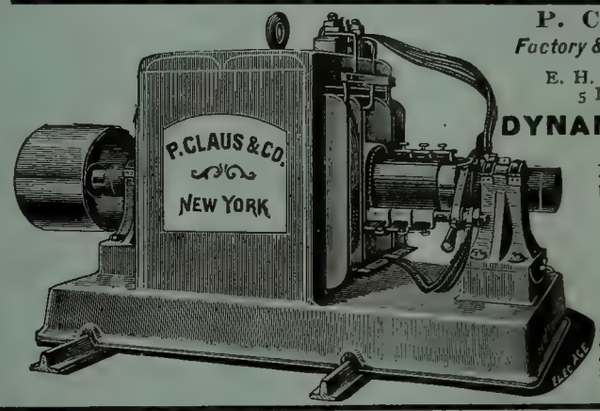
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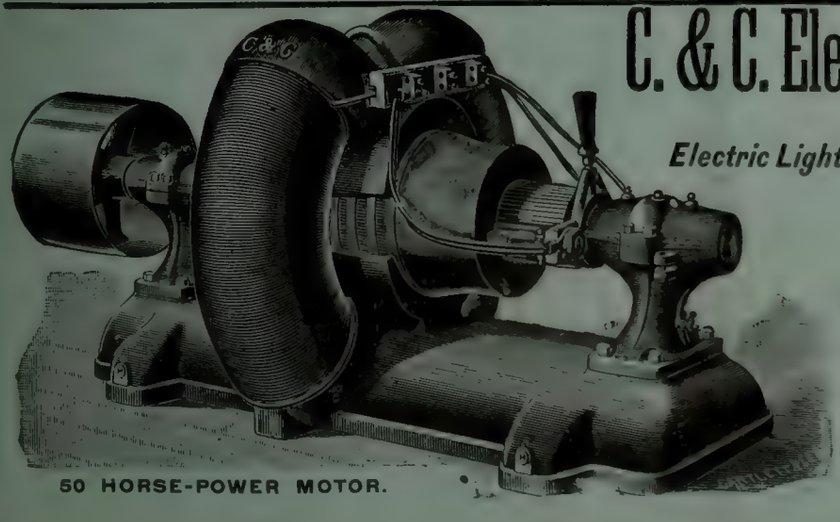
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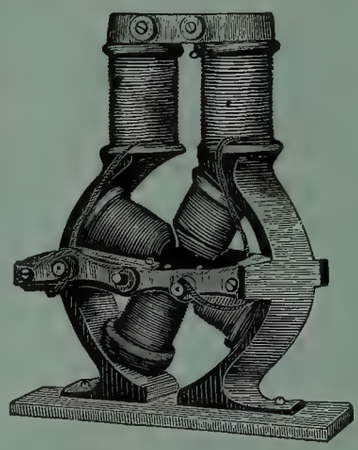
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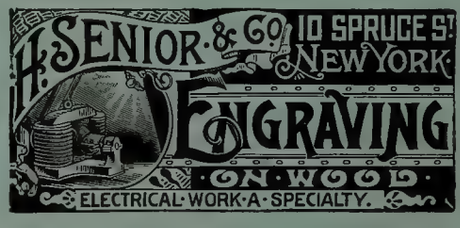
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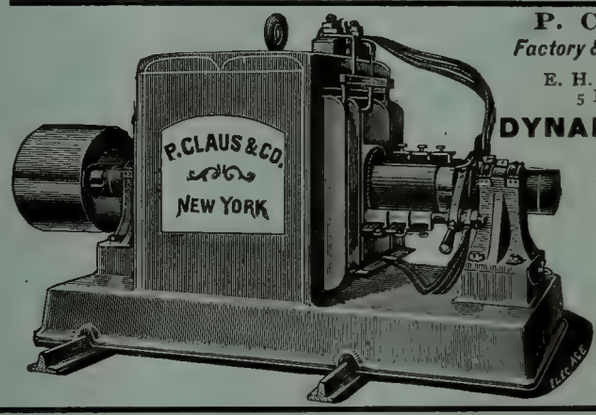
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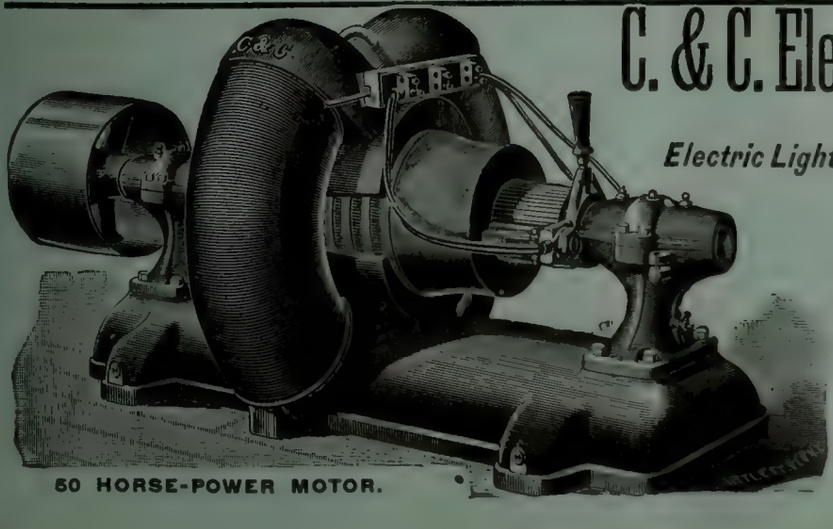
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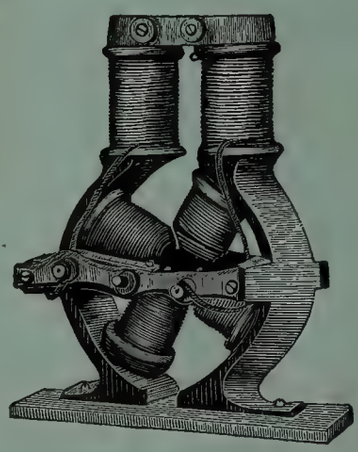
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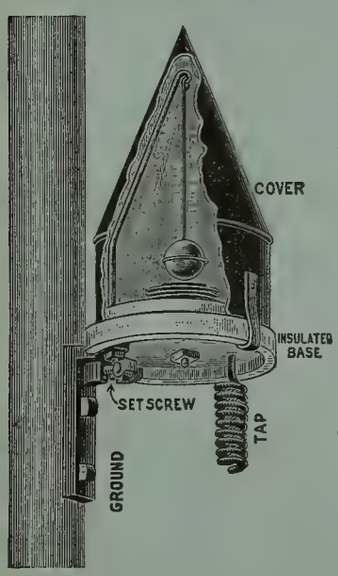
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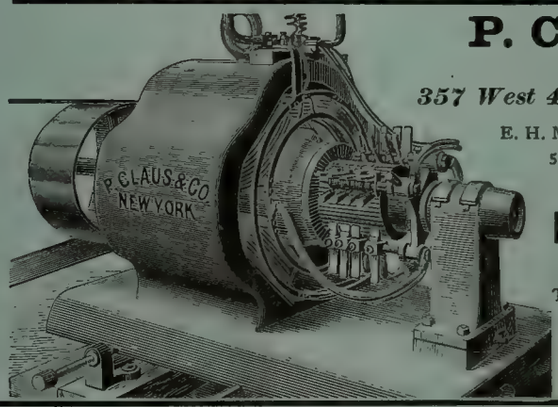
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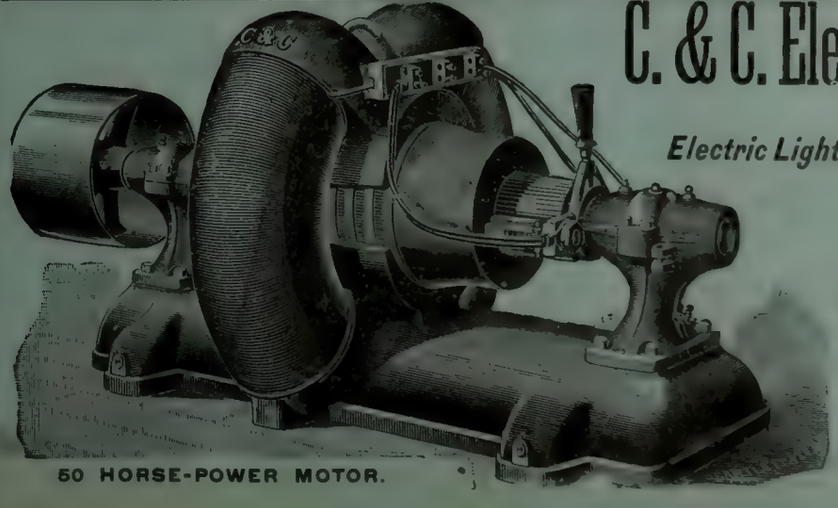
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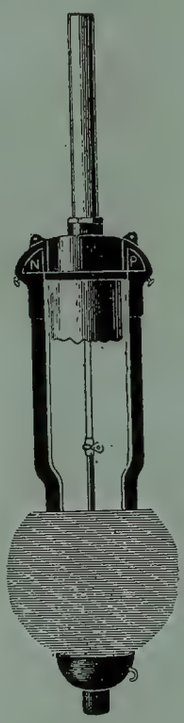
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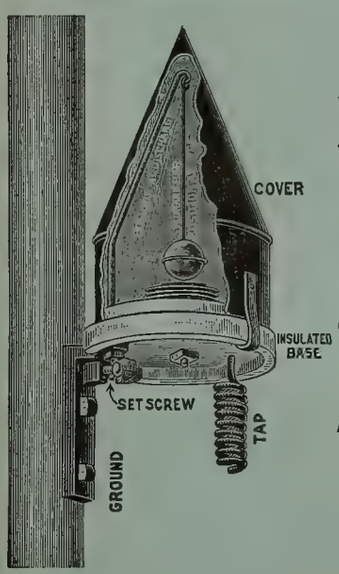
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NEW YORK, APRIL 30, 1892.

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OUR NEW FORM.

On general principles we are opposed to radical changes of any sort in a well-established business, but there are times when it is justifiable and proper to cut loose and discard old forms and take on new.

We have just passed such a period of transition, and in a new form the ELECTRICAL AGE is presented to our readers to-day.

It has always been our aim to improve the ELECTRICAL AGE in every way possible, and while we are opposed, as we said at the beginning, to any great changes in methods and practice unless some decided advantage is to be gained by our patrons, we have, after long and thoughtful consideration, deemed it advisable and proper to alter the form of the ELECTRICAL AGE at this time. This change, we believe, is a decided improvement and will be appreciated for the following reasons:

First—The new size renders the paper far more convenient to handle; our friends can now lay back in their chairs and read its pages with comfort. This was hardly possible with the old size on account of its being larger and possessing a greater tendency to double up, unless it was laid out flat on the desk or table.

Second—While the pages are of smaller size there is the same amount of reading matter as there was in the old, consequently the new form partakes more of the material character of a magazine on account of the greater number of pages and thickness.

Third—The new size is a better one for binding purposes, and a bound volume will not be so bulky and unwieldy as the old. It will be of nearer conformity to library size, and will not require special space for its preservation.

Fourth—The smaller size of the pages will be appreciated more by advertisers and business men, for the reason that advertisements thereon will stand out more prominently and be more attractive than on a larger page. The less cost of a page advertisement of the new size will be a sufficient inducement for advertisers to indulge in this luxury with greater frequency than heretofore, and with greater benefit to themselves. There are other advantages in the small pages which will readily occur to the advertiser and the business man who reads the advertisements.

The change was determined upon only after a thorough canvass of the trade, and the concensus of opinion seemed to be largely in its favor. We think the new pages of the ELECTRICAL AGE can be made more attractive to all classes of readers, and we assure all of our friends that nothing will be left undone that will tend to produce this result. We have in contemplation many other improvements which will be developed in due time.

THE Electric Club, New York, will remain at its present quarters, on 22d street, for another year at least, and there is every reason to believe that the club will prosper, as the members have nobly come to the rescue.

ALUMINUM.

The excessively vaunted and puffed-up aluminum has not figured in any perceptible degree of late in the papers, particularly the daily press. Within the past two years or more, until a few months ago, the "aluminum age" seemed to have been ushered in with a rush, on all fours. Bolstered up by the sensational and imaginative stories published about this metal in the daily papers, people began to think that aluminum was destined to settle all the material difficulties ever encountered by man, and that unheard-of or undreamed-of wonders would be accomplished by its use—at 50 cents a pound.

Little by little, through the instrumentality of these fabulous stories, the great mass of people formed exaggerated opinions of aluminum, which they soon realized would never materialize. The consequence was these notions reacted, much to the discredit of the metal.

Mr. Alfred E. Hunt, a well-known authority on the subject of aluminum, recently delivered a lecture before the Franklin Institute, Philadelphia, on the subject of the manufacture and uses of aluminum, an abstract of which will be found on another page. Mr. Hunt therein states in plain terms what the metal is good for and what it is not good for, and had not the public press fanned the flame of imagination concerning aluminum, that metal would undoubtedly be now in the enjoyment of a better standing in the arts than it has. However, it will find its place in due time, now the public mind is in a more reflective mood concerning it. The same papers which aided in the dissemination of the aluminum fairy tales should now as freely use their columns in spreading the truth.

THE CONTROL OF ELECTRIC CARS.

One of the most difficult problems met with by electrical engineers in the development of the electric railway, has been the proper control of the motors, and after years of experimenting it is but recently that the problem seems to have been satisfactorily solved.

The paper of Mr. H. T. Parshall, read before the meeting of the American Institute of Electrical Engineers last week, on the methods of electrically controlling street-car motors, describes a system which, the author thinks, fairly represents what is now generally accepted by principal designers as being the most efficient method of accomplishing the object under consideration.

The control of the motors, Mr. Parshall thinks, is probably the most difficult question in electric railway practice, and on this question, in no small degree, the design of the motor depends. To start a car under any conditions of track, a certain torque is required, but beyond a certain limit, fixed largely by the convenience of passengers, this torque cannot be exceeded.

After a general discussion of the problem and the principles involved, Mr. Parshall gives a description and illustrations of some controlling apparatus recently devised. Essentially it consists of an improved form of platform switch combining both the "field commutation" and "series resistance" methods of starting cars.

This paper in full, with the illustrations, will be found elsewhere in this issue, and no doubt will be of especial interest to electric railway people.

NO TRUTH IN THE REPORT.

In our issue of April 23 we published a rumor that Prof. J. P. Barrett, city electrician and chief of the electrical department of the World's Fair, had resigned those positions to accept an appointment as director-general of the National Board of Underwriters at New York. Since then Prof. Barrett has emphatically denied the rumor, stating that his interests in Chicago were such as to preclude all thoughts of making a change.

SIAM'S FIRST ELECTRIC RAILWAY.

The first electric tramway will before very long be in operation in Siam. The entire installation is now being shipped by the Short Electric Railway Company, of Cleveland, O., who secured the contract from the Bangkok Tramways Company, of Bangkok, Siam. The company may flatter itself on having secured this contract, as it was awarded after an exhaustive examination had been made of the different railway apparatus in Europe and this country, by M. Aage Westerholz, who is considered to be the finest engineer in Siam. The road is six miles long, practically level, and very picturesque throughout its entire length, crossing fourteen of the many canal bridges in Bangkok. The poles, and in fact all the wood used in construction, will be of teakwood. The track will be 30′ gauge. The installation will consist of 20′ generators, two steam plants complete, six car equipments and extra parts to last for six months.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

A large number of the members of this society met at the Metropolitan Telegraph and Telephone Company's Central Exchange, 18 Cortlandt street, on the night of April 21, and inspected this vast institution.

Mr. J. J. Carty, the company's electrician, took charge of the party, and in his well-known clear and masterly style explained every detail of the telephone exchange.

The testing-room was first visited. Here Mr. Carty explained the long-distance telephone and other apparatus. A large number of receivers were connected up and switched in on a Boston wire, so that the members could hear conversation with Boston.

The operator at Boston could be plainly heard, and an interesting running talk was carried on between the two cities for some minutes.

The magnificent operating-room was next visited, and here Mr. Carty described in detail the practical operation of the telephone. This object lesson was a most effective one. Having the actual apparatus before them and described so ably, the members were able to get a better comprehension of the telephone than they could in a lifetime by reading books. All the details of the immense switchboard were fully explained by Mr. Carty.

The long-distance room was next visited and the apparatus explained and examined in a like manner. The party then went into the cellar and examined the subway connections, lightning-arresters, etc., and found everything of the most approved order and workmanship.

The visit was a highly interesting and instructive one, and the courtesy of the company in affording the opportunity to make this inspection was appreciated by the members individually and collectively.

METHODS OF ELECTRICALLY CONTROLLING STREET-CAR MOTORS.*

BY H. F. PARSHALL.

While in many respects the controlling apparatus for street-car motors and the general requirements of the same do not differ greatly from some other cases, there are some features that demand the closest attention if the car is to be handled either efficiently or comfortably, so far as the passengers are concerned. While the number of methods proposed and tried in times past has been great, at the present time there seems to be sufficient agreement between the principal designers and sufficient data at hand to warrant the writing of a fairly comprehensive paper on the subject.

The problem of controlling the motors is probably the most difficult one in the whole range of street-car work, and in no small degree determines the electrical design of the motors; or to be more specific, to start a car under any given conditions of track a certain torque is required. Beyond a certain limit, fixed largely by the convenience of passengers, this torque cannot be exceeded. The smaller the current with which the motor is able to develop this torque, the smaller the rheostat or other starting devices may be, and the more efficient the car equipment. Should the motor, therefore, be incapable of developing a comparatively powerful torque per ampère, the amount of energy dissipated either in the magnetic windings, armature windings or rheostat becomes excessive, the results being the more or less rapid deterioration of these parts.

It may not be out of order just here to discuss the design of the motor with reference to getting this torque most efficiently. The average H. P. exerted by a street-car motor at the car wheel probably does not exceed 20 per cent. of the maximum it is expected to do in starting the car under the various conditions encountered. Now, to get the highest efficiency from a motor run under these conditions it is necessary to get the highest possible efficiency at that H. P. at which the greatest amount of work is to be done, and inasmuch as the loss in the conductors for this averege H. P. is necessarily low (otherwise the motors would burn out in doing the maximum work to which they are subjected), the question does not resolve itself into how to get the least possible motor resistance of armature and magnets, but, rather, how to minimize the constant loss of hysteresis, eddy currents and friction. While all of these losses vary somewhat with the speed in series-wound motors, the variation of these losses is not great, since for an increased speed there is in general a diminished intensity of magnetization and pressure. To render these losses a minimum, and at the same time to get the requisite torque to handle the car efficiently, there is but one solution, that is, to put the maximum number of turns on the armature compatible with good running as to heating and sparking.

While the truth of these statements may be more or less apparent to all when stated in plain terms, but little attention was paid to this matter in the earlier motors designed. The numerous measurements made, however, have so uniformally been in favor of motors with comparatively a large number of conductors on the armatures, that the importance

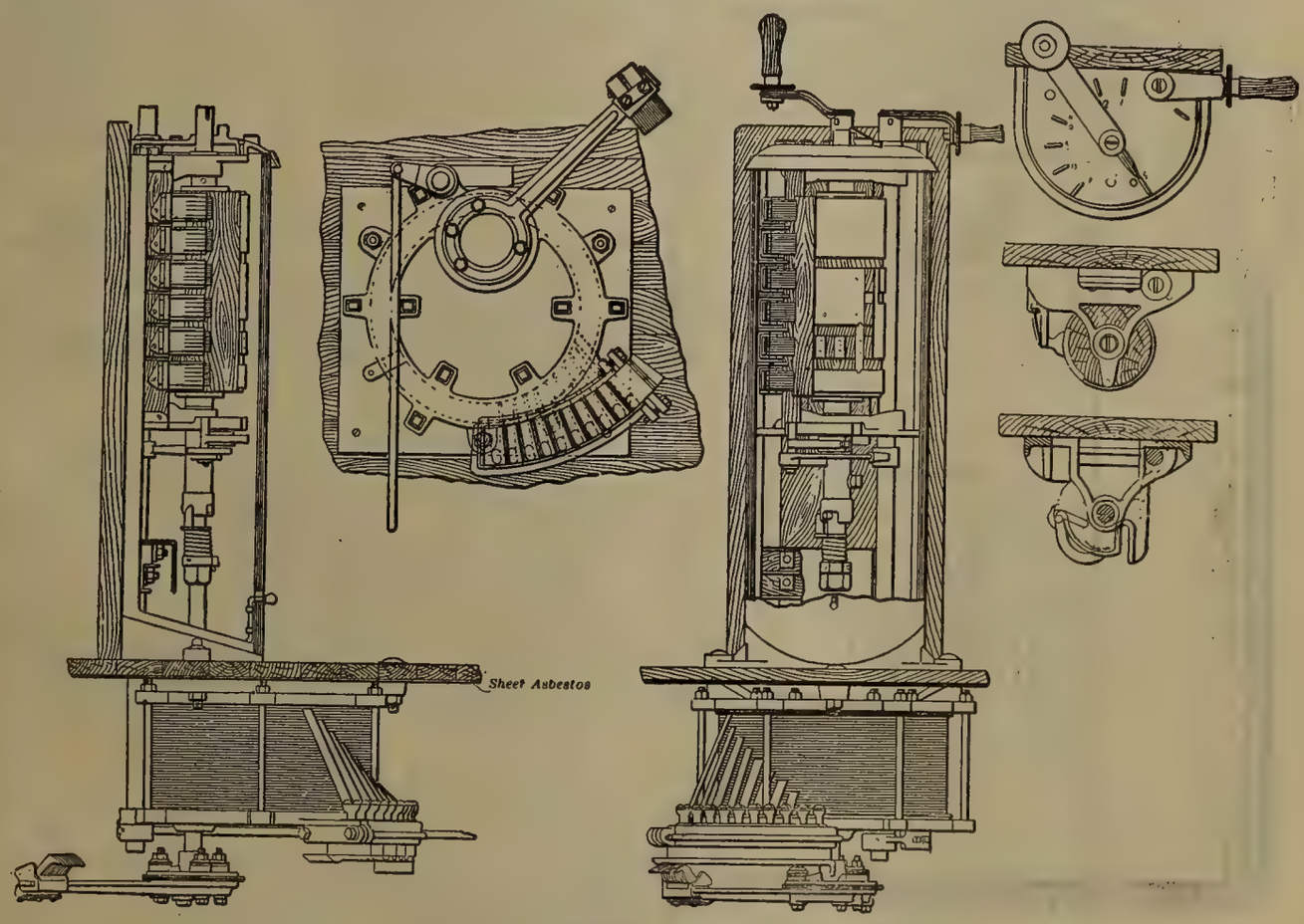


FIG. 1.—COMBINED RHEOSTAT AND PLATFORM SWITCH.

* Paper read before the American Institute of Electrical Engineers, New York, April 19, 1892.

of this matter is now pretty generally understood. This agreement as to the general design of motors has in no small way been influential in bringing electricians into agreement as to how the motor should be controlled, since with an armature of a comparatively large number of turns, less turns are required in the field magnets to produce a given torque with a given number of ampères. The function of the magnets, therefore, has become of less importance. It is always, however, to be borne in mind that, other things being equal, the motor with the greatest number of turns in the magnets will develop the greatest torque for small currents. With a given electromotive force acting on the armature circuit, and a given torque developed by the armature per ampère, it does not matter, so far as efficiency is concerned, only necessary to increase the number of coils. In practice it has been found that this number could not be very great, otherwise the car wiring becomes too complicated and too expensive. This same holds true of the controlling-switch. Three magnet coils or sets of magnet coils seem to be the practical limit, since there is a general agreement between street-railway managers that the present number of magnet connections (6) should not be increased, and even with this number there is occasional trouble with broken wires or terminals. With a 15 H. P. motor it is possible with three sets of coils to run under most conditions met with in practice without employing external resistance. It is occasionally necessary, however, when the car is to be run at two or three miles an hour, to make use of the resistance coil

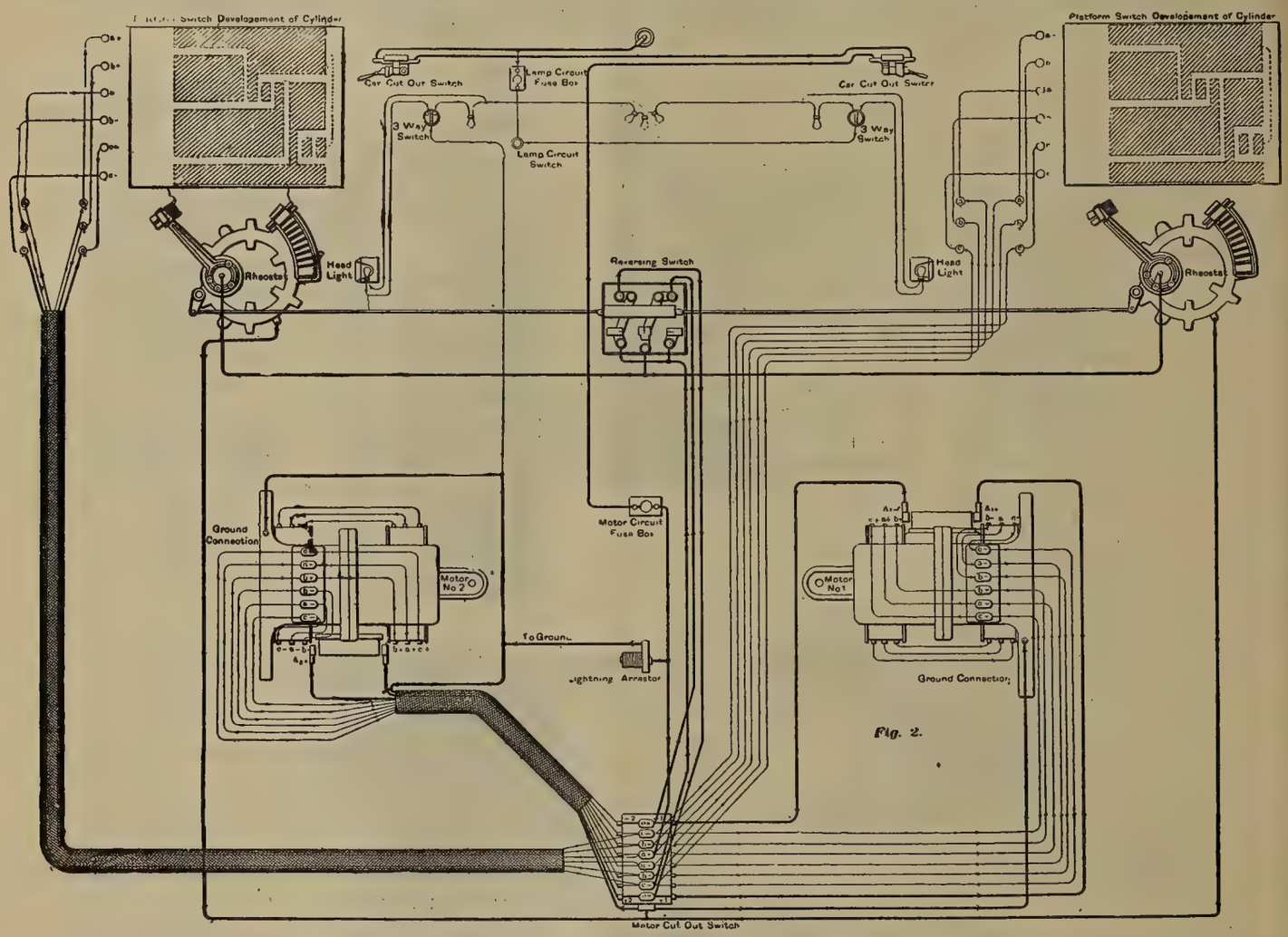


Fig. 2.

FIG. 2.—DIAGRAM OF CONNECTIONS FOR TWO MOTORS IN PARALLEL.

whether the difference in electromotive force at the armature terminals and the line is due to drop in external resistance, or to drop in the magnets. This point determines, once for all, that motors with commutated fields are not necessarily more efficient than other motors.

The particular advantages of the commutated field method are, that with a limited number of pounds of copper, or in the case of street-car motors, with the limited space available for field-magnet windings, it is possible to adjust the magnetizing force of the field coils, so that the rate of doing work of the motors may be made to correspond with the rate this work is required by the car for the various speeds and conditions of track. This adjustment may be made for any size of motor with any required degree of precision by varying the number of magnetic coils. To increase the range or precision it is that is ordinarily used only when starting. With 25 H. P. motors it is necessary, with three sets of magnet windings, to make use of this resistance coil very considerably in ordinary practice, since without this it is not possible to get a speed of less than one-third the maximum speed of the car, which is generally taken to be about 18 miles an hour.

The range of speeds without the use of a rheostat is determined by the limit to which it is safe to heat the magnets. The temperature of the magnets should not in any case exceed 65° C. This would put the increase of temperature at about 30° C. This increase corresponds to an average loss in the magnets of about 0.3 of a watt per square inch of radiating surface. For the few seconds generally taken to start the car the loss may be as high as two watts per square inch without dangerous heating. Experience, however, has demonstrated that to exceed this limit,

even for very short periods, there is considerable risk. Having the maximum number of watts that may be dissipated in the magnets, the series resistance of same may be calculated from the properties of the motor on the supposition that each ampère taken by the motor produces a certain number of pounds pull at the periphery of the car-wheel. In a well-designed motor with commutated fields it is easy to get from 35 to 40 pounds pull at the periphery of a 30″ car-wheel with the coils in the series position. These coils are either wound side by side, or one on top of the other, according to the necessities of the case as determined by the general design of the motor. Experience has shown the advisability of winding these coils in independent spools whenever the general design will permit, since in case of trouble it is cheaper and easier to replace the damaged coil, and there is less liability of crosses between the coils. As an example of a design that has been found to give general satisfaction in practice, I give the following figures from a series of tests made on a Sprague No. 6, S. C. motor, the mag-

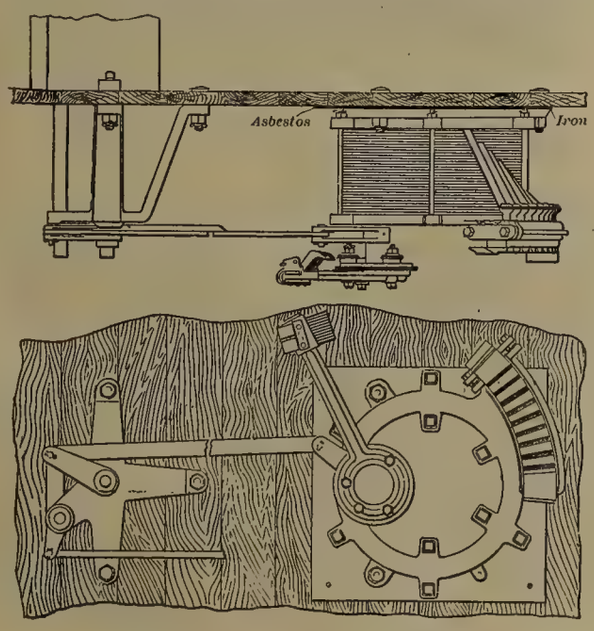


FIG. 3.—DETACHABLE RHEOSTAT.

netic data of which has already been published by myself: *

EFFICIENCY OF STREET CAR-MOTOR NO. 6.

Brake H. P.	Efficiency.	Speed.	Remarks.	Res.
14.3	87 Per Cent.	1110	3 coils in parallel.....	0.8
11.8	87 "	1174	3 " "	.8
11.4	86 "	1184	2 "	1.4
9	84 "	1309	2 " "	1.4
8.25	82 "	955	2 in parallel, 1 in series.	3.24
6.35	79 "	1040	2 " 1 "	3.24
4.9	72 "	1070	2 coils in series.....	4.86
3.9	70 "	1014	3 " "	7.42

It is to be noted especially that it is possible to get an approximately constant speed with a wide range of loads, and yet have the energy dissipated in the magnets remain approximately constant, and that it is possible to get a torque corresponding very approximately over a wide range, to that required to propel a car under conditions met with. This is the solution of the question how to get the highest efficiency. For instance, suppose a car is to be run between two points in a given space of time, and this is not an infrequent requirement, and that the magnet windings of the motor are such that either the car runs the distance in too short a time or in too long a time, it will be necessary then to accelerate the car for a time beyond the limit required, then to allow it to slow down, then to accelerate it again, or go through some such cycle of operations to get the required results. More power will be required with such windings than when such a torque can be had at the motor, that will produce the required speed by an approximately uniform acceleration. To get the same results given above for the No. 6 motor, with the magnet coils arranged in loops instead of separate coils, would require upwards of three times as many pounds of copper as was used in the present case (110 lbs.). This motor was designed to give a maximum car speed under ordinary conditions of from 12 to 15 miles an hour. At present it is thought advisable to have a maximum car speed of from 18 to 20 miles an hour,† since numerous measurements have shown the economy of running street cars at as high a speed as the conditions of track, etc., will permit. In a series of measurements made by myself it was found that the watt hours per car-mile decreased very considerably with the speed of the car up to 30 miles an hour. To get this high speed (20 miles per hour), it has been found necessary to vary the proportions of the magnet coils from that given in the above for the No. 6 motor. Thus for a single reduction 15 H. P. motor the resistance of the last coil to be turned from series to parallel is only 15 per cent. of the total resistance of the magnets, and the turns of this coil only 20 per cent. of the turns in the other two coils. The reason for putting this low resistance coil inside, is to get the greatest number of turns when the coils are all in series, and the least resistance when the coils are all in parallel. Further, under ordinary conditions, this coil has the least expenditure of energy in it, and the least radiating surface. With a winding of this proportion, it is necessary with 15 H. P. motors to use an external resistance of 6 or 8 ohms. With 25 H. P. motors an external resistance of from 10 to 12 ohms is required. This resistance should be so subdivided that there is not more than 20 volts E. M. F. between adjacent contact pieces, and so proportioned that the increase of temperature is not in any case above 150° C.

A method that is receiving a great deal of attention now is that known as the "series parallel method." While it has not yet been introduced very largely in practice, numerous experiments have indicated the desirability of doing this as soon as some of the troublesome features of the switch have been overcome. The method of operating is as follows:

In starting, a rheostat of from 8 to 20 ohms is used, according to circumstances, in series with the motors, which are in series with each other. After this resistance is thrown out of circuit the magnet coils of one of the motors are short-circuited, a section at a time. To make the start smooth, 3 or 4 coils at least are required. The magnet coils being short-circuited, the armature is then short-circuited, and the magnet coils thrown in circuit simultaneously with the armatures being thrown in parallel. It is just at this point where the difficulty with the switch has been encountered, since either the switch has to be operated with great rapidity or the contacts act in perfect unison, otherwise unpleasant results as to short-circuiting occur.

* *Transactions*, vol. vii, p. 218.

† All car speeds are quoted for straight and level tracks. These when calculated for a new motor are determind from the speed and H. P. curve of the motor, assuming the resistance to be 30 lbs. per ton. The methods of measuring these speeds are in general such that the probable error is too great to determine the percentage slip of the wheels.

The advantages of the method are that a very wide range of speeds are obtainable at a comparatively high efficiency, and that the energy required to be dissipated by the rheostat is small for the low speeds frequently required in city practice. This lessening the duty of the rheostat is a very important point, since as yet it has been found exceedingly difficult to construct a cheap rheostat that could be placed under the car in the small space available and dissipate so large an amount of energy as is required when the car is to be run for a considerable time at a speed as low as 2 or 3 miles an hour. Any method of control that has lessened the energy to be dissipated in the rheostat has in general been considered with favor, since there has been a corresponding diminution of trouble in each case that the energy to be dissipated has been lessened.

Having now given a general discussion of the problem a brief description of some of the apparatus recently devised may prove of interest.

Figure 1 shows the general design and arrangement of an improved form of platform switch, which combines both the "field commutation" and the "series resistance" methods of starting cars. To start the car the switch handle is turned from the position marked "off" with a counter clockwise movement; this movement carries the arm of the rheostat, which is placed under the switch, around and over the contact segments, so that the resistance is gradually cut out of circuit. After the contact arm has been carried around to 135 degrees and all the resistance has been cut out, it is released from the cylinder shaft and left locked in this position. A further movement of the switch handle then affects only the cylinder, and commutates the sectional windings of the field-magnets of the motor from series to parallel in the usual way. In stopping the car the field coils are turned from parallel to series, the resistance coil is then again put into circuit and the circuit broken when the contact lever leaves the last segment of the resistance coil, and not, as hitherto, upon the cylinder contacts. The only caution to be observed in stopping is to see that the switch handle shall be turned to the position marked "off," for the motors are reversed by means of a separate reversing switch placed under the car and operated by a lever connecting with a separate shaft in the controlling switch case. The shaft of the platform switch interlocks with this reversing shaft in such a manner that it is impossible to reverse the motors until the cylinder is in the "off" position. The use of this separate controlling switch has been objected to, but to combine both the advantages of the rheostat and commutated fields the switch mechanism becomes too complicated and the switch too large to have the reversing performed by a reverse movement of the controlling switch handle.

The cylinder plates and contacts are made of thick iron stampings, as experience has shown that iron is more durable than brass for this purpose. The burning, due to the formation of arcs, does not have so much effect upon iron as it does upon brass, and there is more certainty of good contact. The contacts on the cylinder consists of a number of stampings arranged in a brass frame, each stamping making an independent spring contact with the switch cylinder. The rheostat employed is built up in a circular form from a large number of flat rings stamped from thin iron sheets. The rings are built up in the form of a cylinder, each ring of iron being separated from the adjacent rings by a ring of mica, except at point where it makes contact with the ring on other side of it. Instead, however, of being arranged in a continuous spiral circuit the coil is divided into a number of parts so arranged that the direction of rotation of the adjacent spirals is reversed, this being done to make the inductance of the coil as small as possible. A coil wound up in a continuous spiral having a mean diameter of 12″ and a radial depth of 1″, 6″ long, and composed of 400 plates, was found to have an inductance of 40 millihenrys. The coil was then wound up in 12 sections, the direction of each section being reversed, and the inductance in this case was found to be 8.5 millihenrys. These sections are stamped from different thicknesses of metal, so that those coils which are in circuit the shortest time and have the least current to carry are of highest resistance and least ampère capacity, and those that are liable to be in circuit for some time are thicker and have less resistance and greater ampère capacity. Copper connections are made at different points in the coil, all these connections being brought to a number of small iron contact pieces fitted in a spiral form and arranged so that the switch contact lever can slide over them. The contact pieces are insulated from the frame with sheet mica and from one another with small slate slabs. The rheostat is entirely fireproof and can expel with safety the heat evolved within it under all ordinary conditions. As a point of practical importance it is, however, advisable to place a sheet of metal and a layer of asbestos paper between the rheostat frame and the car floor. This will prevent any danger from fire, either from heating or sparking, should such occur. It is to be noted that the general design of this rheostat is such that those parts having mechanical functions and energy-dissipating functions have been separated as much as possible. Of course the mechanical functions of a

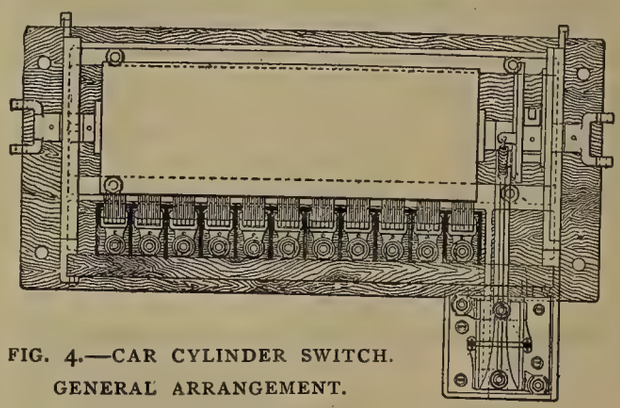


FIG. 4.—CAR CYLINDER SWITCH. GENERAL ARRANGEMENT.

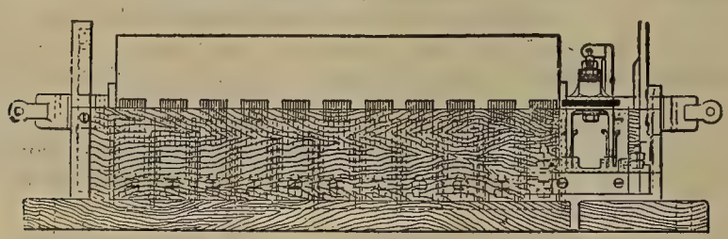


FIG. 4 *a*.

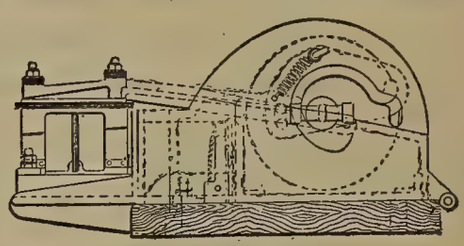


FIG. 4 *b*.

rheostat are more or less limited; it is evident, however, this effort is in the right direction. It is with respect to this particular point that the rheostat has a decided advantage over any form of mechanical clutch in starting a car. The clutch, of course, has its advantage in starting quickly bodies that have a great amount of inertia. In ordinary practice, however, the amount of energy dissipated in a clutch is approximately equal to that necessary to dissipate in a rheostat, but the clutch has in addition to its energy-dissipating function, a very exact mechanical function, and these two functions are interdependent on the same wearing parts. For this reason, if no other, clutches have not yet been made to compete favorably with rheostats.

Figure 2 gives a diagram of the car connections for this switch. It will be seen that the current from the trolley wire first goes through the field coils and switch cylinder for commutation, then through the armature and reversing switch, and thence through the switch-contact lever and resistance coil (in starting) to ground. It will be noticed that by use of the separate reversing switch the armature wires and field wires are each kept separate and distinct from one another. Formerly there was considerable trouble from the breaking of these wires, especially where the wire entered the brass terminals at the various terminal boards. This has been almost entirely obviated by using 49 strand cable wherever wire was subjected to bending.

In some cases the construction at the platform ends is such as to make it inconvenient to place the rheostat used with this form of switch immediately underneath the cylinder. This is the case when certain kinds of draw bar or step constructions are used. In these cases a modification of the switch arrangements is made that is shown in Figure 3. Instead of the rheostat a light frame is placed directly under the cylinder. This frame serves to support the switch shaft, upon which is placed a crank connecting with a bar, which is carried off to the rheostat contact lever. With this arrangement the rheostat can be placed under any convenient part of the car flooring and operated as well as when directly under the platform.

Figures 4, 4*a* and 4*b* show general plans of a car switch designed to be placed under the car and about half way between the motors, when the car construction permits. This design, while open to the criticism that the switch is somewhat inaccessible for inspection, meets the demand that has sometimes been made when it has been thought the space ordinarily occupied by the platform switch could not be sacrificed. The principle is the same as the platform switch already described, but it is modified in form and shape to suit the particular condition under which it is to work, and it is to be noted that the mechanical adjustments required are much more exact, otherwise there would be considerable burning of the contacts, since the motorman would be unable to tell whether or not the switch contacts were on proper positions.

The rheostat is arranged in sections and connections brought from them directly to cylinder contacts. A cylinder is used to commutate both resistance and field-magnet coils.

An important point that has been attended to in this switch is the breaking of the circuit on a separate switch instead of on the cylinder. A snap switch, of the knife-blade pattern, is employed to break the circuit at four points. It operates in connection with the cylinder shaft, to which it is connected with a special locking and releasing gear of similar design to that shown in Fig. 1. The first movement of the cylinder shaft closes the snap switch and completes the circuit through the coil. Further movement then disengages the snap switch from the shaft (leaving it closed), and the different commutations are affected. When breaking the circuit the snap switch is again brought into action.

When this form of car-controlling switch is used, the platform lever is fitted at its lower end with a bevel gear-wheel meshing into another gear-wheel placed on the cylinder shaft. When necessary an extension shaft fitted with one or more universal joints makes connection between the platform lever and the cylinder shaft. When this switch is placed in the middle of the car the amount of car wiring is materially lessened and the car inspection made more easy.

With reference to controlling switches in general, it is evident that a great number of designs may be prepared that will give approximately the same electrical results in point of efficiency. In deciding, then, upon the merits of a new design of switch, the commercial factor relating to repairs has therefore to be very largely considered, and had designers been able to guide their work more closely from the balance sheets of railroad companies, when such had been properly kept, instead of conforming to popular notions, very much more progress would have been made in this line during the last few years.

In closing this paper it might be well that I should remark that my experience has been largely confined to what is known as the commutated field method of control, and that I have naturally expressed many of the qualities of other methods in terms of this method. If these expressions are not judged satisfactory, I leave it for those who have had a similar experience with other systems to express in their criticisms the qualities of the commutated field system in their own terms.

ALUMINUM: ITS MANUFACTURE AND USES, FROM AN ENGINEERING STANDPOINT.*

BY ALFRED E. HUNT.



IN my judgment, the aluminum problems of by far the greatest moment yet remaining to be solved are in connection with the development of the uses of aluminum in the arts. Much has already been done in this matter; the demand for the metal increased tenfold over any previous year in 1891, yet very much more remains to be done. Undoubtedly much has yet to be developed in details in the economical production of aluminum; probably very few realize that more than your lecturer. At the same time, the problems involved in the development of the uses of aluminum in the arts have been underestimated, and have not received the intelligent consideration that the importance of the subject warrants. The world has been centuries learning to use other metals; we have a right to expect more rapid development with the increased general knowledge of to-day, yet it will at best take time to open the entire field that the metal is destined to fill. Within the past ten years there have been two popular widely-spread ways of solving this portion of the "aluminum problem" which are superficial, erroneous and a hindrance to the true solution of the problem; the first assuming properties for the metal that it did not possess, proclaimed that aluminum

* Abstract of lecture before the Franklin Institute, Philadelphia, Pa.

would, as soon as it could be produced in sufficient quantities, replace all the other metals in the arts, not only for the special purposes where the higher-grade metals are now used, but also for structural and building purposes to replace iron and steel; the second view of the subject (the natural reaction from the first erroneous one has become current within the past year or two, as the people began to use aluminum, and found their ideals regarding it shattered) is to the effect that the metal has little or no use in the arts.

The reasoning for the first popular erroneous answer to the problems involved in the development of the uses of aluminum in the arts, was that aluminum was by far the most abundant of all the metals in its distribution in the earth's crust, and *consequently* should be the cheapest. Confusing the comparison of strength of materials, section for section, with equivalent weights, forgetting to take into account its low elastic limit and modulus of elasticity, or modulus of resilience, or its lack of rigidity under compression strains or its natural softness; but noting that the metal withstood the ordinary atmospheric and other usual conditions of corrosion with considerable efficiency over other metals commonly used in the arts, the enthusiastic conclusion was reached that we were rapidly leaving the "steel age," as we had the "iron age" before it, and were advancing upon the "aluminum age," "where this wonderful metal should supersede all others for almost all the uses of mankind." It is surprising that some of the hopeful ones did not propose to mould up the clay banks into buildings and railroads and other useful contrivances, and turn on the electric current and produce the aluminum structures *in situ*.

As instances of the second view of the case, that, I am sorry to say, has become quite fashionable of late, as shown by the frequent publications in trade journals, a writer in a recent German publication, disappointed in his ideals regarding the solubility of the metals in acids, and finding that aluminum could not be used as a substitute for platinum in acid stills, immediately jumps to the conclusion (and publishes his conclusions broadcast) that the metal is entirely unsuitable for culinary utensils, seemingly forgetting that cooking operations are not conducted in muriatic, nitric or even in sulphuric acids, as dressings or gravies, and not considering it necessary to investigate the action of these acids or their salts upon the metal in quantities, and under conditions similar to those the metal would in any likelihood be subjected to in actual use in culinary utensils.

Another writer has gone through a long list of experiments, heading his table of results "Solubility of Aluminum in Acids," using aluminum *foil*, and finding that in from two to four days the foil was dissolved in from one to ten per cent. solutions in water or many organic acids, such as formic, acetic, butyric, lactic, tartaric, citric, oxalic, palmitic, stearic, gallic, salicylic, carbolic, boric, etc., he wisely proclaims that these results show that this metal is unfit for canning materials, cooking utensils or any chemical laboratory purposes. This writer forgets to investigate the differences between foil and thicker plates before drawing his conclusions, nor did he inquire as to the action of these same reagents upon the equally thin foil sheets of other metals, now used for the operations he describes. Had he done so, he would have found that in the sections used in utensils of other metals, aluminum withstands the action of all the reagents mentioned as well as do the metals now in common use; and as for the action of ordinary solutions on thin foil, tin, iron and copper are fully as rapidly acted upon as is aluminum. Aluminum has neither taste nor odor, nor are its salts (in small quantities) especially poisonous, as are the salts of other metals now more commonly used.

Aluminum is not much more acted upon than is tin, copper or silver by salt water, and even by such solutions in vinegar as the metal is liable to be subjected to in ordinary culinary vessels. The salts of tin or copper thus dissolved are very poisonous; but not only are the aluminum salts that are formed less in amount, but the acetate of aluminum formed resolves itself on boiling into either an insoluble subacetate or into pure alumina, neither salt having either taste or injurious toxic action. For these reasons, quite surely aluminum will have a large future for cooking utensils.

The principal impurity of the commercially pure aluminum of to-day is silicon, which exists in two forms, one seemingly combined with the aluminum, as combined carbon exists in white pig iron, and the other in an allotropic graphitoidal modification. These two forms of silicon seem to exert somewhat different effects by their presence in the aluminum; the combined form of the element rendering the metal much harder than the graphitoidal variety. The combined silicon ordinarily preponderates, being fifty-five per cent. to eighty per cent. of the total silicon in the metal of ninety-nine per cent. purity made by the Pittsburg Reduction Company. The graphitoidal silicon is separated on dissolving aluminum in hydrochloric acid as a black insoluble residue, and appears like graphitoidal carbon on similarly treating gray cast iron. In fact, it has been mistaken for carbon by many superficial or ignorant observers. Carbon does not unite with aluminum except at very high temperatures, and its influence seems to be to make the metal very brittle. Metal containing carbon can readily be told by its abnormal crystalline and peculiar colored fracture.

In the electrolytically made commercially pure aluminum of to-day, the only other impurity is iron, which, if it exists in larger quantity than five, or at most ten-one-hundredths of one per cent., is the result of carelessness in the manufacture, or the selection of needlessly impure alumina ore or carbon anodes. The presence sometimes found of copper or lead in any quantity in the metal, is the result of needless contamination with these elements in the preparation of the ore or the carbon anodes, or in the manipulation of the pots. By allowing the pots to run for a considerable time without ore, and with a high current and very hot electrolyte, as sometimes occurs in careless working of the pots, metallic sodium has been alloyed with aluminum in noticeable percentages. Upon placing such metal in hot water, the sodium will be rapidly dissolved out with considerable effervescence, and the pure metal left spongy, honeycombed and weak.

For many purposes the purest aluminum cannot be so advantageously used as that containing three per cent., or even four per cent., of impurity, as the pure metal is very soft, and not so strong as the less pure. It is only where extreme malleability, ductility, sonorousness or non-corrodibility is required that the purest metal should be chosen. For most purposes a small percentage of other elements than silicon and iron are advantageously added in producing hardness, rigidity and strength. Titanium, chromium and copper can readily and cheaply be added, and are constituents that will not detract from the non-corrodibility of the metal as much as do these natural impurities that come from the ore and apparatus—additions that will give the aluminum a better color and greater strength and hardness, with proportionately less sacrifice of malleability, ductility, etc.

The properties of aluminum which will probably give it the greatest availability in the arts are:

(1) Its relative lightness.

(2) Its non-tarnishing quality as compared with many other metals, aluminum not being acted upon by sulphur fumes at all, and being very much more

slowly oxidized by moist atmosphere than most of the metals.

(3) its extreme malleability.

(4) Its easy casting qualities.

(5) The influence of the metal in various alloys will give it advantages, some of which I will try to enumerate and call to your attention.

(6) Its high tensile strength and elasticity when weight for weight of the metal is compared with other metals, and especially when alloyed with a small percentage of titanium, silver or copper, and properly worked by being rolled or hammered or otherwise drawn down.

(7) Its high specific heat and electrical and heat conductivity.

Unfortunately, aluminum is not, section for section, as has been widely claimed, comparatively a very strong metal. It is only about as strong under tensile strain, section for section, as cast iron, and has less than one-half the strength of wrought iron under ordinary conditions. Under compression, the metal, unfortunately, has a very low elastic limit, although its extreme ductility allows the metal to flow on itself so freely as to make it for special purposes a very safe metal to use in compression. I show a series of cylinders of one and one-half inch diameter, which have each had a compressive strain of 200,000 pounds applied to them, together with the result of a compression strain of 180,000 pounds upon similar cylinders of cast iron.

The same remark applies to transverse tests on aluminum. It is not a rigid metal at all, and bends under transverse strains very readily.

SAFETY-CATCH HOLDERS.*

In order to facilitate the control of the electric wires in buildings, and further to safeguard them against accidents, these centre of distribution safety-catch holders have been recently invented and perfected. It is often necessary, in wiring a large building, to run a main line from the dynamo-room or street-service wires to some point or points as centres of distribution whence smaller taps can be taken. Previous to the invention of these devices, a number of porcelain cut-outs or ordinary safety-catch holders of large capacity were used, As the capacity of the ordinary cut-out or safety-catch holders was not sufficient to meet all requirements, the construction of a special device became necessary to carry the heavy current and distribute it to the various requisite points through the building. The centre of distribution safety-catch holders were the outcome of this necessity.

Each branch of the device has a capacity of 250 ampères, and thus one of the appliances can be used where formerly several appliances would have been employed to effect the same end, the saving in cost of construction and improvement in general appearance being a natural sequence. These devices are mounted on slate bases. The lugs are so constructed that they can be easily detached from the appliance, the necessary wires soldered in them, and then returned to their places and screwed fast.

Provision is made of a small plug which, when inserted in its place carries the current around the safety catch when required. This short-circuiting plug is not intended for use for any length of time, and is only employed when changing the fuses, in order that danger from arcing may be obviated.

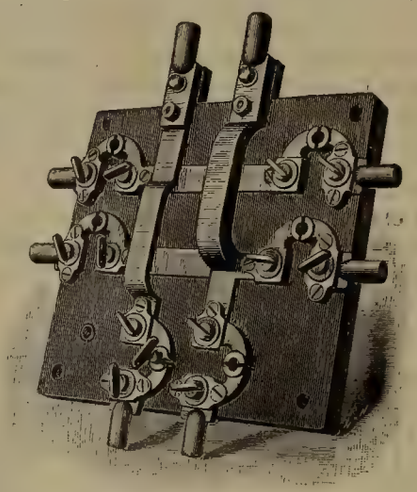


FIG. 4.

If it is necessary to have light after one fuse has blown, the use of the short-circuiting plug still leaves a single-pole protection on the line, but as one plug only is furnished with each device, it would be impossible to have more than one safety catch short circuited at one and the same time.

The thumb-screws are provided with large flat-heads in order that they may be operated by hand, pliers or a monkey-wrench. The specially designed washer under the head rises with the screw without turning on it, and the annoying operation of raising the washer with a screwdriver is eliminated.

The centre of distribution safety-catch holder need not be set up outside of the dynamo-room, nor where the meter is attached to the street service, as it is frequently necessary to run two or more separate mains from this point to sub-centres of distribution in other parts of the building at which points these appliances could be placed.

They are made in four sizes—two for the two-wire system and two for the three-wire system, for two and for three branches.

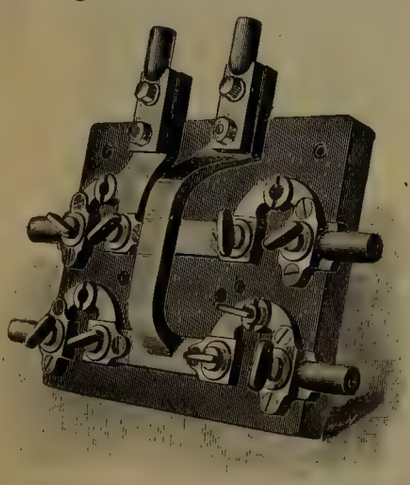


FIG. 1

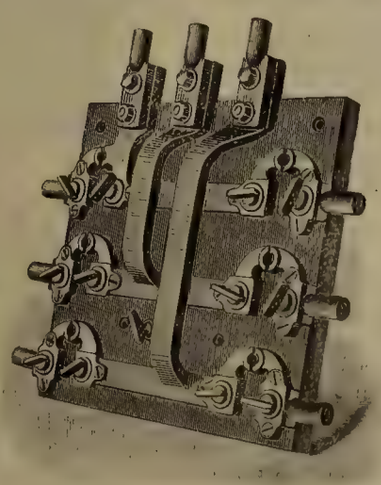


FIG. 2.



FIG. 3.

* Edison General Electric Company, New York.

This invention should prove a powerful incentive in assuaging the rampant timorousness of the fire underwriters against the electrical wire, and should moreover have an excellent effect in reducing the rate of insurance on electrically wired buildings.

SAFETY DEVICE FOR ELEVATORS.

The frequent occurrence of accidents in connection with the operation and use of passenger and freight elevators in buildings has had the effect of directing the attention of inventors towards providing some means for preventing the same.

As usual, the aid of electricity has been invoked to perform this valuable service, and we present to our readers a description and illustrations of a device of this character which, owing to its simplicity, will be readily understood.

Most of the elevator accidents are due to persons falling down the shaft through the doors which have been carelessly left open, and the object of the invention described herewith is to prevent the elevator car from being started until all the doors, or entrances at the different floors, are properly closed and secured.

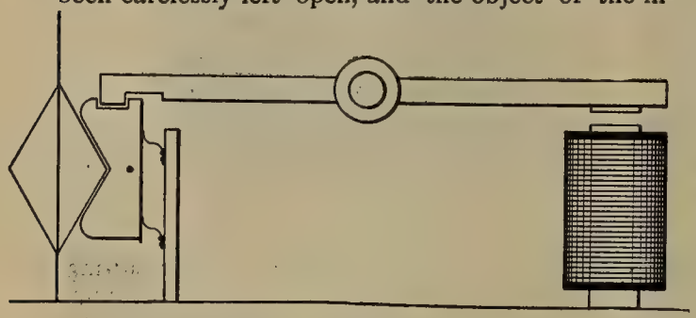


FIG. 1.

This simple and novel device, invented by Mr. Robert W. Magrane, of New York, will fill a long-felt want, and compel careless or incompetent conductors to close the door before the machinery can be started.

We say "careless or incompetent conductors," because the elevators in numerous buildings in this and other cities are run by mere boys or inexperienced persons, notwithstanding that it is in direct violation of the law. In some cases, in factories, for instance, no regular man is employed to control the elevator car.

The management of a large amusement hall in this city until recently compelled the employés to run the car in this fashion. The result was, one of the waiters, carrying a tray of refreshments, and having to wait for the elevator, looked into the shaft to ascertain the position of the car. It happened to be coming down, and before he could withdraw his head the car struck him and he was frightfully injured.

This is an example of one of the commonest dangers attending the operation and use of elevators, and it is manifest that all such accidents are the result of carelessness, either on the part of the employé or the victim.

Mr. Magrane's invention consists of a quadrant with projections placed on the wheel of the starting machinery, together with an electrical arrangement by which the door of the elevator shaft on each floor is connected with a pair of magnets controlling the armature lever, which lever prevents the starting wheel from moving unless every door to the shaft is closed and locked. On opening a door the current is broken, thus releasing the armature lever (shown in the accompanying illustrations) which, coming in contact with the projections on the quadrant (see Fig. 2), prevents the operation of the elevator machinery, and not until the door is closed again and the armature lever is withdrawn can the machinery be started.

This invention can be applied to elevators in any building. The cost of fitting up an elevator with this device is nominal, and there is no reason why every elevator in use should not be equipped with it, thus placing one more safeguard around human life.

Referring to the accompanying illustrations, Fig. 1 represents a simple locking arrangement, applied to the hand or check-rope. The armature-lever shows its position when the door is open. In closing the door, the magnet attracts said lever, thereby releasing the block and permitting the check or hand rope to be moved, starting the car either way.

Fig. 2 represents a complete working-plan of the invention, as applied to the American Express Company's building at 65 Broadway, New York. A quadrant, *c*, is placed on the main check wheel, *b*, with two adjustable wedges, *d*, *d*. The electric instrument, *j*, is placed on the engine base, *f*. The projections or wedges *d* and *d*, are arranged so that when the elevator car is at rest the armature-lever, *e*, will have a free play between, and be in way of said projections, thus preventing the car from being started either way until the armature-lever, *e*, is drawn towards the magnets by the closing of the doors to elevator shaft and consequent closing of the circuit.

In this particular case, a metallic circuit is run and the doors are connected in series.

ELECTRICITY IN INDIA.

"Inventions Likely to 'Take' and 'Pay,' in India and the East," is the title of a pamphlet issued by H. H. Remfry, solicitor and patent agent, 5 Fancy lane, Calcutta, India. Mr. Remfry says that the telephone is increasing in daily use in India. He also says that "enquiries are now being made for a primary battery economically available for heavy work." Such a battery is hoped for in this country, but it has not yet appeared. Mr. Remfry thinks India would be a good field for the introduction of electrical inventions of various kinds.

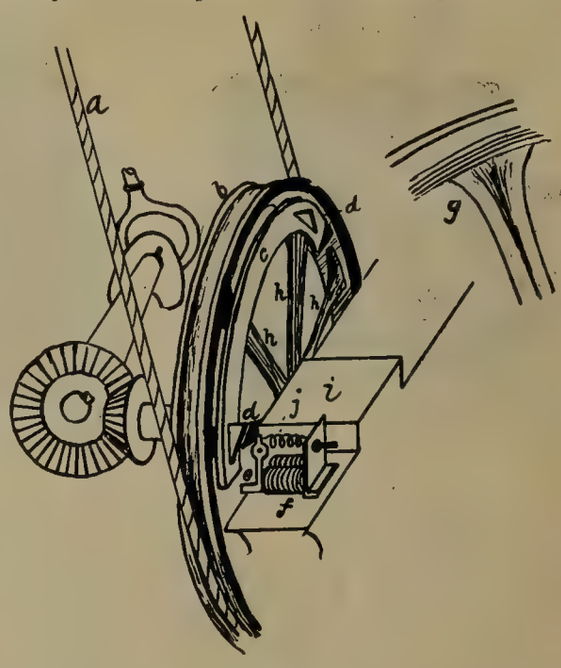


FIG. 2.

BIOGRAPHICAL SKETCHES.

FRANK B. RAE.

We take pleasure in presenting to our readers a brief epitome of the career of Mr. Frank B. Rae, the well-known inventor of the celebrated "Rae" system of electric railways, which is meeting with great success throughout the country. Energetic, ambitious and persevering, he has won for himself through uprightness and honorable dealings an enviable reputation.

Mr. Rae was born in Elmira, N. Y., on July 25, 1854. He attended the common schools up to his twelfth year, at which time his parents moved to Syracuse, N. Y. In his fifteenth year he managed to secure a three months' course in mathematics at a business college. At sixteen he became a messenger for the Atlantic and Pacific Telegraph Company, at Syracuse, and by gradual degrees became successively batteryman, repairer for the division, and finally became an operator on the New York Central Road.



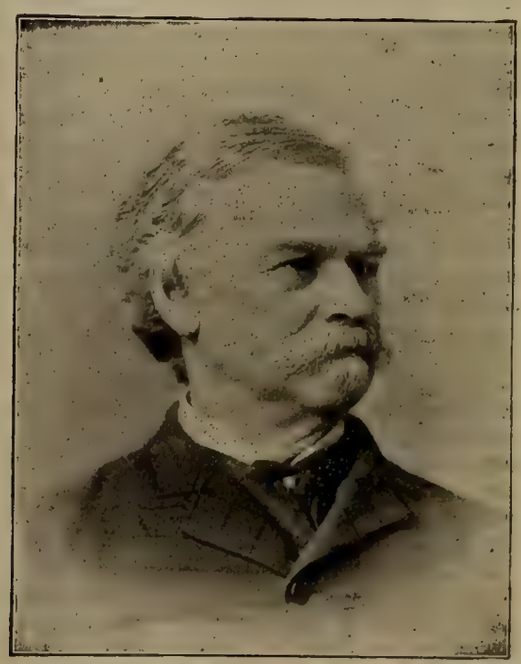
FRANK B. RAE.

After having spent several years in the telegraph service, during which time, in conjunction with Mr. C. H. Davis, he published a work, entitled "Diagrams and Connections," that met with a very favorable reception, Mr. Rae entered the service of the Brush Electric Light Company, of San Francisco, in 1880, and in 1882 was placed in charge of the company's plant at San José.

In 1883 he left for the East to secure patents on several devices which he had invented, and was induced by Mr. Stephen D. Field to remain in New York. He was afterward sent to Chicago by Mr. Field to take charge of the building of the electric railway for the Chicago Exposition of railway appliances, which was equipped with the motor, "The Judge."

On his return to New York, Mr. Rae was associated with Mr. Field in perfecting and bringing out the Field system of stock printing telegraphs, which was subsequently acquired by the Commercial Telegram Company, Mr. Rae for some time having charge of the company's New York offices. As soon as the plant was in good running order he joined Mr. C. O. Mailloux in the electrical engineering business, the partnership continuing until 1886, when he became electrician for J. H. Bunnell & Co. Shortly after this, Count Mitkiewicz, who had obtained concessions from Li Hung Chang, the Chinese premier, made him a very liberal offer to go to China with other electrical engineers, which he accepted. The failure of the Count's plans to materialize, however, after the party had arrived in China, compelled Mr. Rae to return home, which he did by way of San Francisco. He then went to Chicago, and applied the dynamo to use on the stock printing telegraph lines for the Western Union Telegraph Company. Mr. Rae subsequently became identified with the Detroit Electrical Works, with which concern he remained until a few months ago. He is now engaged in business entirely on his own account, as electrical engineer, with his office at 302 Hammond Building, Detroit, Mich.

With his large experience in electrical engineering, particularly in that department which relates to electric railways, Mr. Rae is bound to find future success. He is eminently competent to undertake the installation of electric railways and other electrical enterprises, of any magnitude, and those for whom he may render service of this character may rest assured that his work will be conscientiously and properly performed.



LOUIS W. BURNHAM.

LOUIS W. BURNHAM.

The subject of this sketch, whose portrait adorns this column, Col. Louis W. Burnham, was born in Canterbury, Conn., in April, 1831, and in this case it can be truly said that he is a self-made man.

From the age of ten until twenty he was employed alternately at farming and shoe-factory work, and had very limited opportunities for schooling. At the age of twenty he secured a clerkship with Col. John M. Fisk, of West Brookfield, Mass., in what was then the largest general merchandise establishment in Worcester county. Young Burnham remained here over three years under the most stringent training. After three, he was compelled to give up his position on account of inability to do the hard work required of him.

Determined, however, to be up and doing, he began giving special attention to penmanship; and, with the view of regaining health, he soon began

travelling over the New England and Middle States, giving lessons to classes in writing, and at once met with encouraging success. During this time he was employed as teacher of writing in several of the most prominent academies and seminaries of learning in the East, and he also here again improved his spare hours in study.

During the winter of 1853, after having taught a most successful series of classes in the vicinity of Albany, N. Y., he engaged to take charge of the writing department at the New York Conference Seminary, in Schoharie county, N. Y., where there were at that time over 800 students, and where an average of 300 were daily under his instruction.

Col. Burnham remained here until the winter of 1855, and then entered the Mercantile College at Worcester, Mass., from which he graduated in May. In June following, he migrated to Northern Illinois, and opened a commercial institute at Rockford, which was conducted with marked success for six years. He was elected city clerk of Rockford in 1856–7. During the summer seasons here he devoted much time to the study of law. In the spring of 1861 he opened another school in Freeport, Ill., which was also very successful until the breaking out of the Civil War, at which time a large number of his students enlisted for the war.

After this, in connection with the conduct of his college in Freeport, Col. Burnham turned attention to the collection of war claims, and was thus, on account of influences at Washington, enabled to do many a good turn for disabled soldiers. In the summer of 1862, the ill-health of Mrs. Burnham and death of two children had caused them to think of giving up their many pleasant associations West, and returning East, which was finally brought about in February, 1863.

In the East, Col. Burnham was at once appointed principal of the commercial department of the Hudson River Institute, at Claverack, N. Y., and afterwards opened a college in Hudson, N. Y., which he conducted with success for a year. In 1865 he opened the American Business College, in Springfield, Mass., and at one time had as many as 260 students, so popular was the institution.

Finally, in the spring of 1868, on account of ill-health, Col. Burnham was again forced to give up the college business, and soon after accepted the management of a New York life insurance company's agencies for New England, with headquarters in Boston. In this, as well as all other ventures, he was successful, and continued in the business until 1881.

During this year the National Electric Gas Lighting Company was organized, and Col. Burnham was elected its president and manager. Through his instrumentality the company was reorganized in April, 1882, under the name of The Electric Gas Lighting Company, its capital stock reduced to more reasonable dimensions, and the means provided to start business. Col. Burnham was its first president and business manager, which position he held until 1886, when he was elected vice-president and manager, and Mr. Joseph S. Fay, of Boston, Mass., was induced to accept the presidency in order to enable Col. Burnham to devote his whole mind and energies to the company's trade interests, which he has done up to the present time.

It is through Col. Burnham's indefatigable energy and perseverance that the Electric Gas Lighting Company has been built up to what it is undoubtedly now, the largest and most prosperous concern devoted strictly to the manufacture and sale of domestic electrical apparatus and supplies in the country, its trade covering every State in the Union, while it exports very considerable quantities of its products.

At the present time, Col. Burnham, who is now sixty years of age, is hale and hearty, and apparently possesses as much energy and activity as ever.

Col. Burnham is ably assisted in his numerous duties in connection with the Electric Gas Lighting Company by his son, Mr. Wm. W. Burnham, who is also treasurer of the company, and also by Mr. Arthur Drew, the able secretary and accountant.

OBITUARY.

DR. GRAHAM SCOTT.

Dr. Graham Scott, well-known in the electrical fraternity as the President of the Scott Electrical Works, New York City, died at his home, No. 17 East 21st street, New York, April 18, of acute rheumatism of the heart.

Dr. Scott was born in Philadelphia, and received his early training in the public schools of that city, and was one of the scientists who imbibed the first elements of scientific knowledge at the Central High School of Philadelphia.

At the age of 17 he matriculated at Jefferson College, where he studied for four years, earning the respect of both professors and students, and graduated as



DR. GRAHAM SCOTT.

Doctor of Medicine at the head of a class of over 500.

After graduating, the Doctor was appointed Interne at Berkley Hospital, after a competitive examination, where he served several months. He practised medicine in Philadelphia for a few months, when a desire for new fields seized him. He determined to move to California, where he settled in San Francisco and practised his chosen profession with distinguished success for nearly 15 years. During his residence in California all of his leisure time was spent in the study of science—electricity and magnetism occupying most of his thought. He organized a private telephone association with a number of professional and scientific friends, among whom were Doctors Molech, Hunter, Bettencourt and Decker. The bi-monthly meetings of The Hypocratic Telephone Association were very in-

teresting, and the records would be attractive reading to those engaged in the study of telephony, magnetism, the microphone, etc.

Dr. Scott retired from the practice of medicine several years ago, and returned to New York where he, during the past three years, engaged in scientific investigations of the mysteries of electricity. He organized the Scott Electrical Manufacturing Company of this city, the maker of the well-known Huntington search-light, photo-engraving focussing lamps, and electro-calcium lights.

The Doctor at the time of his death was negotiating for a large tract of land on the Hudson with a 200 H. P. water-power, where he proposed to establish the factory of the Scott Electrical Company and a large storage-battery manufactory.

He proposed to found a model manufacturing village—one of the dreams of his life—where every comfort would be provided for workmen and their families in the most approved co-operative manner.

Dr. Scott was a frequent contributor of articles on medical and electrical subjects to many trade journals.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.



Field Magnets.

THE field magnets of a dynamo electric machine constitute one of the two of its most essential parts. The other part is the armature.

The field magnets are constructed of several parts, namely, the magnet cores (of which there are usually two), the yoke piece, the pole pieces and the wire with which the magnets are wound.

The accompanying illustration shows these various parts and the manner of assembling them to make the field magnets complete.

There are many forms of dynamos in use, but the one illustrated in the diagram is in no essential respect different to all the others.

The function of the field magnets is to create and maintain a magnetic field in which the armature may revolve. As a rule, dynamos are so built that the field magnets are stationary while the armature revolves. Some machines are made, however, with stationary armatures and revolving magnets. One part *must* move ; this is manifest when we think for a moment that in order to create a difference of potential in the wire of the armature, or, in other words, generate a current, that wire must cut through the magnetic lines of force in the magnetic field. This implies motion.

The material used for the different parts of field magnets is the softest iron procurable, except in the case of the wire, which is of copper. Soft iron is used, because with it, it is possible to produce a much more powerful magnetic field than if any other quality were used. Iron is the essential metal to use always for magnets in all classes of electrical instruments on account of its high magnetic properties ; that is to say, it is the best conductor of magnetism. Metals are divided into two classes with reference to their magnetic behavior, viz. : magnetic and non-magnetic. Copper is classed as a non-magnetic metal, while iron is the most magnetic; hence the importance of iron in the construction of magnets will be readily understood.

There are as many different forms of dynamos as there are makers—no two being alike. As the field magnets usually constitute the most prominent part of dynamos, the difference in form of machines relates wholly to the shape of the field magnets, although there are structural differences in different makes of armatures as well. These, however, are not readily noticeable to the observer.

The form of dynamo illustrated in our figure requires a yoke, the function of which is to effect continuity in the magnetic circuit. Without the yoke the magnetic field surrounding the armature would be infinitely weaker, and the machine would be practically valueless. All dynamos do not possess a yoke piece ; indeed, some dynamo field magnets are constructed on the typical horseshoe form, and consequently require no yoke. The form shown in the figure is a modification of the horseshoe ; instead of the curve it has corners.

The pole-pieces are really enlargements of the

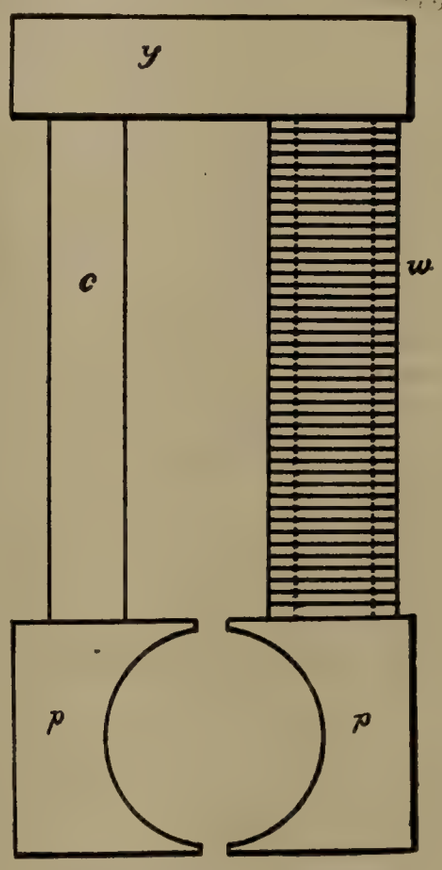


DIAGRAM OF FIELD MAGNETS.

Y, Yoke. *C*, Magnet core. *W*, Magnet windings. *P*, *P*, Pole pieces.

core, so as to increase the surface of magnetic action, and are constructed with curves on their inner surfaces, so as to cover the surface of the armature as completely as possible, and yet have a break in the continuity of the magnetic circuit.

These pole pieces are really the "poles" of the electromagnet. We all know that a horseshoe (permanent) magnet is strongest at its poles ; so in the case of a dynamo, the magnetism is strongest at the pole pieces, and as the lines flow from one pole to the other, according to the direction of the current flowing in the magnet wire, they must necessarily flow or act through the space between the pole pieces. As this place is filled with the magnetic lines of force, and as the wire on the armature must cut lines of force in order to effect a difference of potential, and consequently generate a current, the armature is placed in this space, or magnetic field, as it is usually called.

Concerning the magnetic field we will say more later on.

The core of the field magnets are generally made round. Some, however, are elliptical in shape. They are never made square or in any other form possessing points or corners, because such projections became "poles" themselves, and as it is essential to have all the magnetic influence concentrated at two points, namely, the pole pieces, the importance of adopting every means possible to convey the magnetic lines to these points is manifest; hence the round form is adopted for magnet cores. In the case of the yoke piece the magnetism is very weak, or practically *nil* at that part of the magnetic circuit, hence the existence of the corners makes no material difference in practical results.

The magnetism is strongest between the pole pieces and weakest at the yoke.

As to the winding of the magnets, of course, that involves many factors in its calculation, and as it is not within the scope of these articles to consider intricate problems of this nature, we refer those of our readers who desire to go into the subject further to any one of the text-books which are now published, giving all such information. An excellent work of this class is "Principles of Dynamo-Electric Machines," by Carl Hering.*

Copper wire, of course, is always used for magnet windings. It is covered with some insulating material in order to keep the windings from touching one another. The copper must be of the purest quality obtainable in order to keep the resistance down to a minimum. The size of the wire is determined by calculations based on the work that will be required of the machine.

Some dynamo field magnets are wound with two coils. Such machines are known as compound-wound dynamos.

It is important to have all joints between the parts of a field magnet very secure and reliable, so as to interpose no resistance in the magnetic circuit.

ANSWERS TO INQUIRIES.

Why is it that copper wire is always used on electro-magnets? Would not iron wire do as well? It seems to me that if iron wire were used no core would be necessary, as the iron would act as a conductor and a core combined. U. R. T.

EASTON, PA.

Answer.—The principal reason why iron wire is not used is because of its higher resistance, being six times greater than that of copper. Iron wire has been tried for this purpose, but it does not seem to have met with much success. Iron wire coated with copper and copper wire overlaid with iron have also been tried, and, we believe, with good results, but why it is not more extensively used we are unable to say.

What is the meaning of the word "inductor" as applied to dynamos, and what is meant by "inductor velocity?" T. H.

TUSCALOOSA, ALA.

Answer.—The wires of an armature which move in the magnetic field are the inductors, because it is in them that the induction takes place. Inductor velocity is the speed with which the inductors move through the magnetic field. It is usually measured in feet per second.

* Price, $2.50. This book, as well as all others on electrical subjects, can be obtained at the office of the ELECTRICAL AGE, World Building, New York.

Silver plated and other metallic vessels—sugar-bowls, for instance—are often plated on the inside with gold. How is this done without getting a deposit on the outside? M. V. L.

DETROIT, MICH.

Answer.—Inside gilding is accomplished by filling the vessel with the gilding solution, and suspending in it an anode of gold, the vessel itself being connected to the negative pole of the electric generator.

THE ELECTRIC CLUB.

At the annual meeting of the Electric Club, New York, held at its club house, 17 East 22d street, April 21, the following named gentlemen were elected officers and managers for the ensuing year: President, Samuel Insull; vice-presidents: Edward Weston, E. A. Leslie, W. L. Candee, H. J. Smith; secretary, Stephen L. Coles; treasurer, Geo. M. Phelps; Board of Managers: Chas. D. Shain, Joseph Barré, James Kempster, H. D. Cheever, T. C. Martin, John A. Seely, R. B. Corey, W. J. Morrison, E. F. Peck, Dr. J. B. DeLery, E. E. Bartlett, Frank R. Chinnock; Committee on Membership: Charles Dutton, C. E. Stump, Geo. T. Manson, Jos. Wetzler, C. O. Baker, Jr.

CORRESPONDENCE.

REMEDIES FOR ONE OF THE CAUSES OF ARMATURE BURNOUTS.

EDITOR ELECTRICAL AGE: I was very much interested at an editorial and an article by Edgar E. Stark which appeared in the ELECTRICAL AGE of April 16 last, relating to "Remedies for One of the Causes of Armature Burnouts." The idea is neither new nor original to a great many Philadelphians. I have been using the process for over three years. You New Yorkers call us slow, but in this case, I think, New York, "takes the cake." If you or Mr. Stark will take the trouble to look in the issue of the *Electrical Review* of February 16, 1889, you will find an article on the first page which describes in a modest way my "electrical dissipator" (a name I gave it, not knowing what else to call it). In Mr. Stark's article he did not explain to the novice the difficulty in securing a perfect ground before the discharge passed through the Geissler tubes. Care must be taken not to let your wire come in contact with metal before it passes through the tube, such as nail heads embedded in boards on floors, as it is a well-known fact that nothing has yet been discovered which will insulate static electricity. In experiments with my "electrical dissipator," I found out that static electricity can be used for a great many purposes with satisfactory results, as, for instance, in preventing a boiler from scaling. Let Mr. Stark do some more experimenting with my "electrical dissipator," and see if he can find out how it is done. Some day I may give an explanation.

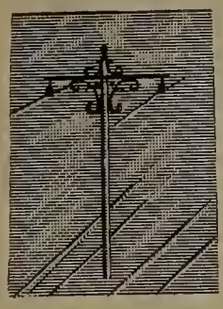
RICHARD L. SMITH, *Engineer.*
200 NORTH 3d STREET, PHILADELPHIA.

Silver Bow Electric Light and Power Co., Butte, Mont., incorporated April 15, with a capital stock of $200,000. Incorporators: W. F. Bartlett, James W. Forbis, J. R. Wharton, Butte, Mont.

Mauston Electric Light and Power Co., Mauston, Wis., incorporated April 20, with a capital stock of $15,000. Incorporators: R. H. Davis, G. S. Cooper, J. T. Heath.

FRENCH AND GERMAN STREET CAR SERVICE.

BY J. M. BATCHELOR.



THROUGH the Department of State we are in receipt of advance information, which will shortly be published, about local transportation in European cities.

In Marseilles, France, omnibuses and horse cars are in use. All of the horse-car lines are owned by one company, which has eight different lines of track, and charges in fare from two to nine cents a trip, according to the distance. The municipality contracted in the franchise for 2¼ per cent. on the gross receipts, and stipulated that the fare should be limited to 0.621 cents per mile. The municipality, through the mayor, also regulates the routes to be taken and gives the company the privilege of reducing the fare below the maximum rate mentioned. The cars are said to be unclean and frequently over-crowded, which is explained as due in part to the custom among the better classes to patronize cabs, which charge 20 cents per course, or 40 cents per hour. Last September 26, the stock of this company was quoted at one per cent. premium. The population of the city is 407,000.

Lyons, France, has steam as well as horse trams, the former running through the city to the suburbs; but no speed is permitted within the city limits exceeding five miles an hour. The summer of last year witnessed a strike by the 300 operatives of the General Omnibus and Tram Company, the chief demand being for hours of service not to exceed eleven hours and twenty minutes per day. The government and the public were in sympathy with the strikers; and after 4½ days, during which time no buses or trams were run, the company conceded the strikers' demands. No personal violence was used and no destruction of property took place worth noting. The affair was managed by the officers of a syndicate of workmen, and excited surprise at its orderliness. The city has a population of 500,000. Where the same company has more than one line, transfer tickets are given at one cent extra; the ordinary fare is four cents for first-class, and two cents for second. Members of the army pay one-half of the regular rates.

Paris, the capital, has a great variety of systems; trams operated by horses, steam cars without firegrates, steam with firegrates, compressed air, electricity, one experimental line—cable, buses, etc. The fare is uniform throughout the city limits; six cents for first-class, and three cents for second; but the first-class rate includes a transfer to connecting lines. Outside of the city the maximum fare is two cents first-class and 1½ cents second-class, per kilometre. The city collects a tax of about $400 annually on each vehicle in circulation, and one-half of the profits when dividends exceed eight per cent. of the value of each share, which is 875 francs. Newer lines pay a tax of about six cents for each round trip; whether this is in addition to the other taxes is not stated. Franchises are regulated to suit the State, and not the companies; out-of-the-way routes are imposed upon the companies, and the government fixes the trips and time tables. The street-car companies are classed as profitable in spite of the many restrictions.

Aix-La-Chapelle, Germany, has one horse-car line, which pays an annual tax of $125 and 6¾ per cent. of its profits to the city and three per cent. of its profits to the state of Prussia. Police are carried free, and army officers and school-children at one-third rate. Rates are fixed by mutual agreement between the government and the company, and are very low: fifteen pfennigs—3¾ cents—within the city, which affords a very small profit. The municipality requires no compulsory service.

Berlin, Prussia, has one elevated steam road, and four street-car lines. The elevated road belongs to the government. Rates of fare on the street-car lines are divided into sections, or zones; the lowest rate is 2.4 cents, and each increase is about 1¼ cents. On the elevated road they have first and second class cars, but inside or outside places cost the same. The companies are permitted to reduce rates, but not increase them, as all rates are subject to the government's approval. Car companies are required to keep the pavement between tracks, and a little on each side in order, although one company pays a rent to the city for the purpose of compensation for pavement repairs, allowing the city to do the work. The Berlin Steam Street Car Company is not required to keep pavements in order. Scholars, police and postal officials are allowed reduced fares if they take out monthly tickets in advance. The cost of such tickets is 72 cents per month. For 1890 the Great Berlin Street Car Company paid a dividend of 12½ per cent., but the other companies made little or nothing. The elevated railroad profits are not known.

Bremen has eight lines of street cars, belonging to three companies, and they are constructing an electric line, Thomson-Houston system. One horse line charges five cents fare for full distance—about five miles (English), and 2½ cents for any distance not exceeding one-third way; two horse-lines charge 7½ cents full distance, and 2½ cents for third way. The municipality makes no tax charge against the companies, almost the only instance of the kind in Europe. But the authorities regulate maximum fares, and oblige the car companies to keep their part of the streets in repair. These car companies are considered financial successes; profits not advertised.

Cologne, Germany, has one company of horse cars only. Fare is a matter of agreement between the company and the authorities; the lowest being 2.38 cents, and the highest, 5.9 cents, with two intermediate figures. The municipality receives lump sums for the franchise—in the neighborhood of $250 per year. At the end of the franchise, 1916, the city comes into possession, but reserves the right of purchasing the plant. The company may be compelled to build additional lines if the city thinks they are necessary; and the company cannot extend without the city's consent. Dividends are 6 per cent.

Dresden has one company, the Tramways Company of Germany, which in 1890 had 86½ cars in use. Horses worked, 671; passengers carried, 14,051,804; passengers per day, 38,496; which is an increase of about 15 per cent. over each immediate preceding year; that is, in passengers. Uniforms are supplied by the company; one cloak costs $11; coat $5.40; one pair of trousers $2.40; vest $1.40; cap 70 cents; total about $21; but the men are taxed 5 per cent. of their wages for uniforms, and they receive a new suit once a year. The horses make 15 miles each day. Conductors work 12 hours per day on the average, with pay varying from sixty cents to seventy-five cents per day, according to length of service. The average cost of the car horse is $205.

NEW ELECTRIC FAN.*

It is truly said that electricity can be adapted to meet almost every requirement of man. It can, when properly utilized, keep him warm in the winter time, and in the summer time it can be harnessed to devices which will keep him cool.

Electric fans have become very popular in the past two or three years, and it is the exception now to find a restaurant or other public place which is not equipped with these useful machines.

The electric fan illustrated herewith has just been brought out, and judging from the favor it has already met with, there will likely be a great demand for it. It is of beautiful and artistic design, and is driven by an electric motor, which may be placed in any convenient place independent of the fan.

The illustration is that of a ceiling fan. These fans, however, can be made to suit any style of decoration and for any position. The company makes a pillar fan of the same general design, which is excellently adapted to situations where a ceiling fan would not be desirable. For restaurants and other similar places these fans are especially adapted, and we understand from the makers that there is already a great demand for them.



ELECTRIC FAN.

One of the ceiling fans is in practical operation in the firm's office, where it may be seen and its merits tested.

LARGE ORDERS FOR MOTORS.

The Short Electric Railway Company, of Cleveland, O., is rapidly securing a solid foothold in the New England States. Mr. Edward J. Wessels, of its New York office, has just closed a contract for the installation of its apparatus with the Norwich Street Railway Company, the New Haven and West Haven Horse Railway Company, of New Haven, Conn., and from the Natick Street Railway Company, of Natick, Mass., the latter road already operating three Thomson-Houston motor cars. The contract with the New Haven and West Haven Railway calls for 19 single equipments of 25-H. P. single reduction motors and 7 double equipments of the same type. Westinghouse, Church, Kerr & Co. will supply the engines and dynamos, consisting of 3 large-sized direct connected engines and dynamo units. The Norwich Street Railway will have 15 25-H. P. single reduction motors. The Short Company has promised to deliver the 52 motors with all possible speed, so as to enable the roads to be operated with their new systems early in June.

* McLeod, Ward & Co., 91 Liberty st., New York.

FRANCHISE SOLD.

The franchise for the construction and operation of an electric railroad on Staten Island from Port Richmond to Prohibition Park and South Beach, which was secured on February 11 by Mr. F. R. Chinnock, State Agent of the Edison General Electric Company, has been sold by him to a syndicate, which will operate the road under the name of the Prohibition Park Railway Company. Messrs. Royal C. Vilas, president of the New York Air Brake Co.; C. A. Starbuck and J. C. Thompson, president of the Eames Vacuum Brake Co., comprise the syndicate which purchased the franchise.

NEW INCORPORATIONS.

The Harvey Steel Car and Repair Works, Chicago, Ill., incorporated April 15, with a capital stock of $250.000. Among other things it will manufacture and dispose of electric motors. Incorporators : T. W. Harvey, Elmer E. Kaulman, Robert Titus.

City Plumbing and Construction Co., Chicago, Ill., incorporated April 15, with a capital stock of $15,000, to do a merchandise and contracting business, consisting of electric lighting and other things. Incorporators : William Holgate, Albert A. Campbell, Frank F. Fox.

Menominee Electric Light and Railway Co., Menominee, Mich., incorporated April 13, with a capital stock of $110,000.

Citizens' Electric Lighting Company, of Pontiac, Mich, principal office, Detroit, Mich., incorporated April 15, with a capital stock of $40,000. Incorporators : G. E. Fisher, O. D. Chase, Detroit, Mich.; George H. Foster, Pontiac, Mich.

The Cyclo Clock Co., Jersey City, N. J., incorporated April 13, with a capital stock of $250,000, to manufacture, sell and let electric self-winding clocks, etc. Incorporators : E. Erschell, Long Island City, N. Y.; C. W. Myer, Brooklyn, N. Y.; E. Klahn, Jersey City, N. J.

Wisconsin Electrical Construction Co., Milwaukee, Wis., incorporated April 14, with a capital stock of $12,000. Incorporators : W. N. Stewart, A. E. Slocum, C. A. Kanister.

Indianapolis Street Railway Co., Indianapolis, Ind., incorporated April 14, with a capital stock of $1,500,000. Incorporators : Edward F. Leonard, John W. Dunn, Edwin Armstrong.

National Electric Brake Co., St. Louis, Mo., incorporated April 13, with a capital stock of $50,000.

Incorporators: William Koedding, G. L. Van Beek, J. H. Grimen, all of St. Louis, Mo.

The Hull Electric Light and Power Co., Hull, Mass., incorporated April 13, with a capital stock of $10,000. Incorporators: Henry F. Holland, Z. T. Harrington, George A. Beatey, George E. Davis.

American Electrical Co., Portland, Me., incorporated April 14, with a capital stock of $500,000. Incorporators: Fred. Balcom, Philadelphia, Pa.; George F. Gould, John Fagan, Portland, Me.

Rockville Electric Light and Power Co., Rockville and Indianapolis, Ind., incorporated April 16, with a capital stock of $20,000. Incorporators: Charles E. Thornton, W. W. Hubbard, W. J. Hubbard, all of Indianapolis, Ind.

Cajon Mining and Water Co., Los Angeles, Cal., incorporated April 14, with a capital stock of $250,000. Among other things it will deal in electricity, lighting, etc. Incorporators: F. A. Marcher, I. E. Lucas, J. E. Lane, B. E. Toler, Los Angeles, Cal.

The Massillon Street Railway Co., Massillon, Ohio, incorporated April 13, with a capital stock of $50,000, to construct a street railway to be operated by electricity or other suitable means. Incorporators: William Lynch, J. W. McClymonds, C. A. Gates, Charles M. Russell, Warren E. Russell.



SPECIALTY NO. 18.

The Canton-Massillon Electric Railway Company, Canton, Ohio, incorporated April 13, with a capital stock of $200,000. Incorporators: William A. Lynch, A. J. Underhill, H. M. Lyman, L. A. Soichot, T. R. Catlin, J. W. Underhill.

The Catasauqua and Northern Street Railway Co., Catasauqua, Pa., incorporated April 11, with a capital stock of $50,000. Incorporators: G. H. Campbell, George W. Mansfield, Boston, Mass.; R. E. Wright, Allentown, Pa.

The Hamburg Electric Light and Power Co., Hamburg, Pa., incorporated April 12, with a capital stock of $15,000. Incorporators: Milton L. Ritter, Windsor Castle, Pa.; George F. Meharg, Frank S. Correll, Hamburg, Pa.

The Manor Electric Co., Manor, Pa., incorporated April 14, with a capital stock of $6,000. Incorporators: W. J. Beamer, F. L. Fry, W. H. Gress, Manor, Pa.

The Connecticut Tramway Co., New London, Conn., incorporated April 12, with a capital stock of $20,000. Among other things it will construct electric-light plants and electric railways in Connecticut. Incorporators: Dwight Townsend, New York, N. Y.; Tracy Waller, New London, Conn.

Pasco Union Land Co., Pasco, Wash., incorporated April 15, with a capital stock of $750,000. Among other things it will maintain and operate electric light works. Incorporators: Louis C. Frey, R. Olney, W. P. Gray, Pasco, Wash.

A NEW SPECIALTY.

The McCreary Electrical Specialty Company, 136 Liberty street, New York, has just brought out several new specialties. The cut shows what is known as specialty No. 18, and represents a new special ceiling fixture for utilizing reflector shade and half shades combined. This fixture is so arranged that each lamp can be used separately or jointly. In the latter case, by using colored lamp shades a beautiful effect is produced. These fixtures are of elegant design and workmanship.

COAL MINING MACHINES.

There is a great demand for the coal mining machines operated with electrical power, manufactured by the Jeffrey Manufacturing Co., Columbus, O. There are now fifty-one of these electric machines in daily use and giving complete satisfaction. It is claimed to be the only successful coal mining machine operated by electricity, up to the present time, and with the aid of practical, experienced men, combined with an experience gained during the past three years, the company is enabled to contract for complete plants under guarantee to accomplish all that is claimed for them. The following are a few of the orders recently received: Second order, for one Jeffrey electric mining machine, from the Congo Mining Co., Congo, Ohio. Third order, for one Jeffrey electric mining machine, from the Redstone Oil and Coke Co., Grindstone, Pa. Also three orders, first equipment, for complete Jeffrey electric coal mining machine plants for the Hocking Valley, briefly described as follows: Two plants each, consisting of boilers, engines, dynamos and all necessary connections to run four Jeffrey electric mining machines, with a daily tonnage capacity of 800 tons. Also, a third plant complete, to run six Jeffrey electric coal mining machines, with a daily tonnage capacity of 1,200 tons.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, April 23, 1892.

PROF. GEORGE FORBES, of London, England, is in the city on a visit.

MR. W. R. MASON, general manager of the Railway Equipment Co., Chicago, was in town last week.

FIRE recently destroyed the Long Island Railroad Company's electric-light plant at Long Island City.

A CONTROLLING interest in the Tropical American Telephone Company has been acquired by the Western Electric Company, and hereafter the affairs of both concerns will be conducted on such a basis as to prevent conflicting with each other's interests. Under the new arrangements the following officers have been elected: Chas. N. Hough, president; H. B. Thayer, general manager, and Mills H. Lander, treasurer. The offices of the Tropical Telephone Company are now at 125 Greenwich street.

A BILL has been introduced into Congress for an appropriation to increase the illuminating power of the torch in the Statue of Liberty from 54,000 to 100,000 C. P. It is claimed that the present light is useless in foggy weather.

MR. E. L. BRADLEY, of the Delaware Hard Fibre Co., Wilmington, Del., manufacturer of pure hard fibre for electrical and mechanical purposes, was in town a few days ago.

BURGLARS recently made an unsuccessful attempt to force open two safes containing a large quantity of platinum in the office of Baker & Co., metal refiners, of Newark, N. J.

THE firm of Julian Scholl & Co., mechanical engineers and general contractors, including the installation of complete power plants, etc., and the New York managers of the celebrated Weston Engine, have removed from 40 Cortlandt street into a suite of large and well-adapted offices at No. 126 Liberty street.

THE "Roy Valve," manufactured by the Roy Valve Company, 15 Cortlandt street, has given such universal satisfaction that the company is kept constantly busy attending to the great number of orders which are being received daily from all parts of the country. The superior merits of the valve are so well known that it needs no further recommendation.

WOODBRIDGE AND TURNER, contractors and expert engineers, Times Building, this city, are constructing the track for the Paterson Central Electric Railway Company, Paterson, N. J. They are also putting up the trolley systems of the Brooklyn and Coney Island Street Railway Co., and Portland City Railroad Co., Portland, Me. This firm has an enviable reputation for first-class work.

BENJAMIN BLUM, of this city, has brought an action in equity in the United States Court of the State of Maryland against the Wenstrom Consolidated Dynamo and Motor Company and Edwin L. Tunis (formerly president of the company); also John E. Semmes and B. Howard Haman, who were appointed receivers of this company by the Circuit Court of Baltimore, to set aside certain assignments of patents made by B. Blum. This action is brought against the company for failure to carry out the terms of sale. An application has been made restraining the defendants from making any transfer of patents pending the trial of this action. Ex-Judge A. J. Dittenhoefer and D. Gerber, of this city, and Messrs. Savage & Taylor, of Baltimore, are attorneys for the plaintiff. Messrs. Gans & Haman, and Steele, Semmes & Carey, of Baltimore, are attorneys for defendants.

THE following named gentlemen, well-known in the electrical trade, gave this office a call last week: R. D. Nuttall, of Pittsburg, Pa.; H. B. Oakman, of the Edison General Electric Co., Buffalo; F. R. Chinnock, of the same company, and E. D. Carter, New York manager of the Ball Engine Co., of Erie, Pa.

TRUEX AND VAIL, 136 Liberty Street, this city, report an active trade in swinging ball lightning arresters and Walker ammeters. These arresters are said to be the best and cheapest in the market, and are highly endorsed by the many who use them. The Walker ammeter is an excellent instrument. It is accurate and reliable, aud can remain in circuit without affecting its calibration.

THE CLARK ELECTRIC COMPANY, of No. 192 Broadway, this city, reports a great increase in business. This company is said to be the only one in the United States that makes a specialty of manufacturing under its own patents electric arc lighting apparatus. One of the latest and strongest testimonials received by the Clark Co.is from Mr. R. Stewart (an electrical expert), Superintendent of Telegraphs of the Central Railroad of New Jersey. He states that he has had no trouble in any respect with the lamps put in at his large station in Communipaw.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Engineering Co., N.Y.	1,000,000	100 00	60 0
American Telegraph and Cable	14,000,000	100 00	85 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	204 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	110 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 50
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	81 00
Edison General	15,000,000	100 00	101 00
Edison General Receipts		100 00	101 50
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Franklin Electric Co., N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co. 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N.Y.	50,000	50 00	40 00
Hickory Electric Co., N. C	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 50
Laclede Gas pref	2,500,000	100 00	57 50
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	20,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Muncie-Coles Electric Railway Equipment Co., N.Y.	500,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	15 00
Postal Telegraph	10,000,000	100 00	55 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*95
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	61 25
Thomson-Houston pref	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Western Union	86,188,852	100 00	92 00
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	29 75
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	47 00
Westinghouse Ass. Rects		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Among the dividends which have been earned and declared payable early in May, I note the regular quarterly one of the Edison General of 2 per cent. The holders of the trust receipts will receive theirs in common with the holders of the old shares; this is in full accord with the circular agreement of February 9, and is the first payment on account of the receipts. The Edison Electric Illuminating Company pays 1¼ per cent. for the quarter on the same day, May 2. The Thomson-Houston declares its regular quarterly dollar per share dividend, payable May 14. The next dividend of this and the Edison General Company will probably be paid on the shares of the General Electric Company. I do not find the old well-known names of the Brush Electric, Brush Illuminating, United States and United States Illuminating among the list. Now is the time to invest in the General Electric Company in any one of the various methods offered; there will be a big boom as soon as the consolidation is perfected and the company in working order. Many new improvements, which have lain practically dormant on account of actual or possible conflict in ownership, will be vigorously introduced, and competition on many lines will cease to exist, consequently larger profits and better public service will result. The present understanding is that the new corporation will issue $4,000,000 30-year 5% gold bonds and retire the floating debts of the Edison and T.-H. companies, and offer these bonds at 95%; they will be convertible into General Electric stock, taking the stock at 120. The Governor of New York took a long step in the right direction when he kept the corporation in this State, one which only a banker-governor would be apt to do.

EASTERN NOTES.

An order for a 1,000 horse power electric light plant, to be used in a Milwaukee brewery, is being filled by the Mather Electric Light Company, of Manchester, Conn. It will consist of six 150 horse power generators, each weighing 18,000 pounds, and are the largest the company has so far made.

A plot of ground containing 10,000 square feet has been purchased by the Malden, Mass., Electric Light Company, on which will be erected,a duplicate electric lighting plant at an expense of $50,000. On completion of the station a day power and lighting service will be put into effect.

WESTERN NOTES.

The R. D. Nuttal Co., Allegheny, Pa., reports great demand for its new style steel trolley pole. A new department for the construction of armatures has been recently opened.

The offices and store-room of the Pittsburg Reduction Company, Pittsburg, Pa., have been removed from 95 Fifth avenue to 116 Water street, where a full line of aluminum supplies will be kept in stock.

Mr. Wilton, the popular secretary, treasurer and manager of the Peninsular Electric Light Co., Detroit, Mich., sailed for Europe on the 16th inst. He will remain away about four months. It is said to be a trip of pleasure.

The Electric Appliance Company, Chicago, has been appointed agent in the West for the Security Insulator Company, of New York. The merits of this insulator were fully described in a previous issue of the Electrical Age.

The Western office of the Electric Construction and Supply Company, of 18 Cortlandt street, New York, which has heretofore been located in the Phenix Building, Chicago, has been removed to the Unity Building, in the same city.

Mr. L. E. Myers, the Chicago representative of the Detroit Electrical Works, has closed a contract with the Sioux City and Leeds Railway Company for the equipment of its road into an electric system. The contract includes motors, overhead trolleys, poles, car bodies, etc., with the exception of rails.

The telephones for the World's Fair are to be furnished by the Chicago Telephone Company at a rental of $25 per quarter; 300 instruments will be used. The company will do the wiring at its own expense. Private subscribers will be charged city rates only, and a fee of ten cents from the public exchanges.

Kuhlman & Co., of Cleveland, O., who make a specialty of street car work, are at the present time, building a large number of motor car bodies for the East Cleveland Railway Company, and it is stated they will be as fine a lot as ever graced the streets of any city. Kuhlman & Co. pride themselves on this class of work.

The Government of France, through its consul at Chicago, applied for 20,000 square feet of space in the Electricity Building, but was awarded only 6,000. The request for 20,000 square feet was made on the ground that Germany had been awarded that much space. Germany's grant was made months ago, when it was not thought great demands for space would be made, and it is now thought the allotments made to that country and England will have to be reduced.

The Electrical Equipment Co., of Detroit, Mich., reports business very good. One of its most recent installations is that of a 25-light plant on the steam yacht *Grace*, which plant consists of C. & C. dynamos and Blake engine. The dynamo-room is only four feet square by 1¾ feet in height, and is encased in plate glass. It is said that the workmanship on this plant is the finest in this part of the country, which reflects great credit upon the company. Mr. J. J. McKenna is the manager, and, in the language of the Westerner, he is a "rustler."

John Wood, Jr., of the Schuylkill Foundry and Machine Works, Conshohocken, Pa., reports an active business in his patent water tube boilers at the main works, also at the branch works at East Saginaw, Mich., and Zanesville, O. Recent shipments are as follows: 1,000 H. P. to Duncannon Iron Co., Duncannon, Pa.; 600 H. P. Windsor Locks Steel Co., Windsor Locks, Conn.; 200 H. P. New Haven Rolling Mill Co., New Haven, Conn.; 1,000 H. P. J. Wood & Bros. Co., Conshohocken Pa.; 400 H. P. Hughes & Patterson, Philadelphia, Pa.; 600 H. P. Chester Pipe & Tube Co., Thurlow, Pa.; 500 H. P. John & James Dobson, Philadelphia, Pa.; 500 H. P. Alex. Kerr, Bro. & Co., Salt Works, N. Y.; 100 H. P. Pottstown Iron Co., Pottstown, Pa., and 150 H. P. to Pottsville Steel & Iron Co., Pottstown, Pa. The greater number of orders now in hand are for electric light and railway purposes, for which these boilers are particularly adapted. The increasing demand for these boilers will necessitate the establishment of other works in addition to those now in operation.

FUSE WIRE INTERESTS.

On April 16 the Massachusetts Electrical Engineering Company, Boston, sold all the material and machinery which it used in the manufacture of fuse wire, together with the good will of the business, to the Shawmut Fuse Wire Co., of Boston.

This company has been organized expressly for the purpose of manufacturing fuse wire and links of the highest grade, and will have every facility for filling orders in a prompt and satisfactory manner.

All the wire and links which it manufactures will be tested, as heretofore, at the laboratory of the Massachusetts Electrical Engineering Company, and a certificate of test signed by the same company will accompany each spool of wire and lot of links sold.

The Shawmut Fuse Wire Co., 85 Water street, Boston, has issued a notice to the effect that it has purchased of the Massachusetts Electrical Engineering Co. its present fuse wire business, including all machinery, apparatus, etc., used in the manufacture of fuse wire and links.

The company intends to devote itself exclusively to the manufacture and sale of the different forms of fuses used for electric lighting, street railway and telephone purposes.

LARGE POWER FROM A SMALL AMOUNT OF WATER.

The Pelton Water Wheel Company has recently furnished the Commercial Mining Company, of Arizona, a power plant which affords a good illustration of the extraordinary results that can be obtained from a small quantity of water under a high head, as also the estimate of value placed upon water-power where so large an outlay is made for a comparatively small amount of power. This plant consists of a 4-ft. Pelton wheel, which runs under a 1,200 ft. head at 699 revolutions a minute, developing 45 H. P., using a nozzle tip $\frac{53}{100}$ of an inch in diameter. Also a 24-inch Pelton wheel running under the same head at 1,380 revolutions, developing 20 H. P., with a nozzle tip $\frac{35}{100}$ of an inch diameter.

These wheels run a concentrating and smelting plant, including rock-breaker, blowers, pump, etc. The pipe line is 20,000 feet in length, the upper end being 6 and 5 inch casing, and the lower end 5-inch lap-weld pipe.

All the water supply that can be counted on during the dry season is a flow of about 30 cubic feet a minute. The large expenditure here made in pipe line for results obtained will indicate the advantage that water-power has over steam under much more unfavorable conditions than generally exist.

NEW "A. B. C." CATALOGUE.

The New "A. B. C." catalogue is just out. It is a book of over 270 pages, handsomely bound, and contains prices and descriptions of almost every article required in the construction and operation of electric light, power and railway plants.

Part of the book is devoted to railway appliances, and shows a number of insulating devices and other specialties which will be kept in stock at the New York store.

From an examination of this book, it is apparent that there have been during the past year many novelties brought out in the line of electric light fittings and fixtures, about 50 pages of the catalogue being devoted to new goods.

The subject of fan motors is given special prominence, several new forms of machines being described, among them a $\frac{1}{10}$-horse-power motor and fan for 110 volts, direct current, which appears to be the most compact outfit of the kind yet put on the market. The catalogue also describes a new alternating fan motor which has several advantages, and on account of its superior efficiency is likely to be largely called for by stations using the alternating system.

A WONDERFUL PERFORMANCE.

The "C. & C." motor comes to the front with a wonderful record again. One day last week the *Star* newspaper building of Washington, D.C., was the scene of a very large fire, which entirely destroyed the steam plant and rear end of building. While the fire was still burning, Mr. C. W. Messner, the local agent for the "C. & C." Motor Company, received orders to at once examine the condition of the motor (a 20 H. P. "C. & C.," which was purchased some three years ago for just such emergencies) and to report the possibilities of running off the next day's edition. The motor was found surrounded by fire, with water flowing in torrents all around and over it. After the fire the motor was tested and found all right; came out without a scratch.

The Saturday's edition of 60,000 copies, of 12 pages each, was run off on the two large Hoe presses, which alone require 30 H. P. to start and 20 H. P. to run.

Considering that the presses were rusty and all the shafting stiff, and that the paper was gotten out on time, it is indeed a wonderful performance of this motor. It also shows the push and enterprise of the *Star* people.

NEW EQUIPMENT COMPANY.

The Street Railway Equipment Company, 617–619 Pullman Building, Chicago, Ill., has just been organized with Mr. W. R. Mason as general manager, for the purpose of manufacturing and dealing in electric railway supplies for use on all systems. As the company's representatives have had long and practical experience in all branches of the business, its ability to successfully meet all requirements is unquestioned, and railway officials about to equip their systems will no doubt find it to their advantage to correspond with the company before giving out their contracts. A catalogue will soon be issued by the company, fully illustrating and describing material of its manufacture, also containing data of great interest to builders, owners and managers of electric roads.

Mr. Mason has a host of friends in the trade, and no doubt there will be a great desire among them to see him make an unqualified success of his new venture. These are our sentiments, exactly.

BALL ENGINES.

The following letter to the Ball Engine Co., Erie, Pa., maker of the well-known Ball engines, is self-explanatory:

WARRENTON ELECTRIC COMPANY,
WARRENTON, MO., April 18, 1892.

BALL ENGINE CO., Erie, Pa.

DEAR SIRS: We started the engine purchased from you for our electric plant last night, and the way it moved off was beautiful to behold. It is certainly a very fine and powerful piece of machinery. No vibration, no noise; in fact and in short, it is perfect in every part and way. The satisfaction it gives is a pleasure to us, and must be gratifying to you.

Yours respectfully,
C. E. PEERS, *President.*

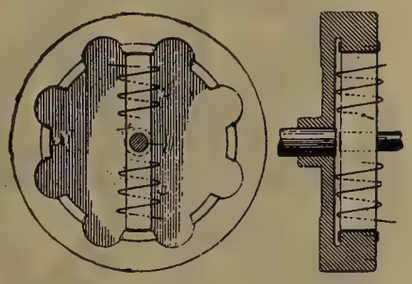
The Electrical Age's Illustrated Patent Record.

Issued April 19, 1892.

473,003. Heating and Welding by Electricity. Henry Howard, Halesowen, near Birmingham, England. Filed Oct. 21, 1891.

473,024. District-Telegraph Box. Charles Selden, Baltimore, Md. Filed June 15, 1885.

473,042. Electric Clutch. Peter W. Willans, London, England. Filed July 21, 1891.



473,042.—ELECTRIC CLUTCH.

473,045. Lightning-Arrester. Montraville M. Wood, Chicago, Ill. Filed June 20, 1891.

473,061. Electric Lock. Charles H. Crockett and Chancellor C. Allen, Boston, Mass., assignors to the Boston Electric Company, same place. Filed May 5, 1888.

473,076. Electric-Arc Lamp. Octave Patin, Paris, France. Filed April 11, 1891.

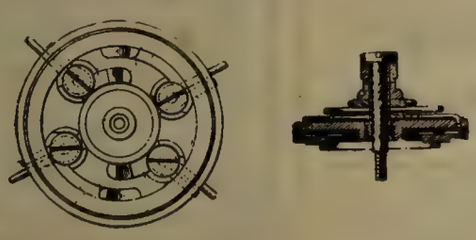
473,077. Armature-Core for Electric Motors. David Pepper, Jr., Philadelphia, Pa. Filed July 24, 1891.

473,078. Armature-Ring. David Pepper, Jr., Philadelphia, Pa. Filed Dec. 3, 1891.

473,089. Testing-Apparatus for Trunk-Lines of Telephone-Exchanges. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 13, 1885.

473,105. Electrolytic Apparatus for Separating Gold and other Metals from their Ores. George J. Atkins, London, England. Filed April 28, 1891. Patented in England, in France, in Germany, in India, in Cape of Good Hope, in Natal, in Canada, in Victoria, in New South Wales, in South Australia, in Tasmania, in Queensland, in New Zealand, in Spain, in Austria-Hungary and in Transvaal.

473,117. Electrode for use in Electro-Metallurgical Processes. Paul Héroult, Neuhausen, Switzerland, assignor to the United States Aluminium



473,228.—ELECTRIC SWITCH.

Metal Company, of New York. Filed Sept. 3, 1889. Patented in England.

473,121. Electrical Annunciator. Thomas W. Lane, Boston, Mass., assignor to the Electric Gas Lighting Company, of Maine. Filed Dec. 15, 1890.

473,132. Electric Switch. Francis H. Soden, Chicago, Ill. Filed July 2, 1891.

473,133. Electro-Therapeutic Heating-Pad. Francis H. Soden, Chicago, Ill. Filed Sept. 1, 1891.

473,134. Electric Switch. Francis H. Soden, Chicago, Ill. Filed Oct. 26, 1891.

473,146. Secondary Battery. Harry E. Dey, New York, N. Y., assignor to Phœbus H. Alexander, same place. Filed Sept. 10, 1890. Renewed July 8, 1891.

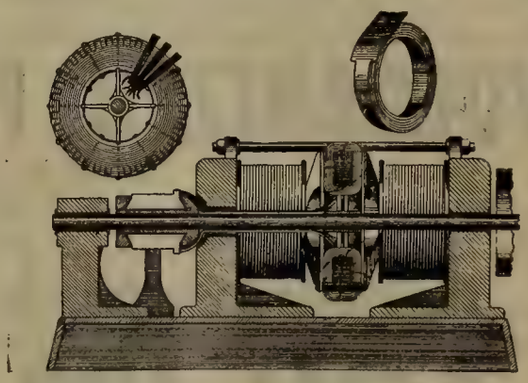
473,147. Secondary Battery. Harry E. Dey, New York, N. Y., assignor to Phœbus H. Alexander, same place. Filed Sept. 17, 1890. Renewed July 8, 1891.

473,158. Hanger for Electric Wires. Thomas Imeson, Lewis D. Tibbets and Charles L. F. Kellogg, Seattle, Wash. Filed Feb. 2, 1892.

473,174. Electric Indicating System and Instrument. Henry J. Haight, New York, N. Y. Filed Dec. 15, 1891.

473,195. Commutator-Brush. George Meyer, Indianapolis, Ind., assignor to Fred L. McGahan, same place. Filed June 6, 1891.

473,208. Incandescent Electric Lamp. Augustus



473,363.—ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

C. Carey, Lake Pleasant, Mass. Filed Dec. 1, 1891.

473,228. Electric Switch. Edward H. Johnson, New York, N. Y. Filed Aug. 25, 1891.

473,229. Electric-Light Support. George M. Kim, Allegheny, Pa., assignor to the Keystone Mast-Arm Company, same place. Filed Oct. 10, 1891.

473,240. Lamp-Shade and Holder for Incandescent Lamps. George F. Seavey, Boston, Mass. Filed Aug. 6, 1891.

473,253. Converter System for Electric Railways. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed June 25, 1889.

473,256. Telephone-Receiver. Edwin C. Hess, Camden, N. J. Filed July 1, 1891.

473,267. Electric Cable. William H. Sawyer, Providence, R. I., assignor to the American Electrical Works, same place. Filed Oct. 27, 1891.

473,282. Cut-off for Electrical Machines. James P. Woolley, Simcoe, Canada. Filed Nov. 23, 1891.

473,283. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Filed July 8, 1890.

473,288. Electric Railway-Signal. John M. Brasington, Morven, N. C. Filed July 24, 1891.

473,341. Electric Odometer and Speed-Indicator. William A. Phillips, U. S. Army. Filed March 19, 1891.

473,351. Electric Cable. William H. Sawyer, Providence, R. I., assignor to the American Electrical Works, same place. Filed Oct. 27, 1891.

473,352. Electric Cable. William H. Sawyer, Providence, R. I., assignor to the American Electrical Works, same place. Filed Oct. 27, 1891.

473,353. Electric Cable. William H. Sawyer, Providence, R. I., assignor to the American Electrical Works, same place. Filed Oct. 27, 1891.

473,361. Multiple-Arc Railway System. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Jan. 8, 1890.

473,362. Trolley Switch. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Jan. 8, 1890.

473,363. Armature for Dynamo-Electric Machines. Sidney H. Short, Cleveland, Ohio. Filed June 10, 1891.

473,364. Armature for Dynamo-Electric Machines. Sidney H. Short, Cleveland, Ohio. Filed June 19, 1891.

473,365. Gearless Motor for Electric-Railway Cars. Sidney H. Short, Cleveland, Ohio. Filed June 24, 1891.

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SUBWAYS.

There will be some activity in subway work in this city during the coming summer. About fifty streets have been named in which subways will be built, although in those that have been repaved by Commissioner Gilroy the ducts will have to be laid under the sidewalks. If some reliable method of placing them under the sidewalk can be devised we see no reason why greater satisfaction should not result, because wires thus laid should be more accessible than when laid in ducts under the roadway.

NEWS FROM PHILADELPHIA.

With the opening of spring Philadelphia returns to life and activity. The *Press* of that city, on April 27, announced that a "gigantic electric combination has been effected by the Thomson-Houston and Edison General Electric Companies," going into all the details with which the public all over the country outside of Philadelphia were made familiar two or three months ago.

What care the Philadelphians, any way, about electrical trusts or any other kind of trusts during the chicken-hatching season, and when the golden creamery butter is being churned for the voracious New Yorkers?

ADVERSE INFLUENCES AGAINST STREET RAILROADS.

In recent times the sentiment has developed among the masses that railway and other corporations are not entitled to any consideration when they are brought to court on the complaint of an individual or individuals. They seem to be a sort of prey for unscrupulous lawyers who, in order to create business for themselves, make it their duty to urge legal action against railroad corporations on the most trivial grounds, and too frequently they win their case simply because of this unaccountable and unreasonable prevailing sentiment.

This class of lawyers is found in all large cities and is growing rapidly. If a person gets a slight injury or even a scratch on a street car, whether it be due to his or her own carelessness or not, legal proceedings against the company are urged by one of these predatory lawyers, and the chances are the trial jury will decide against the company, so prevalent is this inordinate feeling against corporations.

In an article which will be found on another page the author very ably points out the tendency of juries to decide against corporations whether the evidence warrants such action or not; in short, justice is not dealt out as it should be, owing to this prejudice, and unscrupulous lawyers are constantly on the lookout for cases of injury, however trivial they may be, in order that they may incite an action against the company in behalf of the injured one, and they are apparently a thriving lot. The fact that many juries are so prejudiced is what emboldens these lawyers and prompts them to carrying on their unjust business.

It is not fair that street-railroad companies should be held responsible for accidents which are due to the carelessness of the victims themselves, but very often they are by biassed juries.

It is often said that corporations have no soul. It is a good thing for them that they have not; if they had they would be sorely tried with lawyers, juries and politicians against them.

SEARCH-LIGHT PROJECTOR.*

A search-light projector, recently designed by this company, and known as the new "D" type, is described and illustrated below. Figure 1 shows the side and front view, and Figure 2 the lamp mechanism, which will give a good idea of the general style of this projector.

The lamp is designed to run on an incandescent circuit with a potential of 50 to 55 volts, at which it requires about 15 ampères of current and gives a light of 3,000 C. P. A suitable resistance is placed in series with the lamp to permit its adjustment to the potential of different circuits upon which it may be used. The lamp is both self-regulating and self-focusing. The lower carbon is pressed upwards against fixed stops by a spiral spring, thus maintaining the arc in the focus of the reflector. A hand adjustment is provided for raising and lowering these stops, by which the vertical position of the arc can be altered. The upper carbon falls by gravity, its descent being perfectly regulated by the lamp mechanism, so that great steadiness of light is obtained. The negative carbon being placed a little back of the line of the positive carbon, a crater is thus formed on the side of the latter, and nearly all the light is thrown toward the reflector. A ventilating hood on the top of the drum provides an escape for the heat.



SEARCH-LIGHT PROJECTOR.

The drum is of iron and 18 inches in diameter. A highly polished silver-plated parabolic reflector 17 inches in diameter, with 5-inch focus, is mounted at one end of the drum on a finely threaded screw-piece, by which it can be moved to or from the arc. By this means the light can be concentrated in a narrow beam or be widely diverged. The usual focus in projectors of this class is from 2 inches to 3 inches, and considerable advantage is derived by the increase in focus obtained in this projector. A fine hole is drilled through the screw-piece on which the reflector is mounted, through which the exact position of the arc is shown on a small piece of ground glass.

The drum is provided with vertical and horizontal adjustments. The vertical adjustment is effected by means of a hand-wheel operating a double-threaded screw. It has a vertical movement of thirty degrees, 15 degrees above and 15 degrees below the horizontal line, which is sufficient for ordinary purposes.

The horizontal adjustment permits a complete revolution of the drum upon its base, so that the light can be readily thrown toward any point of the compass. By means of a clamp-screw the drum can be quickly fastened in any position.

Provision is made for a card attachment in order that the projector may be operated from a distance if preferred, as for instance from the pilot house, when the projector is set at the bow or any other part of a vessel.

The connecting terminals for the lamp are placed on opposite sides of the drum, the conductors can therefore be brought up in the form of spirals without risk of their "crossing."

The height of the projector is 48½ inches, and the centre of the reflector is 36 inches above the bottom of the base. The floor-space required for the base is 22 inches in diameter. This projector is simple, strong and substantial, and all the parts have been arranged with a view to secure efficient and easy operation. It is estimated that in clear weather the beam of light will have an effective range of 2,000 yards. The compactness of the entire apparatus renders it especially advantageous for use on vessels, wharves, etc.

* Edison General Electric Co., New York.

AMENDING THE PATENT LAWS.

The United States patent laws will likely be amended and revised during the present session of Congress, the House Committee on patents having on April 23 ordered a favorable report on a bill introduced with this object in view. The bill allows a patent to any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country and described in any printed publication in this or any foreign country before his invention or discovery, and not in public use or on sale or described in any patent or printed publication issued in this country for more than two years prior to his application, unless it is proved to have been abandoned.

No person shall be debarred from receiving a patent for his discovery or invention, nor shall any patent be declared invalid by reason of its having been patented or caused to be patented in a foreign country prior to the application for a patent on the same invention in this country, but every such patent granted hereafter is to be limited in duration to the term for which any such prior patent had been granted, or, if there be more than one foreign patent prior to the filing of the application

in this country, then the patent granted is to be limited in duration to the shortest term for which the prior foreign patent had been granted, but in no case is any such patent to be granted for a term exceeding seventeen years.

It is also provided that whenever a patent is altered to be infringed, the patentee is to seek his remedy by bringing suit in the first instance against the manufacturer or vender of the article alleged to have infringed on the patent, and is in no case to bring suit against any individual who has purchased in good faith an article of a regular dealer in the open market for his own use; provided, that the individual purchaser must give to the patentee, at his request, the name and residence of the party from whom the article was purchased. The exemption from liability of the individual purchaser is not to apply to any corporation, firm, or company, nor to any corporation or party as to any patented machine or process made or used by them for the manufacture of an article or product for sale.

WATER WHEEL.

One of the most remarkable mine water-power plants in existence is that in the Chollar shaft in the Comstock lode. There are six Pelton water-wheels running under a vertical pressure of 1,680 feet, giving an efficiency of 88 per cent. With the exception of replacing a few buckets, no repairs have been needed in three years. Pelton wheels are guaranteed to give an efficiency of 85 per cent. under all heads and from every variety of application.

INTERESTING LECTURE.

Dr. W. M. Hutchinson gave a very interesting lecture on "Electric Lighting" at a meeting of the Plymouth League, held in the Sunday-school room of Plymouth Church, Brooklyn, on April 25. Several experiments were made during the course of the lecture, and elicited much applause.

The doctor was furnished the material for his experiments by the Baehr Electric Manufacturing Co. and General Manager Barstow, of the Edison Co., of that city.

STREET RAILWAY SUPERINTENDENTS ORGANIZE.

The Massachusetts Street Railway Superintendents' Association was organized at Spencer, Mass., on April 26.

At the invitation of Mr. George A. Murch, Superintendent of the Worcester, Leicester and Spencer Street Railway Company, fourteen street railway superintendents visited Worcester on April 26, and in company with some twenty-three invited guests took a special car for Spencer. A stop was made at Leicester for the purpose of inspecting the car and power station and the offices of the company. On arrival at Spencer the party repaired to the Massasoit House, where arrangements had been previously made for a collation. After the wants of the inner man had been satisfactorily taken care of, the party adjourned to the parlors of the hotel, which were temporarily turned into a meeting room, and the business of the day, that of forming the organization, was thereupon proceeded with.



MECHANISM OF SEARCH-LIGHT PROJECTOR.

Superintendent Murch presided over the meeting, and explained the objects of the proposed organization. Great benefit, he thought, would be derived, both by the companies and themselves, by being brought more closely into communication with each other, as they would thereby be enabled to profit through the interchange of ideas and experiences.

After several other speeches in favor of the movement had been made, Mr. Murch was unanimously elected president. The other officers elected were: B. J. Weeks, superintendent of the Boston and Quincy Road, vice-president; F. G. L. Henderson, of the Newton Street Railway Company, secretary and treasurer.

It was voted to authorize the officers of the association to formulate rules and by-laws for the guidance of the organization. The admission fee was placed at $5, and the secretary was instructed to invite all superintendents to join.

Those present were: B. J. Weeks, Quincy; F. G. L. Henderson, West Newton; M. E. Carter, Attleboro; N. Wentworth, Malden; S. S. Heywood, Salem; C. E. Smith, Boston; N. A. Morton, Lawrence; R. E. Morton, Lawrence; J. O. Sherwin, Woburn; James J. Hennessy, Framingham; R. E. Bradford, Providence; R. Sennette, North Carolina; Charles Page, Toledo, Ohio; Hon. Samuel Winslow, G. A. Murch, I. E. Bigelow, H. J. Newton, S. Lamoine, of Worcester; Edwin Watson, J. B. Gorman, W. S. Wittemore, of Leicester, and O. A. Freeman and George F. Madison, of Spencer.

A large warehouse at the corner of 31st st. and Blaisdell avenue, for use as a supply depot, at a cost of about $7,000, is to be built by the Minneapolis Street Railway Company, Minneapolis, Minn.

GILLETTE MAGNETO BELL.*

A constant source of annoyance to the occupants of residences, apartment-houses, offices, hotels, factories, etc., is the incessant failure of electric bells and door-openers to operate, due principally to improper care of the batteries. Our illustrations and description, then, of a new system of operating electric bells, etc., without the aid of a battery, and claimed to be absolutely reliable and efficient, requiring practically no attention and on which time and wear has no appreciable effect, will appeal to

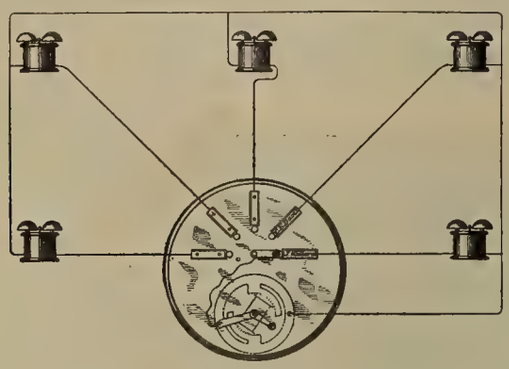


FIG. 1.

the sympathies of a long-suffering humanity. This system is that of the Gillette magneto bells, and in Fig. 1 will be seen a diagram of its operation in flat-houses. It consists of a dial, on which is placed the name-plate and a corresponding number of points, also a switch or handle to place on any one of the points opposite name, and by turning the lower handle it will ring the bell in the apartment or on the floor desired. The diagram represents a five-bell connection, and it can be readily seen how the circuits are run from each name-plate or point. One or all of the five bells may be rung simultaneously or separately.

The active principle of this system is electro-magnetism, a constant and powerful resource on which time and wear have not the slighest effect.

Fig. 2 gives a side view of the generator by which the system is operated, and in Fig. 3 will be seen a face view of it.

Fig. 4 is a cut of the bell used, which is a little larger than the common three-and-one-half-inch electric bell, and rings as loud. These bells are claimed to be equal

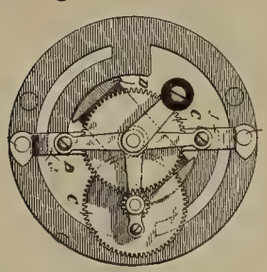


FIG. 3.

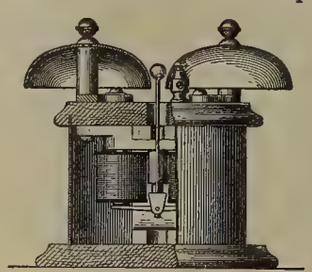


FIG. 4.

if not superior to the best in the market in every particular, and specially adapted for a variety of uses.

Fig. 5 shows them as applied to telephones.

In houses or places already wired for electric bells, the Gillette system may be substituted by simply removing the old bells, leaving the wires as they were.

ELECTRIC COTTON-GIN.

We have received from the Department of Electrical Engineering, Agricultural and Mechanical College, Auburn, Ala., a sample of the first cotton ginned by electricity.

*Joseph F. Bray & Co., 221 8th avenue, New York.

QUARTZ FIBRES FOR SUSPENSION PURPOSES.

In the electrical laboratory of Queen & Co., Philadelphia, have recently been made a series of careful experiments upon the properties of quartz fibres for use in suspending galvanometer systems and in other physical measurements as compared with fibres of glass, metal and cocoon silk. These tests have shown conclusively that quartz fibres are so greatly superior to all

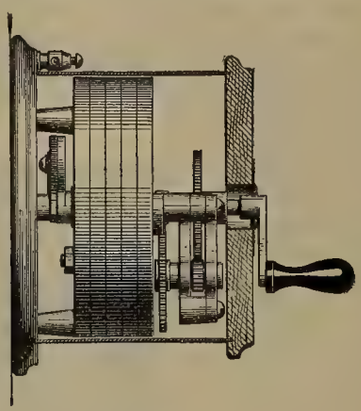


FIG. 2.

others in every way, that the above-mentioned firm has decided to prepare them for sale, and the following details will be of much interest to our readers.

These fibres are drawn in the oxy-hydrogen flame from pure rock quartz, their diameter being regulated by the speed of drawing. As to size, it is possible to draw them from those too fine to manipulate (less than $\frac{1}{10000}$ inch) up to rods $\frac{1}{10}$ inch in diameter, and in lengths (for diameters less than $\frac{1}{10000}$ inch to $\frac{1}{100}$ inch) as desired. Inspection with a microscope shows that they are extremely uniform in diameter and contain no "fishes" or flaws of any kind.

The principal advantages possessed by quartz fibres over all others are, first, perfect elasticity; they show absolutely no "Nachwirkung" or "set," and when twisted come back to the same position immediately; it is thus possible to reach a much higher degree of sensi-

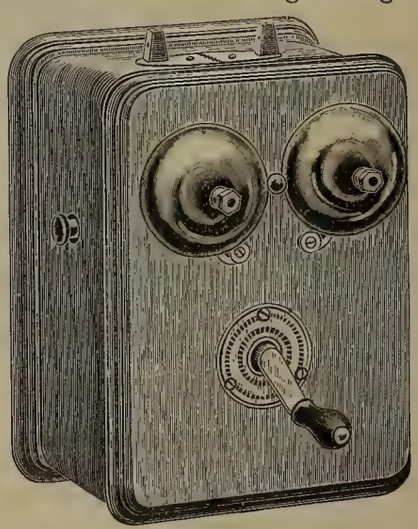


FIG. 5.

bility with a galvanometer using a quartz fibre in place of unspun silk, for, as is well known, a cocoon fibre, to which is attached a system under small controlling force will not return at once to the zero point within 5 % of the total deflection. Quartz fibres are also absolutely unaffected by ordinary changes of temperature or atmospheric conditions, whereas silk fibres, absorbing greater or less amounts of moisture at different times, will have correspondingly different zero points.

The tensile strength of quartz fibres is from 50 to 70 tons per square inch, which is nearly as great as the best steel, and many times that of silk. Fibres of extreme fineness may consequently be used; as for example, a quartz suspension $\frac{1}{10000}$ inch in diameter will sustain a weight of $\frac{1}{2}$ gram. They are, however, very easily broken by lateral stress, and it is therefore raised or lowered as a whole instead of attempting to bend them around a spindle, although the finer ones can be successfully wound upon spindles of $\frac{1}{2}$ inch or greater diameter.

The uses of quartz fibres are various; they can be employed advantageously for the suspension of all delicate electrometer and galvanometer suspensions. They may also, as suggested by Mr. Boys, be used to suspend very small bodies, the specific gravities of which are required to be ascertained, as there is practically no capillary attraction between the fibre and water. Being unaffected by heat and of very uniform diameter, they are excellent for use as cross-hairs in telescopes and microscopes.

For further information regarding quartz fibres, our readers are referred to a paper by V. C. Boys "On the Production, Properties and Some Suggested Uses of the Finest Fibres," *Phil. Mag.*, 1887; also a paper by Prof. Richard Threlfail on "Elastic Constants of Quartz Threads," *ibid.*, 1890.

"THE HOLE IN THE JAR."

Every one who has had anything to do with gravity batteries knows how difficult it is to keep the copper elements in place in the cells. The least disturbance will cause them to get on top of the bluestone, in which condition the cell naturally becomes inefficient. Some simple means, therefore, of avoiding this difficulty would meet with a hearty welcome by those whose duty it is to care for batteries of this type and who appreciate the vexations caused by this tendency of the copper and bluestone to exchange places.

A very simple remedy for this difficulty has been designed and patented by J. Jones & Son, 602 and 604



FIG. 1.

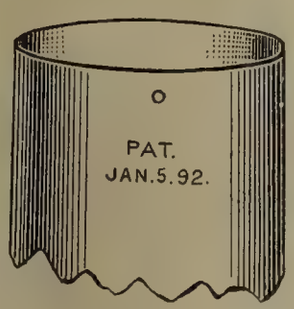


FIG. 2.

West 22d street, New York City, illustrations of which are given herewith. It consists of providing a hole in the side of the jar near the top, through which the insulated conductor connected with the copper is passed. This is accomplished by passing the wire over the edge of the jar, then bending it over backwards and putting it through the hole, then bending it again upwards. It will thus be seen that a sort of a half-hitch is made with the wire, which holds the copper securely against the bottom of the jar and prevents its easy displacement by ordinary handling of the cells.

This simple remedy means a more efficient battery and longer life; the current is of course steadier and the internal resistance of the cell remains practically invariable.

Fig. 1 shows a cell of the old style of gravity battery, with the copper displaced by the bluestone, throwing the copper well into the solution above the copper line.

Fig. 2 shows the hole cut in the side of a jar, and Fig. 3 represents the advantage of the new style, showing that it is possible to lift a cell up by the wire without displacing the copper.

This simple but ingenious remedy should take well in the trade, and will be a boon to battery-men. It is known by the name of "Hole in the Jar."

A PROPERLY MADE FAN.

We illustrate below a brass fan made by Holmes, Booth & Haydens, of New York, and Waterbury, Conn., for electric motors.



FIG. 3.

Such fans heretofore made were so out of balance that a perceptible jarring accompanied their use, and the blotches of solder carelessly affixed to the blades to effect a balance, produced noise enough to shame a Japanese humming-top.

Experience has been availed of to form a fan that



BRASS FAN.

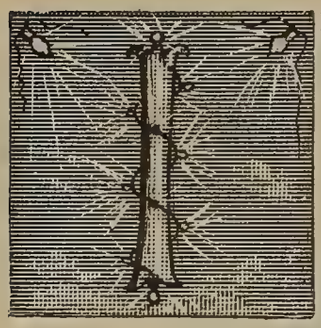
will distribute the breeze from it, and not throw it as a gleam from a search-light, as many fans do.

The high speed of a motor-fan requires absolute mechanical efficiency to insure safety.

Being finished by the Lamp Department of this firm, an elegance is secured which makes these fans decidedly ornamental.

They are of all sizes from 5 to 15 inches, and lacquered or silver-plated. Fan-guards are also made for any size fan.

SMALL LAMPS FOR DECORATIVE PURPOSES.



IMPROVEMENTS in the methods of electric lighting and new and novel changes in their adaptation are now being made so rapidly that the finite mind of the average electrician finds difficulty in becoming acquainted with their protean developments. The old and fast-disappearing illuminant which our fathers considered as the *ultima thule* of lighting has been put to many and varied uses, but they are as nothing when compared with the multifold duties which electric incandescent illumination has been called upon to fulfil. The supersession of the light which can only burn in the upright position is an accomplished fact, which but a short time more will render universal. Retrospect with our unveiled eyes reveals a great step in advance—a material progress of such vast magnitude that the bewildered brain almost withholds credence.

The incandescent lamp with bulb and hair-like filament, which has glowed itself into our high appreciation during the past eight years, has been subject to stresses of evolution similar to those which every other department of practical electrical adaptation has undergone. The familiar luminous pear-shaped lamp of sixteen candle-power is not, however, suitable for every requirement in these increasingly fastidious times. Occasions have arisen where decorative effects have been desired but have remained unattained, the sixteen candle-power lamp being inappropriate on account of its size. As, for instance, in dainty boudoirs or salons where side-brackets are used instead of the centre pendant chandelier, or in a palace, where the interior decorations are splendidly ornate. The use in these cases of the larger lamp would justly be considered an anomalous inartistic intrusion. The character of electric illumination is fast changing. Instead of the large 16 candle-power lamp we can now have a number of smaller lamps of varying intensity, so distributed as to render the same amount of light, but more diffuse and agreeable and less obtrusive.

This change the Edison General Electric Company has not been slow to recognize. In its lamp works at Harrison, experiments have been proceeding for the past six or eight months, all pointing to the invention and perfection of smaller lamps, which could appropriately be used for almost all requirements. The success which has crowned their efforts has been signal, and the perfected small incandescent lamp is now an accomplished fact.

The uses to which these small lamps can be put are too numerous to catalogue. Socketed in a wall-bracket at the top of an imitation candle they simulate the flame of the wax light highly intensified. Studded in numbers in the ceiling of some vast ball-room, they diffuse a soft radiance unattainable by any other means, or they can be concealed in flowers and under leaves in a table-piece with exquisite effect.

Their purely commercial adaptation will, however, appeal most strongly to the practical man. The theatre manager is heartily tired of his stained-glass transparency with the flickering gaslights behind it, over the entrance to his play-house. He wants something more novel and effective. This the use of these small lamps will give him. The retail storekeeper desires some sign characteristic of his business. It can be artistically devised, and the little incandescent sparkles flashing from it will give it a value of peculiar attraction.

These small lamps can be grouped to form any letters of any size or shape, in any colors. By the aid of a special switch actuated by electricity or otherwise, they can be made to flash and die out alternately at fixed intervals, or all can be flashed at a time.

The Actors' Fund Fair at Madison Square Garden will afford electricians the first opportunity of beholding and appreciating the progress that has been made in this direction. The entire illumination of the Fair and the booths has been confided to the Edison General Electric Company in so far as the lamps and special designs and apparatus are concerned, and every lighting effect produced will be absolutely novel. Each stand will be especially illuminated by means of the beautiful small lamps, and among the wonders of the Fair, the great electric decorative illumination will be, perhaps, the greatest and most worthy of attention.

THE BROOKLYN ELECTRIC ROADS.

Preparations for the conversion of its various lines into electric systems are being rapidly pushed by the Brooklyn City Railroad Company, Brooklyn, N. Y. The Second avenue, Fort Hamilton and Hamilton avenue lines will start out with 55 new 34 ft. open cars; 20 to be made by the Lewis & Fowler Mfg. Co., Brooklyn, N. Y.; 20 by the J. M. Jones' Sons Co., Troy, N. Y., and 15 by the J. G. Brill Co., Philadelphia, Pa. They will each be equipped with two 25 H. P. Thomson-Houston waterproof motors. The Lewis & Fowler and Jones cars will have Robinson radial trucks, and the Brill cars maximum traction trucks.

For the present, the old road-beds will be used, and it is said that the new system will surely be inaugurated by Decoration Day, if not before. The power-plant will consist of 4 McIntosh & Seymour 400 H. P. engines, with 4 Thomson-Houston 75 K. W. generators connected to each engine. A new 10,000 horse-power plant is being built, the foundation having been already commenced, and every effort will be made to have two engines running by October next. This plant will be used to run the Third avenue, Flatbush avenue, Fulton avenue and Court street lines. The company will repair the old cars and dummies for the new road to run from Ridgewood to Richmond Hill, L. I.

A SUCCESSFUL ROAD.

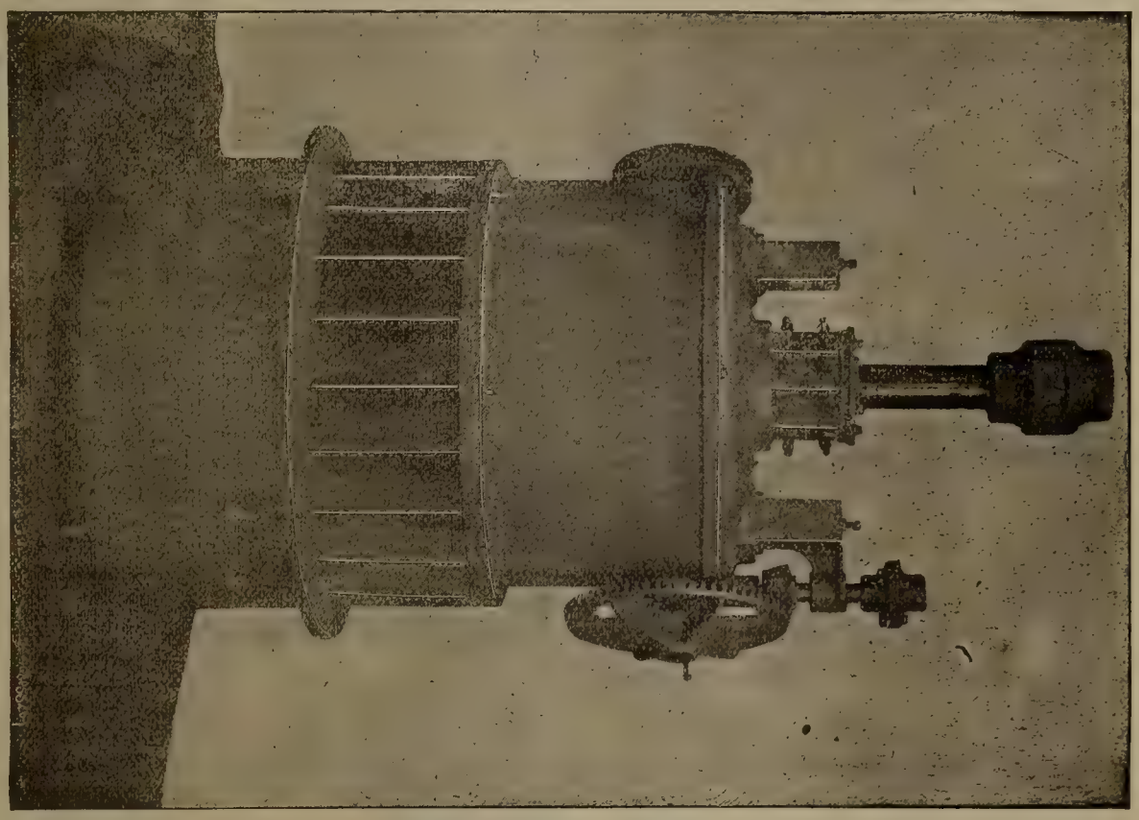
The electric road between East Liverpool and Wellsville, Ohio, although only opened for traffic about five months ago, has met with such phenomenal success as to necessitate the doubling of its equipment. This road, which consists of eight miles of overhead construction and eight cars, was completed in exactly three months from the day when the ground was broken, the work being superintended by Mr. Al. Johnson, an indomitable worker, and it is said to be one of the finest to be seen. Messrs. Al. Johnson, S. H. Short and C. E. Grover, all of Cleveland, compose the company, and have awarded the contracts necessary for this additional equipment. The J. G. Brill Company, Philadelphia, are just completing eight fine open cars, somewhat unusual in the fact that they are eight instead of seven bench cars, and for these cars the Short Electric Railway Company, of Cleveland, Ohio, will furnish 16–20 H. P. single-reduction motors and two additional 133 H. P. generators.

E. H. Jones & Company, of Cleveland, who put in the first steam plant, are also doubling their part of the equipment.

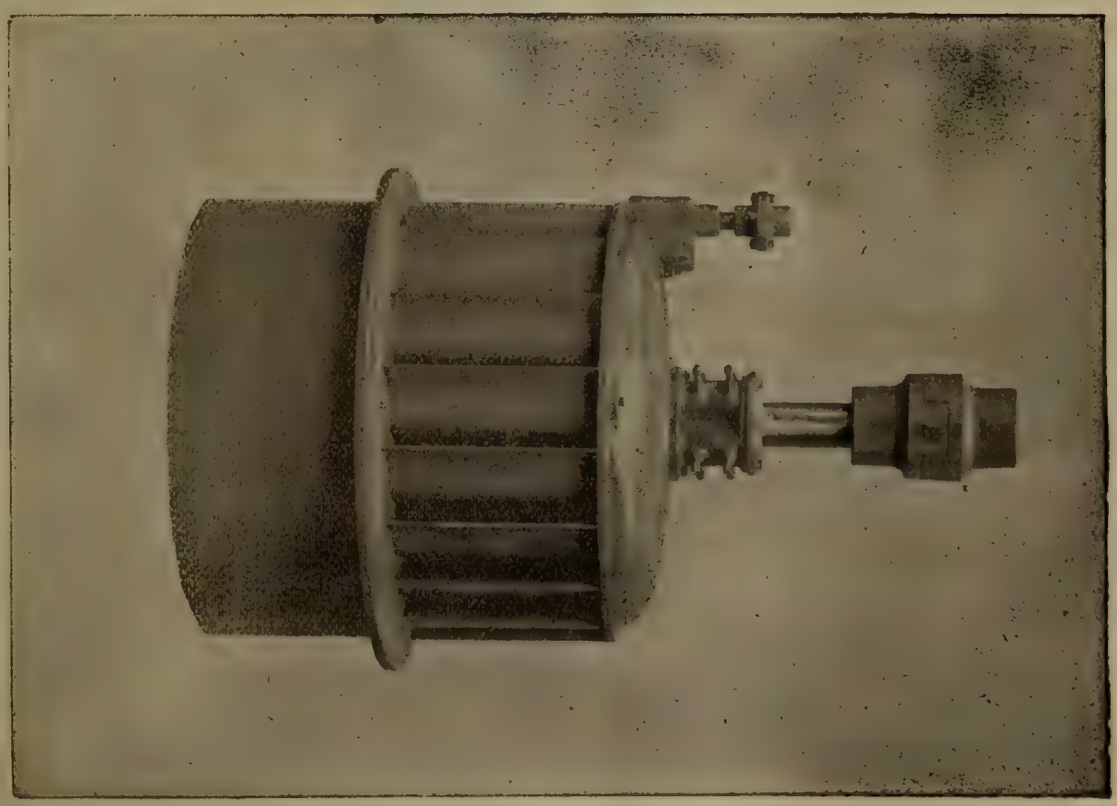
It is a curious fact, to be explained only by the character of the manufactories in Wellsville and East Liverpool, that these towns, the total population of which is 16,000 people, can support a street-railway system larger than that to be found in some cities of 40,000 and 50,000 inhabitants.

VICTOR TURBINE.*

The Victor Turbine has achieved remarkable success, being used extensively in all parts of the world, its superiority having been demonstrated not only in the testing flume, but in the vast number of promi-



CYLINDER GATE.



REGISTER GATE.

nent manufacturing establishments of all kinds which have it in use. Until recently only turbines with a register-gate were made by the manufacturers, and in a great majority of cases that style meets all the requirements admirably, and is preferred on account of its simplicity, ease of operation, quick regulation, etc. There are, however, situations where a cylinder-gate is preferred, and to meet this demand the manufacturers have perfected and put on the market the style known as the "Cylinder-Gate" Victor Turbine. Our illustrations show both the "Register-Gate" and "Cylinder-Gate." A separate catalogue is published for each one of these wheels, and will be furnished by the manufacturers to interested parties on application.

The "Cylinder-Gate" Victor Turbine has been carefully tested in the Holyoke testing flume with

* Stilwell & Bierce Mfg. Co., Dayton, O.

gratifying results, not only as to high efficiency, but as to power, it being developed that the power of this wheel was very much larger for its diameter than any known turbine. This is a very important feature, as by using this wheel a manufacturer wishing to increase his power by using a turbine of same diameter as the one he had in use, could do so, thus avoiding any change in gears, etc.

The tests also developed a remarkably high efficiency at part gate in all stages of the gate opening from one-half to full gate.

These turbines are built in sizes ranging from six inches to sixty inches diameter, on vertical or horizontal shafts, in a great variety of plans adapted to all classes of establishments, from the simple country mill requiring fifty horse-power or less, up to the mammoth cotton-mills, paper-mills or electric plants consuming many thousand horse-power.

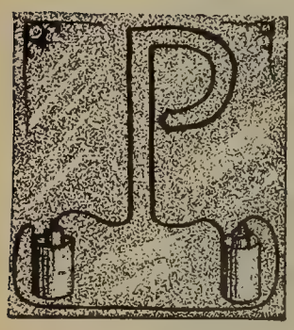
The manufacturers are also provided with a very complete line of patterns of all kinds of modern appliances for transmitting power, and make a specialty of complete water-power plants for all purposes.

The electrical transmission of power over long distances is a demonstrated commercial success. This fact gives an immediate value to water-powers, which have hitherto remained unimproved because located more or less remotely from transportation lines, or because the local demand for power was not sufficient to justify the expense. Our country abounds in such water-power, many of them of immense magnitude, and it is only a question of time when they will be improved and the power generated, transported by wires to the surrounding cities and towns, and utilized for light, heat and power. In view of these facts, a new and increased interest attaches to the question of turbines, their construction and application.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Primary Batteries.



PRIMARY batteries will always have a useful place in the active and rapidly expanding field of electricity. It is not many years ago that the primary battery was the only practical source of electricity that we had, but the invention and development of the dynamo has had the effect of somewhat limiting its uses and application.

Still, the dynamo has not encroached on the primary battery field to the extent that many suppose. The primary battery will always be useful for many purposes where it would be impracticable to use a dynamo for the generation of current.

The cost and expense of operating a dynamo is the greatest barrier to its use for small work; and there is no danger that it will to any great extent take the place of batteries in such work as ringing bells, making delicate tests, operating medical apparatus, etc., etc. In these applications the primary battery will likely hold its own for a long time to come, and particularly for experimental work in the laboratory or at home; therefore, it is by no means a "thing of the past."

In our previous articles we have considered subjects pertaining to the dynamo and its operation; for a change, we propose to direct our attention briefly to primary batteries, in view of the fact that this form of electric generator still occupies an important position in the electrical field.

The word "battery" properly refers to more than one cell; a battery, therefore, is composed of two or more cells, although the word is commonly applied to one.

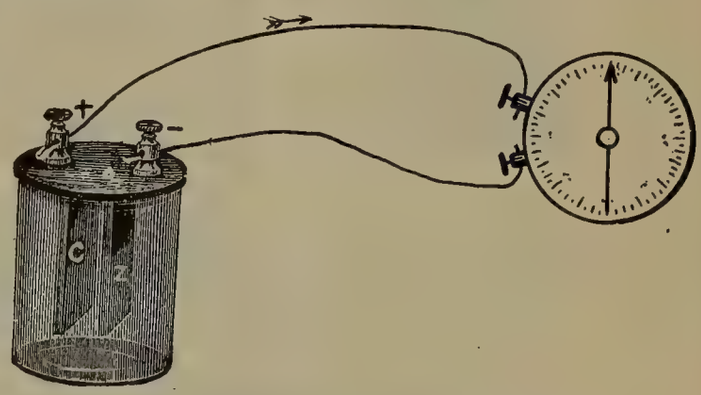
A cell, as is well known, consists of a vessel which contains the fluid, or electrolyte, and the electrodes. There are many makes of batteries, but for our present purpose we will consider the simplest form, namely, a cell containing water with a little sulphuric acid in it, and elements of zinc and copper; all other batteries are modifications of this one.

If we take a jar of any material—glass, earthenware, hard rubber, etc., and put into it sulphuric acid diluted with from 10 to 20 times its volume of water, and in the water put a plate of copper and one of zinc—both metals being kept apart in the liquid—we have a simple voltaic cell.

So long as the metals are kept apart no apparent action takes place, but if we take a piece of bare wire and connect the two metal plates, a vigorous and visible action at once occurs in the cell, which continues as long as the copper and zinc are kept in contact by the wire.

The visible result of this action is the collection on that portion of the copper plate in the liquid of large numbers of bubbles. These bubbles are composed of hydrogen gas which is set free by the chemical action in the cell. As soon as the connection between the two plates is broken by removing the wire, the chemical action within the cell ceases and the evolution of hydrogen discontinues.

If we pass the current generated by this cell through



TEST FOR "POLARIZATION" OF SIMPLE VOLTAIC CELL.

a galvanometer (which is an instrument to measure galvanic current), we will notice that the current attains its full strength at the time the circuit is first established, and that it gradually grows less until it practically ceases. We will notice, moreover, that as the hydrogen bubbles multiply on the copper plate that the current grows correspondingly weaker. There is, indeed, a direct relation between these two phenomena; the current grows weaker on account of the collection of hydrogen bubbles on the copper for the reason that the bubbles form on the surface of the plate a film of gas which prevents the liquid from touching the plate—direct contact being essential to the generation and maintenance of the current. As soon as the hydrogen disappears or is removed from the copper plate, the current will be as strong as ever, only to be weakened again, however, as in the first place.

This phenomenon—*i.e.*, the collection of hydrogen bubbles and the consequent deterioration of the current, is termed "polarization." The effect of polarization is to weaken the current in two ways: first, because hydrogen being a poor conductor of electricity interposes a resistance to the flow of current from the liquid to the copper plate; and second, because it sets up an electromotive force in the cell in the direction opposite to that of the original current. Hydrogen, when freshly deposited, is a substance almost as oxidizable as zinc is,

hence the tendency is to start a current in the reverse direction, resulting in the reduced original current.

A continuous-working battery therefore should be provided with some means of preventing polarization; or, in other words, the accumulation of hydrogen gas at the copper plate. There are several ways in which the hydrogen may be either removed or prevented from accumulating. It may be accomplished mechanically by brushing the bubbles away, or by making the surface of the plate rough, with points; the gas, collecting with great freedom at these points, escapes and rises to the surface of the liquid, where it dissipates. The first means is, of course, impracticable, and the second has been used with partial success.

The accumulation of hydrogen can be prevented by chemical means—by adding to the acid some highly oxidizing substance which will destroy the hydrogen bubbles while still in the nascent state. ("Nascent" means the condition the hydrogen is in immediately it is freed from a previous chemical combination.) Such a substance is bichromate of potash. Inasmuch, however, as the various substances used for this purpose attack the copper as well as the zinc, the copper is substituted by a carbon element or plate.

It is possible also to prevent polarization by electrochemical means—that is, by using proper substances, so that metallic atoms shall be liberated instead of the hydrogen. The Daniell battery is an example of this kind of cell. A porous cup or cell containing the zinc element is placed in the liquid, which in this battery is a solution of sulphate of copper instead of dilute sulphuric acid. On the copper element metallic copper is deposited instead of hydrogen; this battery is practically constant in its output of current, and does not polarize.

Reverting to the original simple cell, it will be of interest to consider the reactions that take place within and without when the circuit is completed (by connecting the zinc and copper plates by a wire).

The zinc plate, dilute acid and copper plate form a combination capable of producing chemical action under certain conditions. Zinc is an element, and is symbolized in the list of elements by the letters Zn. Sulphuric acid is a compound substance; one molecule of the acid is composed of two atoms of hydrogen, one of sulphur and four of oxygen, and the chemical expression for it is H_2SO_4. Copper is an element, and is expressed chemically by the letters Cu, which stand for *cuprum*, Latin for copper.

Now when the plates or elements are not connected by a wire there is practically no chemical change in the constituent parts of the cell, but the moment a metallic connection is made between the elements, chemical reaction immediately takes place. This reaction is expressed chemically by the following formula:

$$\underset{\text{(circuit open)}}{Zn+H_2SO_4} = \underset{\text{(circuit closed)}}{ZnSO_4+H_2},$$

which means that the four atoms of oxygen and one of sulphur in the sulphuric acid combine with the zinc, setting the hydrogen free, which appears at the copper plate as bubbles. The combination of the zinc, sulphur and oxygen forms sulphate of zinc, which is expressed by the symbols $ZnSO_4$.

On a little reflection it will be evident to the beginner that if these reactions are continued a sufficient length of time the sulphuric acid will be entirely consumed or broken up, and its constituent parts separated, and in its place sulphate of zinc will be formed; such is the case.

Having considered the elementary form of a voltaic cell, we will now refer briefly to a type of cell which is a modification of the one just discussed, and which is very extensively used in experimental work, namely, the bichromate battery.

Sulphuric acid treated with bichromate of potash or sodium, in solution, forms chromic acid, which is rich in oxygen. This acid gives up its oxygen readily to nascent hydrogen, and for this reason is valuable as a "depolarizer" for batteries. A depolarizer is a substance which will prevent polarization of the cell.

The simplest form of bichromate battery consists of a glass or earthen cell, a plate of zinc, a plate of carbon (instead of copper) and the bichromate of potash solution as the electrolyte. It is usual to withdraw the zinc plates from the liquid when the battery is not in use, to prevent needless consumption of metal, which takes place within the cell.

The initial electromotive force of this battery is a little more than two volts, but the current gets weakened by continuous action on account of the exhaustion of the liquid in immediate contact with the plates. It, however, may be increased by agitating the liquid.

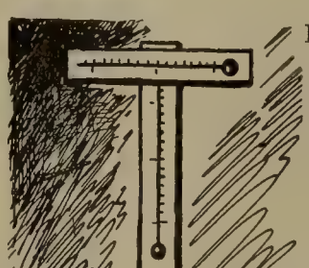
This battery gives a powerful current when the parts are properly assembled. By placing the zinc and carbon plates as close together as possible the internal resistance of the cell is reduced, and consequently the amount of current increased.

This battery is valuable for experimental purposes and half a dozen such cells will give a brilliant light by using a small incandescent lamp.

If any of our readers desire to more fully familiarize themselves with the different kinds of batteries made, their constitution, characteristics, uses, etc., the little book gotten up by Prof. H. S. Carhart, of the University of Michigan, will give them all the practical points they need. The title of the book is "Primary Batteries," and the price is $1.50. It can be obtained at the office of the ELECTRICAL AGE.

DEVELOPMENT OF HEAT.

BY J. H. GLOVER.

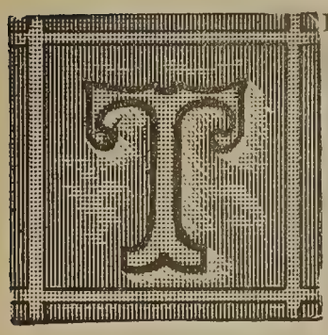


THE amount of heat developed by the urging of a current of electricity through a solid conductor is proportional to the total energy expended in the conductor, and this energy is proportional to the product of the strength of the current C, and the difference of potential E, between the extremities of the conductor necessary to produce that strength — or, the heat H developed is proportional to EC; but by Ohm's law, $E=CR$, therefore $EC=C^2R$. This shows that the heat developed varies directly as the resistance, and directly as the square of the current strength, and may be said to also vary directly as the potential difference; as, for example, by maintaining in two uniform conductors, A and B, a potential difference at the ends of one of them, A, twice that of the other, B, the heating effect will be quadrupled, for the current strength with equal resistances will also be doubled, and the rate of energy being expended in A will be four times that in B. On the other hand, if, with both conductors being equal in length and sectional area, the specific resistance of B is twice that of A, with the same potential difference being maintained in both of them, the resistance of B being twice that of A, the strength of current flowing through B will be halved. Therefore, if in A, $H=EC$, or C^2R, then in B, $H=\frac{1}{2}CE$, or $2R(\frac{C}{2})^2=\frac{1}{2}C^2R$. In this example there is developed twice as much heat and twice as much energy expended in A, as compared with B. Should the current in B be made equal to that in A, through the potential difference in the former being doubled, we would then have in A, $H=EC$ or C^2R, and in B, $H=2EC$ or $2C^2R$, which goes to show that the heat developed is doubled, and twice the amount of energy expended by doubling the resistance and keeping the current strength constant. The lesson here taught is that never by any possible means

can the amount of energy obtained by heat more than equal or exceed the amount of electrical energy expended or absorbed in the conversion.

THE INFLUENCE OF JURIES AGAINST STREET-RAILWAY CORPORATIONS.

BY J. M. BATCHELOR.



HERE are many facts to prove that there is a growing class of unscrupulous lawyers in nearly all the larger cities of the country who make it their special business to hunt up cases where people have sustained some injury, directly or indirectly, by means of steam or street railways, in order that they may have an opportunity to feed upon such railways through the prevailing tendency of juries to decide against corporations whenever the excuse offers. This habit of juries is well illustrated in the words of a Western judge, who recently said: "We affirm a good many unjust judgments against railways because juries will find verdicts against them if there be any pretext for so doing, and unless on a record there is such a want of evidence to support the verdict, or what evidence there may be in that direction is so overwhelmed by opposing evidence that the verdict is glaringly wrong, we have no right to disturb it."

It is difficult to learn where this jury prejudice originated; that is, why a jury prejudice should exist against railway corporations as a class rather than against firms. But it exists, whatever the reason or its justice, as the above extract taken from the *Railway Review* well testifies, and the worst of it is, unscrupulous lawyers are in plenty to take advantage of it for the purpose of not only inciting cases into activity where the natural sense of the complainant would not dream of there being a case, but these lawyers make it their business to take up a case whether there is any justice on their side or not, well knowing that juries will give them the benefits of all doubts. A good instance in point is a suit brought against an ice company last month in Brooklyn, where, according to the complaint handed in, a boy was running after an ice-wagon to steal a ride, and while clinging to the wagon one of the cakes of ice worked loose and fell out on him and injured his head. The boy, through his guardian, brought suit against the ice company for ten thousand dollars damages. With such a precedent we may reasonably expect that burglars may be the next on the list to bring suit for any damages they may sustain while robbing corporations of their property. Of course it was unfortunate that the boy was injured, but the idea that the company is responsible under such circumstances is merely a part of that injustice which the judge above so well describes.

While this ice company is not a street railway, it is a good illustration of the same kind of suits brought against street railways and for precisely the same cause. Boys will steal rides, and many of them get injured while doing it; in fact, boys worry bob-tail car drivers sometimes to an unbearable extent, and we have ourselves witnessed instances where we have thought the driver would have been justified in using some pretty severe measures to stop it. Yet if any injury happens to one of these painfully annoying children, an injury which they have wholly brought on themselves, a jury nine cases out of ten will decide against the company. Injustice of this kind is not in behalf of the public good; it is a breeder of vice in itself. If a corporation is flagrantly or justly in fault not a word is to be said, but there is no sense in making a corporation responsible for accidents which are due to the carelessness or the mischief of the injured, or where every reasonable care has been taken by the corporation to avoid them.

Only a few days ago an honest and intelligent man was on one of these juries—his name is Henry George, well known in all parts of the country—and this man had the audacity to decide in favor of a street-railway company, greatly to the astonishment of the court, the jury and a large part of the press as well as the public. We say astonishment of these people, not that they were astonished through the nature of the evidence, as that was not a question in their minds, but the fact that Henry George, a professed champion of the people, should decide in favor of a street-railway corporation, whatever the nature of the evidence, seemed to be a point beyond the average understanding. When called upon to explain, to a reporter Mr. George said he decided in favor of the company because the evidence did not permit him to decide in any other way. This was a new view of the subject, and those who lost an absurd case that had according to evidence no excuse for existence, have not yet got over the striking impression made upon them by Mr. George's originality.

The elevated railway of New York City has hundreds of suits now against it which are awaiting their turn in the courts, aggregating in amount almost enough to swamp the entire corporation if all are decided against it. Lawyers are fattening on these cases, not because of their justice, but because there seems to be an opportunity to incite legal controversy and damages, which in most of them is more imaginary than real, oftentimes relating to some shadow that is cast on a neighboring property by the road's plant. The point we make here is not against any real damage to property recovering its loss, but that unscrupulous attorneys go about and incite factitious cases into existence—a practice which the attorneys think will pay because juries generally decide against corporations on principle.

Nor have we stated the worst of this issue. Politicians note this jury sentiment as an expression of the popular will, and in seeking votes to retain office they, when elected, look upon such decisions as models for their own conduct; consequently, whenever any legislative measure is introduced at all calculated to antagonize transportation companies, without considering the justice of the issue before them they strive to flatter what they suppose is the voice of their constituents by voting against railway progress.

It is a sad confession to make, but it must be said the majority of the legislators, both state and national, do not vote upon the questions put before them from a standpoint of strict justice, but chiefly look upon all issues brought up for their consideration in the light of how they will affect the "party," or they vote in accordance with what they suppose will give them the best political "pull." So long as such a state of political morality more or less rules this country, unjust laws and decisions are likely to prevail. The only complete remedy is in the press, in the instruction the press can give the public by exposing the short-sightedness of everything contrary to a strictly just or honest policy. The root of the trouble is in compromising with crime, or compromising with oppressions, be such oppressions against corporations or against the humblest individual, and until the people themselves, their juries and their caucuses, rigidly stand by honesty in every form, it cannot be expected that legislators will so much oppose their own pockets as to antagonize the average will, wherever they are able to learn what that may be.

Electric locomotives are to be used in drawing trains through the tunnels on the Belt Railroad in Baltimore. The Thomson-Houston Electric Co. will equip the road.

ELECTRICAL SOCIETIES.

BROOKLYN INSTITUTE.

Mr. Douglass Burnett read a paper before the Department of Electricity, Brooklyn Institute, on Friday evening, April 29, entitled "The Electric Trolley and How it Will Benefit Brooklyn." The subject was illustrated by lantern photographs and apparatus.

THE MAGNETIC CLUB.

The spring meeting of this club was held at the "Columbia," on 14th street, New York, on the night of April 30, and was very largely attended, between 150 and 175 members and guests sitting down to the tables. The guest of the club was the Hon. James D. Reid, U. S. Consul to Dunfermline, Scotland, who has recently returned to this country on a vacation.

Mr. W. H. Baker, vice-president of the Postal Telegraph Cable Company, and vice-president of the club, occupied the chair in the absence of the president, Mr. E. C. Cockey.

After dinner Mr. W. J. Dealy, manager of the Western Union Telegraph Company, New York, made a few felicitous remarks of welcome to the honorable guest, who is probably the best-known man in the telegraph service to-day.

When Mr. Dealy had finished, the company sang "Home Again" with great effect, after which Mr. Reid responded to the hearty and enthusiastic welcome tendered him by his friends, and thanked them. He then spoke briefly of the early days of the telegraph. He learned to make the Morse alphabet from Alfred Vail.

Mr. Reid referred to the attempt now being made by Alfred Vail's son to have his father recognized as the inventor of the telegraph instead of Morse. "It is claimed by his son, Alfred Vail," continued Mr. Reid, "that his father was an inventor; nothing could be more false." The first time Vail ever saw the telegraph, said Mr. Reid, was when Morse showed it to him in a complete and working condition. "Vail was a machinist and did his work well, but did nothing more," continued the speaker.

Mr. Reid then told how he had rejected Vail's work; the machines the latter made were unsuitable and impracticable, the magnets weighing 150 lbs., which was too much for him (Reid) to carry around. "Don't let Vail or any other man take the honor away from Morse," he said in conclusion.

Col. C. A. Tinker, general superintendent, and W. C. Humstone, district superintendent of the Western Union Telegraph Co., also made appropriate speeches, which were enthusiastically received. The speeches were interspersed with music, both vocal and instrumental, and humorous recitations.

The event was one of the most successful ever held by the club, and the utmost good feeling and cordiality prevailed.

Among those present were: Hon. James D. Reid, W. H. Baker, W. J. Dealy, A. S. Brown, J. C. Hinchman, H. H. Ward, Col. C. A. Tinker, D. Doren, W. C. Humstone, F. W. Jones, Gen. Fowler and many others well known in the telegraphic and electrical world.

PHYSIOLOGICAL ACTIONS OF THE ELECTRIC CURRENT.

Currents of electricity passed through the limbs affect the nerves with certain painful sensations, and cause the muscles to undergo involuntary contractions. The sudden rush of even a small charge of electricity from a Leyden jar charged to a high potential, or from an induction coil, gives a sharp and painful shock to the system. The current from a few strong Grove's cells, conveyed through the body by grasping the terminals with moistened hands, gives a very different kind of sensation, not at all agreeable, of a prickling in the joints of the arms and shoulders, but not producing any spasmodic contractions, except it be in nervous or weakly persons, at the sudden making or breaking of the circuit. The difference between the two cases lies in the fact that the tissues of the body offer a very considerable resistance, and that the difference of potential in the former case may be many thousand of volts; hence, though the actual quantity stored up in the Leyden jar is very small, its very high E. M. F. enables it at once to overcome the resistance. The battery, although it might, when working through a good conductor, afford in one second a thousand times as much electricity, cannot, when working through the high resistance of the body, transmit more than a small fraction, owing to its limited E. M. F.

After the discovery of the shock of the Leyden jar by Cunæus, in 1745, many experiments were tried. Louis XV. of France caused an electric shock from a battery of Leyden jars to be administered to 700 Carthusian monks joined hand in hand, with prodigious effect. Franklin killed a turkey by a shock from a Leyden jar.

In 1752 Sulzer remarked that "if you join two pieces of lead and silver, and then lay them upon the tongue, you will notice a certain taste resembling that of green vitriol, while each piece apart produces no such sensation." This galvanic taste, not then suspected to have any connection with electricity, may be experienced by placing a silver coin on the tongue and a steel pen under it, the edges of them being then brought into metallic contact. The same taste is noticed if the two wires from the poles of a voltaic cell are placed in contact with the tongue.

Ritter discovered that a feeble current transmitted through the eyeball produces the sensation as of a bright flash of light by its sudden stimulation of the optic nerve. A stronger current transmitted by means of moistened conductors attached to the battery terminals gave a sensation of blue and green colors, in flowing between the forehead and the hand. Helmholtz, repeating this experiment, observed only a wild rush of color. Dr. Hunter saw flashes of light when a piece of metal placed under the tongue was touched against another which touched the moist tissues of the eye. Volta and Ritter heard musical sounds when a current was passed through the ears; and Humboldt found a sensation to be produced in the organs of smell when a current was passed from the nostril to the soft palate. Each of the specialized senses can be stimulated into activity by the current. Man possesses no specialized sense for the perception of electrical forces, as he does for light and for sound; but there is no reason for denying the possibility that some of the lower creatures may be endowed with a special electrical sense.

The following experiment shows the effect of feeble currents on cold-blooded creatures. If a copper (or silver) coin be laid on a piece of sheet zinc, and a common garden snail be set to crawl over the zinc, directly it comes into contact with the copper it will suddenly pull in its horns and shrink in its body. If it is set to crawl over two copper wires, which are then placed in contact with a feeble voltaic cell, it immediately announces the establishment of a current by a similar contraction.

QUEBEC NOTES.

Quebec City is calling for tenders for electric lighting, to be addressed to Charles Baillairge, city engineer, and handed in before 4 o'clock the 4th of May. Two responsible names must be given in guarantee of the fulfilment of contract; tender to state price per year for arc lights of 2,000 candle-power (to be tested and proven) to burn all night and during every night in the year regardless of moonlight. The tenderer must provide power and complete plant; the present number of lights is 308, which may be increased to say 400, more

or less ; the separate price per light per annum shall be stated, whether for underground or for overhead system, also a separate price for a five years' and for a ten years' contract, and an accepted check for $4,000 must accompany each tender.

The city street-car system is to be improved and extended, and electricity will be partly adopted, but the town is very conservative and will probably take another year to begin the improvement.

MONTREAL NOTES.

Matters in connection with the Montreal street electric railways came up before the Municipal Committee on April 21, and it was decided to call for tenders ; at the same time there was a disposition to give Mr. Mainwaring and Mr. Bickerdike consideration in reference to their offer to build the lines that they were the promoters of.

The Montreal Elevated Railroad Co. asks for privileges as follows : To run electric cars from city limits on Mount Royal avenue, thence by Park avenue to Sherbrooke street ; thence by Bleury to Craig, laying a double track ; a single track from and on Bleury to Sherbrooke and St. Kathrine streets ; to have power to run over present street-railway track and to make running arrangements with said company ; fare 5 cents, and speed 8 miles limit per hour, paying to the corporation $100 for first 4 years, $200 next 5 years, $300 following 5 years, and $400 remaining 5 years.

The mayor has sent circulars to the larger American cities for information concerning their systems of electric railways.

There is a great deal of sparring for wind going on ; but from a significant remark made by the mayor "that there was a syndicate backed by $25,000,000 ready to build 100 miles of railway in Montreal," and the announcement in the ELECTRICAL AGE of April 23 that the parties who control the Toronto and Montreal street car system had placed an order with the Edison Company, of New York, and that that company hoped to have the Montreal furnishing contract, you can set down "the syndicate" as being the winner.

Tenders are called for the electric railway, to be handed in Tuesday, May 17, to assistant city clerk of Montreal, to construct and operate electric railways in the city for a period of 18 years in streets mentioned in specification, in whole or in part. Each tender must be accompanied by a deposit of $2,000 per mile of track to be laid, said deposit to be returned after consideration of tenders. Specifications have not been printed, but may be summarized. Description of routes, privileges of running over certain parts of present system, periodical time-table, speed not to exceed 8 miles per hour, give power to city surveyor to decide on the number of passengers each car shall accommodate ; forbids carriage of freight ; provides for a 5-cent fare ; transfer to all parts without extra charge—six tickets for 25 cents, 25 tickets for $1. If sleighs are to be run in winter tenderer must specify where and what difference it will make in the contract conditions ; the "special tax clause" is left open ; the accepted tenderer will have preference if extension is granted after the 18-year term.

The Council committee met April 23, and it was decided to refuse Mr. Mainwaring's offer, likewise Mr. Bickerdike's ; they must take the chances with the others. The $2,000 per mile clause was amended and $25,000 was to be the limit ; that is, tenders must be for a 12½ mile section.

OTTAWA (ONT.) NOTES.

Ottawa has had the trolley system for over nine months, and no accident to life is reported.

The City Council is having trouble with the Bell Telephone Company and the electric railway in reference to the removal of a pole, and on the night of April 19 Alderman Cluff proposed that the city engineer be instructed to remove said pole ; his object, he claimed, was to ascertain if the citizens of Ottawa had a right to their own streets. He understood that the city engineer had asked an official of the Electric Railway Company to remove this pole, but the official informed the engineer that it would not be removed.

NEW INCORPORATIONS.

Electric Power and Transmission Co., Baker City, Ore., incorporated April 18, with a capital stock of $150,000. Incorporators: B. W. Levens, F. L. Giroux, William H. Packwood, Jr., Baker City, Ore.; George Amslie, Boise City, Idaho.

The Columbian Electric Co., Camden, N. J., incorporated April 18, with a capital stock of $200,000. Incorporators: S. J. MacFarren, Pittsburg, Pa.; F. H. Elder, Philadelphia, Pa.; T. P. Curley, Camden, N. J.

The Electrical Protection Co., Jersey City, N. J., incorporated April 18, with a capital stock of $100,000. Incorporators: H. W. Spang, N. B. Amory, New York, N. Y.; W. Bruns, J. N. Bruns, P. Sury, Jersey City, N. J.

The Muncie Electric Street Railway Co., Muncie, Ind., incorporated April 20, with a capital stock of $100,000. Incorporators: David Cammack, William L. Little, Darius C. Mitchell, Roscoe C. Griffith, John M. Kirby.

National Investment and Improvement Co., Davenport, Ia., incorporated April 13, with a capital stock of $2,000,000. Among other things it will operate electric light and power plants. Incorporators: Charles F. Hathaway, Henry G. Davis, Azel C. Buell, all of Davenport, Ia.

La Grange Light and Water Works Co. (incorporated in W. Va.), New York, N. Y., incorporated April 20, with a capital stock of $125,000, to construct and operate electric light and water-works at La Grange, Ill. Incorporators: H. C. Hodgkins, C. T. Moffett, Charles F. McLain, Syracuse, N. Y.

The National Automatic Fire Alarm Co., of Chicago, Ill., incorporated April 21, with a capital stock of $300,000. Among other things it will construct and operate lines of electric fire-alarm telegraphs, alarm signals, etc. Incorporators: Frank C. Elliott, Horace C. Alexander, Fremont Hill.

Tuna Creek Land and Water Co., Los Angeles, Cal., incorporated April 18, with a capital stock of $100,000. Among other things it will generate and supply electricity. Incorporators: E. G. Kun, E. W. Abbott, L. R. Patty, W. L. Willis, George L. Willis, Los Angeles, Cal.

American Battery Company, Chicago, Ill., incorporated April 25, with a capital stock of $1,000,000. Incorporators: George F. More, Charles S. Kaufmann, Samuel E. Hibben.

The Phœnix Consolidated Gas and Electric Light Co., Denver, Col., incorporated April 23, with a capital stock of $300,000. Incorporators : Frank Evans, D. Albert Abrams, Charles F. Musgrove, Denver, Col.

New England Electric Therapeutic and Alarm Co., Biddeford, Me., incorporated April 21, with a capital stock of $100,000. Incorporators : John H. Roberts, Chelsea, Mass.; George E. Fowle, Wilbur L. Libbey, John Winn, all of Boston, Mass.

York Cliffs Improvement Co., York, Me., incorporated April 23, with a capital stock of $300,000. Among other things it will deal in electric light and gas-works. Incorporators: J. D. Vermeule, C. C. Vermeule, New York, N. Y.; Samuel W. Junkins, York, Me.

The Wichita Falls Electric Light and Power Co., Wichita Falls, Tex., incorporated April 16, with a capital stock of $30,000. Incorporators: D. J. Calkins, W. C. Heath, A. Zundelowitz, J. A. Kemp, Wichita Falls, Tex.

Centre and West End Passenger Railway Co., Williamsport, Pa., incorporated April 19, with a capital stock of $18,000, to operate an electric street railway. Incorporators: W. W. Champion, William C. King, James B. Coryell, Williamsport, Pa.

Chester and Media Electric Railway Co., Chester, Pa., incorporated April 18, with a capital stock of $100,000. Incorporators: Samuel A. Dyer, George B. Lindsay, J. G. Dyer, all of Chester, Pa.

Rochester and Beaver Electric Railway Co., Beaver, Pa., incorporated April 16, with a capital stock of $60,000. Incorporators: Thomas Darragh, Rochester, Pa.; Alfred C. Hurst, Bridgewater, Pa.; Almond R. Leyda, Beaver Falls, Pa.

Liberty Avenue Street Railway Co., Pittsburg, Pa., incorporated April 23, with a capital stock of $50,000, to operate an electric road. Incorporators: S. J. Wainwright, M. F. Leslie, P. C. Byrne, Pittsburg, Pa.

OPPOSED TO LANDING A CABLE.

Secretary of State Blaine was heard by the Senate Committee on Commerce, on April 28, on the question of granting the right to the French Atlantic Cable Company, of Paris and New York, to land a cable on the shores of Virginia or South Carolina, thence to Cuba and San Domingo.

Secretary Blaine made a vigorous protest against favorable action, or any action at all, on the resolution, urging that it should be killed in the committee. The United States wanted to secure direct cable communication with Brazil, and there were reputable men ready to build such a line. If the Senate gave the French company the right to land in Virginia or South Carolina this could not be done. The Brazilian Government had given the French company the exclusive right to land for thirty-five years, and if the right to land in the United States were given by Congress a monopoly would be given the company, and the United States would be prevented from having cable entry into Brazil during the period of exclusiveness. The sending of all messages by way of London and Paris would place the United States merchants under great disadvantage and at great expense, and the construction of the line would prevent the establishment of an American line. Such a line, he believed, would be under way in a year if Congress did not give to the French company the right asked. All cable lines, he said, sought to preserve a monopoly, and where there was a monopoly the service was usually bad. When the United States had a line in competition with the French and English lines, then this country would get cheaper ates.

The Hon. Jeff Chandler and Gen. Eppa Hunton, counsel for the company, made brief arguments in support of the resolution. They contended that Congress had no right to interfere in the right granted to the company to land by the Legislatures of Virginia and South Carolina.

THE ADVISORY COUNCIL OF THE WORLD'S ELECTRICAL CONGRESS.

Upon the invitation of Dr. Elisha Gray, chairman of the Committee on the World's Electrical Congress, an informal meeting of the Eastern members of the Advisory Council was held at the rooms of the American Institute of Electrical Engineers, New York City, on Tuesday, April 26. It was the object of Dr. Gray to consult with the members previous to his departure for Europe on business of the Congress. The following were present: Dr. Elisha Gray, chairman; Prof. F. B. Crocker, Prof. A. E. Dolbear, Dr. William E. Geyer, Mr. G. A. Hamilton, Mr. A. E. Kennelly, Mr. Thos. D. Lockwood, Mr. T. C. Martin, Mr. Geo. M. Phelps, Mr. Franklin L. Pope, Dr. M. I. Pupin, Mr. R. W. Pope. Letters of regret were read from Professors Alexander Graham Bell, Geo. F. Barker and John Trowbridge. It being simply a gathering of a portion of the council, no formal action could be taken, but it was unanimously agreed that the last week in August, 1893, would be the most suitable time for the meeting of the Congress, and this date will doubtless be recommended. Dr. Gray sailed for Europe on the *Majestic*, April 27. He is accompanied by Prof. H. S. Carhart, secretary of the committee.

ELECTRIC STREET RAILWAYS AS INVESTMENTS.*

BY LEMUEL WILLIAM SERRELL, M.E.

The value of street-railway securities as safe investments is only beginning to be generally appreciated. In the past they seldom have been offered to the public. The fact that a road once located upon a principal thoroughfare in a city is fixed upon the line of personal travel, which cannot be changed by the building of a parallel line upon another street, has not been brought forcibly enough before us to be generally appreciated The fact is that a street railway located upon a principal thoroughfare, equipped with modern appliances for rapid transit, runs upon a highway through which people move, and they will ride on these cars rather than those of a parallel line on another street. The securities on such a property, when once on a paying basis, make a safer investment than steam-railroad bonds, the value of which are always liable to be impaired by rate wars and by the building of parallel lines. Steam railroads run between terminals and not upon fixed lines of personal travel, and where terminal facilities can be secured in cities parallel lines are always likely to be built.

When a city reaches a population of 25,000 its growth and business prosperity may safely be expected to increase steadily, and the securities on street railroads on a paying basis and located as above described, are sure to rise in value. The tendency of human nature is also to locate and build close to this line of travel, causing the thoroughfare to become more important as the city grows.

The introduction of electricity as a means of rapid transit has done, and is doing much to bring this class of securities before the investing public. * * *

The remarkable cheapness with which electric roads can be operated as compared with horse roads and the cheapness of the first cost as compared with cable roads has led to the building of more than 3,600 miles of such roads within the past five years. The earnings for the capital invested are larger for electric street railways than for steam, horse or cable roads, and the securities on such properties are now beginning to attract the attention of the general public. The cost of building and equipping street roads varies considerably with different local conditions. A comparison of the average cost of building and equipping cable, electric and horse railways per mile of track, taken from the recent census reports, is given below:

Cable roads	$350,000
Electric roads	30,000
Horse roads	41,000

The above represents a fair average for paved streets in cities proper. For suburban travel the cost per mile of track and electric equipment need not exceed $20,000.

The earnings of the various properties may best be expressed by the ratio of their operating expenses to their gross receipts. It is hard to get figures giving this

*Abstract from the *Engineering Magazine* for May, 1893.

ratio for cable roads. The only ones published that I have been able to find are for Denver, Col., where this ratio is reported as 77 per cent., while for the electric lines owned by the same company it is reported at 55 per cent. Cable roads cost almost as much as elevated railroads, yet in some places they both are bonded for more than $1,000,000 per mile and have dividend stocks. The same ratio for horse railroads we find, by taking the average of over fifty roads from the reports of railroad commissioners, is 80 per cent.

A large number of reports have been published on electric roads, placing this ratio at about 50 per cent. From my own investigation I have found that these figures were true for certain months, but they do not represent the average for the whole year, and that in the section of the country where snow must be removed from the tracks the year's average is from 60 per cent. to 65 per cent. The increase in the net earnings in cities like Boston per revenue car-mile run for electric road over horse roads averages 50 per cent. This enormous increase of earning capacity has given a well-merited "boom" to the electric railway, but at the same time has opened an opportunity for objectionable speculation, the same as surrounded the steam railroads, which caused the wrecking of so many fortunes and gave the opportunity for great railroad steals, followed by reorganizations and "freeze-outs."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, April 30, 1892.

THE UNITED ELECTRIC TRACTION COMPANY has secured fine new quarters at 126 Liberty street.

J. STANFORD BROWN, the well-known electrical engineer, is now associated with the Duplex Rail Co., 51 Wall street.

F. VAN WINKLE, who has an excellent reputation as an expert engineer, has opened an office at 126 Liberty street.

THE SHAVER CORPORATION, manufacturer of the well-known acoustic telephones, has moved its office from 207 to 1 Broadway.

J. RANDOLPH HARD, who is a practical electrician and model-maker, does all kinds of experimental and repairing work, and will be found at 24 Howard street.

H. H. HUNGERFORD, manager of the J. H. McEwen Mfg. Co., 141 Liberty street, has installed one of that company's 80 H. P. automatic engines in the new Akron Iron Co.'s building, Fulton street, this city, for electric light and power service.

THE PREMIER ELECTRIC CO., of Brooklyn, has moved into its new factory, 17 and 19 Whipple street, where it has greatly increased its facilities for turning out motors, batteries and electrical novelties. All orders will receive prompt attention.

F. S. BLACKALL, general district agent for the Crocker–Wheeler Electric Co., has recently opened an office at 126 Liberty street. Mr. Blackall also represents the Carpenter Electric Heating Co., of Minneapolis, Minn., and carries a full line of samples of this company's goods.

MR. W. H. ECKERT, general manager of the Kerite Cable Co., 16 Dey street, city, resigned his position on April 30 to accept an appointment as general superintendent of the Gray National Telautograph Co., with offices at 80 Broadway. This company is prepared to organize sub-companies for the introduction of its system.

MR. W. R. BRIXEY has been appointed general manager of the Kerite Company, with headquarters at New York, to take the place of W. H. Eckert, who resigned on May 1. Mr. Brixey was formerly superintendent of the company's factory at Seymour, Conn., and is well and favorably known in the electrical trade. The company's interests could not have been placed in better hands.

IN our issue last week we stated that the Western Electric Co. had acquired a controlling interest in the Tropical American Telephone Co. This was an error. The gentlemen named in the original article, individually and collectively, now control the telephone company in the capacities named, and while they are also connected with the Western Electric Company, that company has nothing to do with the telephone company's affairs.

MR. A. E. DAVIS, for the past two years manager of the advertising department of *Electric Power*, has resigned his position with that publication and left for Troy, N. Y., where he has taken up the management of the advertising of two large concerns. Mr. Davis while a resident of this city made himself extremely popular in the electrical fraternity. His departure is much regretted.

F. C. TIMPSON, manager of the Electrical Engineering and Supply Co., Syracuse, N. Y., has secured the offices formerly occupied by Wing & Co., on the main floor of 126 Liberty street, where he will carry a full line of the well-known electric light and railway supplies manufactured by his company. Mr. Timpson reports an excellent business during the past few weeks, with very promising prospects ahead. Purchasers of any of the specialties carried by Mr. Timpson will do well to consult him before closing contracts.

THE New York office of the Wainwright Mfg. Co., of Massachusetts, will after the 1st of May be located in the Electrical Exchange Building, No. 136 Liberty street. Mr. F. B. Aspinwall, who has represented this company for the past three years in this city, will still retain his connection with the company and have under his control the entire trade for its goods for the States of New York, New Jersey, Pennsylvania and Ohio. It is the intention of this company to push its trade in the most vigorous manner, which with the steadily increasing demand for its goods and the improved facilities that it has at its command to fill orders promptly, predicts for it a very large increase in business over all previous years. Mr. Aspinwall reports that the demand for its heaters was never better than it is now, and the coming year's sales bid fair to be greatly in advance of last by a very large percentage. W. T. H.

CATALOGUES.

A very handsome illustrated catalogue and price-list has been issued by the American Telephone Booth Co., 18 Cortlandt street, New York, in which will be found full details of the various designs of telephone booths manufactured by it for office use, and which will be sold to regular telephone subscribers at a moderate cost.

The J. H. McEwen Mfg. Co., of Ridgway, Pa., has issued a very complete illustrated and descriptive catalogue of the various automatic engines and steam-boilers manufactured by it. On pages 18 and 19 will be found two very interesting tables, one showing dimensions, powers and speeds, and the other indicated horse-power of single-cylinder engines at different speeds and pressures.

The Interior Conduit and Insulation Co., 42–44 Broad street, New York, has just issued its new illustrated general catalogue No. 7, which contains full and complete descriptions of the interior conduits and special light, heat and power appliances for use in connection therewith, manufactured by it. The catalogue is of a handsome design, printed on very fine paper and divided into two departments, A and B. This company's reputation for turning out first-class work is so well established as to need no further commendation.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Engineering Co., N.Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	84 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	203 25
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 50
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	81 00
Edison General	15,000,000	100 00	80 25
Edison General Receipts		100 00	99 50
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co., N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	20 00
Laclede Gas pref.	2,500,000	100 00	58 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*05
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	10 000
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	61 50
Thomson-Houston pref.	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Western Union	86,188,852	100 00	93 25
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	29 75
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	46 00
Westinghouse Ass. Rects.		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The dénouement of the amalgamation of the Edison General and Thomson-Houston corporations approaches completion rapidly, and under the plain name of the General Electric Company, the public will soon become familiar with the advancement of electrical science. Investors will not have to bother their heads as to whether certain patents on which they are enthusiastic, or certain contracts with which they feel somewhat familiar, are in the interests of one or the other securities, but accept for granted that any part of the business can be supplied by and will redound to the emolument of the one company; consequently both speculation and permanent investment in the stock will be active. The present capital stock of the Edison is $15,0000,000 and of Thomson-Houston $10,000,000, with $650,000, the capital of the Thomson-Houston International Co., thrown in. Almost as a matter of course the capital has been doubled for the new company to start off with, and is $50,000,000. It will be remembered that this column has advocated $75,000,000 and the name to be simply Edison Electric Co., but one can't always have all they want, and the issue as above stated is accepted as final. The hundreds of thousands of readers of the ELECTRICAL AGE are scattered all over the world, and we take some considerable pride in informing them that after full consideration the company is incorporated under the laws of New York, with its head office in the city. A grand victory was gained at the outset in reducing the corporation tax to reasonable dimensions. There seems little room to doubt but that Mr. C. A. Coffin, of Boston, will be the first president of the company. His experience renders him the most desirable man of all who have been mentioned for the position. It is expected that all arrangements will be completed and the work all brought under the management of the new officers on the 1st of June. The various offices in the large cities will be occupied as fast as possible, and here is one of the great savings for the shareholders; a reduction of one-half in rent and office expenses means a good dividend in itself; added to this is the immediate settlement of a large number of law-suits and the cessation of that expense. Further than this, all competition between not only the companies themselves, but all they each control is dispensed with, and for a great many large contracts there will not be any opposition, although separate organizations will for a limited period be kept up. The stock will soon be issued, and in the first scramble should go some distance above par, and it will take a full year for them to find their legitimate value, while several years must elapse before they can be run up and down at the whim of a few brokers. Next comes the question as to whether the Westinghouse will join or not. Personally, I am inclined to believe, and risk a reputation, that once the stocks are listed on the New York Stock Exchange under separate names, no influence can be brought to bear, short of the sheriff, capable of joining that which is separated in this manner. Another month will settle the whole matter, and in that month the rush for these securities should be exactly the same as the late land rush in Oklahoma.

On the 27th ult. the New York Stock Exchange, by the governor's proclamation, closed its doors at noon. The legal cessation of business only covered greater New York, but I note the Boston Exchange also took a half holiday. I am often abused for saying there is but one Stock Exchange in America and that no country is large enough to support two. If I am wrong I would like to know why it is that if the New York Stock Exchange for any reason closes its portals, practically all other stock dealings cease.

A point of interest and showing that there is still money in the quick electric transmission of financial news

is that from the second day of May the Gold and Stock Telegraph Co. is charging for tickers $20 per month below Chambers street, $25 from there to Fifty-ninth street, and $30 for points above there.

Now is the time, as will be readily seen by noting the new incorporations, extensions, alterations and new equipments in electric plants, to invest small amounts when of necessity continuous profits must accrue. To this statement there is no exception; they are developing the whole country; the ocean, lakes and rivers are also included. No new vessel carrying steam leaves port without an electric apparatus of at least one description, many being equipped with several. The spring flood of new inventions include quite a number of marine devices, all requiring money to manufacture, the orders in most cases being already obtained. The annual exodus of Americans has set in, and every passenger on an ocean steamer is personally interested in the ship's electrical plants and electrical engineers to the extent of their personal safety at all events. I am not aware that any marine law has been enacted on either side of the Atlantic governing the use and application of electricity. There is a grand field open for some young Plimsoll to make a reputation in. Both life and capital require special attention in this direction. The master of a ship at sea is still the most autocratic individual in existence until accident comes, when he at once sinks to the level of the others on board. It is full time to change the ancient style of dying inactive on the bridge, to saving the ship by engineers who have to-day to meet a different state of things from that which obtained twenty years ago. The passenger traffic is immensely in our favor but with this difference, the Americans go abroad with a full purse and leave at least $100,000,000 of our capital before they return, while the immigrant comes without money but remains in the country; each is entitled to far more protection by the carriers than they receive, and the capital invested in the business is worthy of special legislation all round.

There are probably more patents of an electric nature being secured just now than in any other single direction, and consequently more money is required to exploit them. The great majority which after the usual delay acquire a patent, seem to find capital quite ready to manufacture enough to fully test the device, and then when orders come in the alleged investor is crazy to realize a large profit, instead of pushing it on until the demand is sufficiently urgent to create a market which must be satisfied, and with nothing but these particular goods. We all know that the inventor's and patentee's life is not passed in a bed of roses, as was proven early this month when a French electrical inventor, having concluded to marry an American lady, came here to do it, and naturally brought with him his invention, a dynamo. To his great surprise he found he could not bring in his own invention free; it was appraised at $116, and $52 duty demanded, the dynamo not having been made here, according to law. Either this was more money than monsieur had to spare or he acted on principle, for the creation of his brain and muscle lies in the United States public stores.

NEW ANTI-FRICTION BABBITT METAL.

Mr. A. C. Stiles, for six years the superintendent of the brass foundry of the N. Y., N. H. & H. R. R. Co., is the inventor of a formula for the manufacture of an Anti-Friction Babbitt Metal, the success of which has been phenomenal. Tried as it was for a long time on the locomotives and cars of the above-mentioned road and in competition with many other metals, it soon proved itself far superior in its ability to withstand the severest tests, and its durability in the long runs of the through Boston express trains, eliminating the long dreaded hot-boxes which cause so many vexatious and expensive delays; for one of the best features of this metal is its ability to run *long* and *cool* without wearing out.

It has also had many tests on electric motors and rapid-running machinery of all kinds with great success.

Mr. Stiles is also the originator of a formula for bronze for heavy bearings that sustains a record on locomotive driving-wheel bearings now in use of 7,000 miles per month for 27 months, and cannot be equalled for heavy work.

All mixtures of both of these metals are made by the originator of the formula, and insure a uniform quality—always the best

The real merit of these bearings becoming more widely known, a company has been recently formed called the Stiles Smelting Co., with A. C. Stiles, pres.; Newton H. Cox, sec.; James R. Lyon, treas. New York office, 136 Liberty street. F. H. Alling, manager.

The already numerous orders would indicate the large and ever-increasing business in store for it.

THE
"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

TRADE NOTES.

We extract the following notice from the *Baltimore American* of April 22, regarding the conduit system of the Interior Conduit and Insulation Company, of New York: "The contract for the electric equipment and interior wiring of the new City Hall, at Richmond, Va., was awarded yesterday to the Southern Electric Co., of this city. This is one of the largest contracts of the kind ever made. The company will use the Interior Conduit Company's system throughout, which comprises a method of insulated tubing, together with all the modern appliances for safety and convenience, giving full control of the electric plant at one central point in the building. The contract was awarded to the Baltimore house owing to the superiority of their work, although they were not the lowest bidders."

The following copy of a letter received by W. R. Fleming & Co., 174 Fulton street, New York City, from H. C. F. Koch & Co., the well-known dry-goods firm on West 125th street, is self-explanatory:

NEW YORK, Jan. 28, 1892.

Messrs. W. R. FLEMING & Co.,
New York office Hbg. Foundry and Machine Works,
174 Fulton street, N. Y. City.

GENTLEMEN: We beg to state to you the the entire satisfaction we experience in the every-day service of the 13″ x 12″ and 10½″ x 10″ Ideal Self-Oiling Automatic Engines we have now been running for nearly a year past. We cannot detect throughout the building the slightest vibrations or noise of any kind outside of the engine-room when outlets to same are closed.

We find after a careful test made lately under an expert employed by us that the engines from a mechanical standpoint are economical in fuel consumption, carry their maximum load smoothly and quietly, and in regulation are perfect.

We are entirely satisfied with your liberal and capable treatment of us, and will take great pleasure in exhibiting your work to any parties in search of first-class equipment. We believe our plant unequalled for its purpose, and believe also in recognizing merit and giving credit to whom it belongs. Yours very truly,

H. C. F. KOCH & Co.

The Electrical Age's Illustrated Patent Record.

Issued April 19 and 26, 1892.

ISSUED APRIL 19.

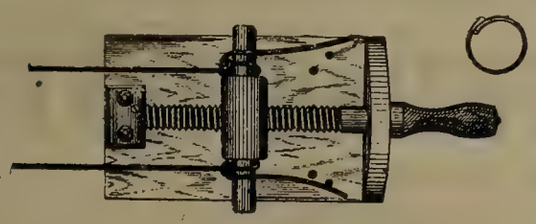
473,366. Armature for Electric Generators or Motors. Sidney H. Short, Cleveland, Ohio. Filed June 24, 1891.

473,367. Dynamo-Electric Machine. Sidney H. Short, Cleveland, Ohio. Filed June 24, 1891.

473,373. Incandescent-Electric-Lamp Socket. Craig R. Arnold, Sharon Hill, Pa. Filed Dec. 17, 1891.

473,378. Electric Stop-Motion for Looms. John C. Brooks, Paterson, N. J., assignor to George Draper & Sons, Hopedale, Mass. Filed May 14, 1891.

473,386. Electric Battery. James E. Emley, Laredo, Tex. Filed Jan. 27, 1891.



473,528.—DEVICE FOR STRETCHING WIRE.

473,393. Electrode. Paul L. T. Héroult, Schaffhausen, Switzerland, assignor to the United States Aluminium Metal Company, of New York. Filed Aug. 8, 1889. Patented in England.

473,435. Electric Switch. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 2, 1889.

ISSUED APRIL 26.

473,463. Plunge-Battery. James H. Howard, Medford, Mass. Filed Dec. 1, 1890.

473,504. Electric Switch. Halbert K. Hitchcock, Louisville, Ky., assignor of one-half to Chas. W. Kellogg, Brookline, Mass. Filed Sept. 16, 1891.

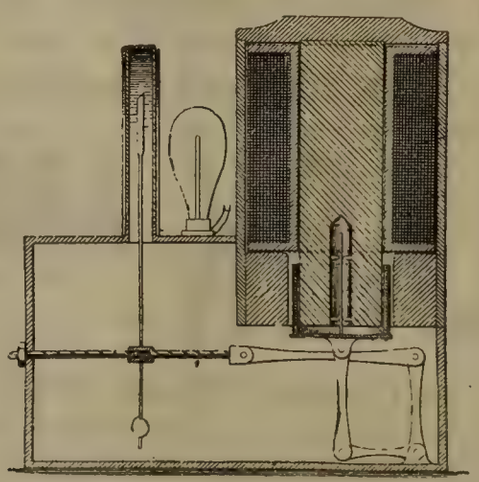
473,514. Induction-Discharge Protector for Welding Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 14, 1889.

473,522. Telegraph or Other Pole. William Pitt, London, England, assignor to the Sectional Standards Limited, same place. Filed Nov. 27, 1891.

473,527. Wire-Stretcher. Herbert S. Shaw, Dudley, Mass. Filed May 29, 1891.

473,528. Device for Stretching Wire. Fred H. Speed, Rockland, Me., assignor to Edmund N. Wilcox, Meriden, Conn. Filed Feb. 18, 1891.

473,536. Alternating-Current Arc Lamp. Barton B. Ward, New York, N. Y. Filed March 28, 1891.



473,538.—ELECTRICAL MEASURING INSTRUMENT.

473,538. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Filed Jan. 8, 1891.

473,539. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Filed Jan. 24, 1891.

473,547. Dynamo-Electric Machine. Ward Decker, Owego, N. Y. Filed Nov. 25, 1891.

473,567. Commutator Connection for Electric Motors or Generators. Charles G. Curtis, New York, N. Y., assignor to the Curtis Electric Manufacturing Company, of West Virginia. Filed Aug. 26, 1891.

473,568. Armature for Dynamo-Electric Machines or Motors. Charles G. Curtis, New York, N. Y., assignor

to the Curtis Electric Manufacturing Company, of West Virginia. Filed Nov. 12, 1891.

473,587. Car-Replacer. James M. Morris and Sumner J. Harkness, Scofield, Utah. Filed June 3, 1891.

473,594. Electric-Circuit-Controlling Device. Mandeville Thum, Louisville, Ky. Filed June 5, 1891.

473,595. Circuit-Controlling Device. Mandeville Thum, Louisville, Ky. Filed June 5, 1891.

473,614. Electric Railway-Signal. Charles E. Corporan, Colorado City, Col. Filed June 17, 1891.

473,618. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed June 13, 1888.

473,619. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed Dec. 23, 1889.

473,637. Coupling for Electric Wires. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Nov. 24, 1891.

473,661. Combined Gas and Electric-Light Bracket. John Fitzgerald, Montreal, Canada. Filed July 14, 1891.

473,674. Electric Locomotive. Sidney H. Short, Cleveland, Ohio. Filed May 26, 1891.

473,693. Electric Locomotive. Joseph I. Conklin, Brooklyn, N. Y. Filed March 4, 1891.

473,699. Automatic Heat-Regulating Apparatus. Chas. F. Goodhue, Boston, Mass. Filed May 29, 1891.

473,713. Covered Electric Wire. Henry A. Rueter, Boston, Mass. Filed July 25, 1891.

473,717. Electric-Contact Protector. Richard Varley, Jr., Englewood, N. J. Filed July 7, 1891.

473,832. Electric Signal for Railway-Trains. Lawrence Dunn, Fort Smith, Ark. Filed Nov. 30, 1891.

473,848. Electric Switchboard. John B. Mayer, Newark, N. J., assignor of one-half to Joseph Meier, same place. Filed May 11, 1891.

473,871. Electrically-Propelled Vehicle. Fulton Gardner, Chicago, Ill. Filed Aug. 31, 1891.

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AT THE ACTORS' FUND FAIR.

We give on another page an interesting account and illustrations of the electrical decorations at the Actors' Fund Fair which was held in this city last week. By the aid of small incandescent lamps with bulbs of various colors some most beautiful and artistic effects were produced. The little lamps were arranged with extraordinary skill, and the scene in Madison Square Garden was as charming as it was beautiful, and what gave it these pleasing qualities was the tiny incandescent lamps.

AMERICA FOR AMERICANS.

Secretary Blaine is to be commended for his true American patriotism. "America for Americans" is his motto, and he carried out this idea in a practical way the other day before the Senate Committee on Commerce, when he opposed the proposed bill to grant to a foreign company the right to land its cable on American shores *en route* to Brazil. Mr. Blaine's objection was on the ground that if this right were granted to the foreign company it would frustrate the plans of an American company which proposed to lay a cable to the same objective point, namely, Brazil. We understand that the foreign company's petition stands no chance whatever of being granted.

PROTECTION AGAINST LIGHTNING.

Lightning had its own way in the station of the Allegheny County Electric Light Company, Pittsburg, the other day, notwithstanding the protective devices which are supposed to be provided in all well-regulated stations. Protection against lightning is one of the most important things to look after in station operation, and too much care cannot be bestowed in the selection of lightning arresters.

No less than seven dynamos were burned out in the case above referred to, and the damage to the station amounted to about $7,000.

This should be a lesson to all station operators; it emphasizes the importance of having reliable lightning arresters and other protective devices.

EARTH CURRENTS.

A few weeks ago general interest was excited by the appearance of a group of immense "spots" on the face of the sun, and those experienced in the telegraph service knew that this meant a magnetic storm. Magnetic storms invariably follow the appearance of sun spots, and sometimes they become so violent as to seriously interrupt the working of telegraph wires.

On February 13 last considerable difficulty was experienced in the operation of telegraph wires in this country owing to the existence of strong earth currents in consequence of a magnetic storm then prevailing. In some cases it is possible to work telegraph lines by these earth-currents alone, the regular source of current being entirely cut off. Earth-currents, however, vary too much in their intensity to be of any practical value while they last; they come and go in waves, surcharging the wires one minute and disappearing entirely the next.

Fortunately, however, these abnormal currents do not make their appearance very frequently. Normal earth-currents exist all the time, but they are so feeble as to have practically no effect on ordinary telegraph instruments.

Mr. William Finn contributes an interesting article on this subject in this issue, and by the aid of diagrams shows the relative intensity of the normal and abnormal earth-currents. Mr. Finn has made a special study of these phenomena, and concludes that a great deal of the trouble experienced in working telegraph lines in ordinary times is due to these mysterious visitations. These experiences simply emphasize man's littleness and weakness in all his works compared with nature's might. Nature cannot be controlled.

EARTH CURRENT DISTURBANCES IN TELEGRAPH LINES.

BY WILLIAM FINN.



FOR some time past, and at intervals more or less periodic, serious disturbances due to earth currents have again been experienced on the telegraph lines of this country. A long period of immunity from these troublesome visitors had been enjoyed prior to Saturday, Feb. 13, last, on which date the first of the series of recent phenomena was observed. On the evening of that day a very brilliant display of aurora borealis was observed in various parts of the United States. During the day strong earth currents had appeared in many of the wires, being of sufficient strength on some circuits to completely demoralize the service.

Their existence on the Western Union lines was first noticed about 8:30 A.M., by means of the sensitive galvanometers with which the Wheatstone automatic circuits are provided. These galvanometers are used to balance with, and also serve the useful purpose of enabling the receiving offices to detect whatever "bias" there may be on the distant transmitting apparatus through lack of proper adjustment, etc. On this particular morning the bias was very pronounced and variable, and the sending offices were continually called upon to readjust their transmitters with a view to remedying the trouble, but all to no purpose. It was not until a number of other circuits became similarly affected that the real cause began to be suspected; and eventually by grounding a number of the wires at their opposite extremities, earth currents of considerable magnitude were found to exist in them. Some readings taken of their value at that time on a wire between New York and Buffalo showed a variation in current strength of between 5 and 21 milliampères, representing a maximum difference of potential between those points of about 50 volts. No subsequent measurements were made, but it is calculated that during the height of the storm (between 3 and 4 P.M.) the current strength exceeded 40 milliampères.

Circuits running east and west were more generally influenced than those extending in other directions, though the latter were by no means entirely free from interruption.

It is worthy of note that during the course of the afternoon, when nearly all the wires between New York and San Francisco were completely prostrated, a Wheatstone automatic circuit between Chicago and St. Louis—or one running approximately at right angles to the easterly and westerly line—worked at a high rate of speed without apparently any interference whatever.

Scarcely any disturbance was noticed on the New Orleans automatic circuit until about 4:30 P.M., after which time this, as well as other lines north and south, became more and more affected, until it was possible between 7 and 8 P.M. to work the circuits with the earth currents alone, as was actually done in one or two instances.

The storm disappeared, or at least ceased to influence the regular working, shortly after 8 P.M.

From information received it appears that the magnetic storm began as early as 12.40 in the morning, as shown by the magnetographs in the observatories at Washington and Toronto; and that between midnight and morning, as well as during the evening of that day, a fine red aurora was visible.

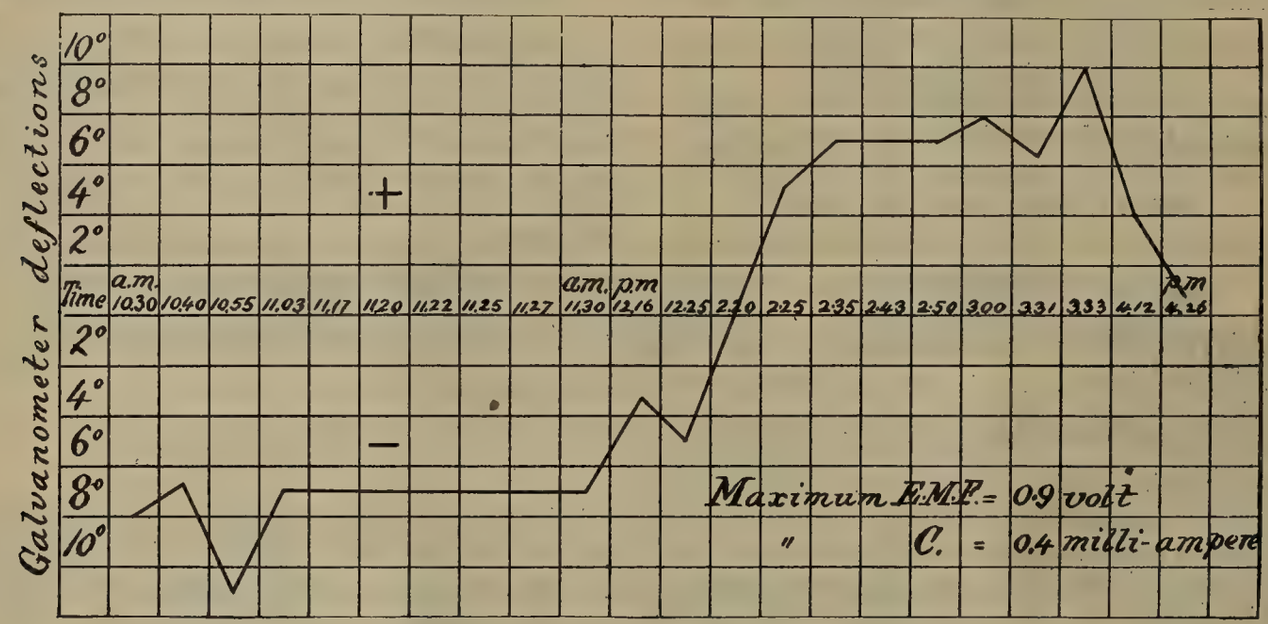


FIG. 1.—CHART SHOWING VARIATIONS OF NORMAL CURRENTS.

A less vivid auroral display occurred on Sunday evening, March 6, and several instances are recorded of interruption to the telegraph service during the prevalence of the aurora, especially on circuits west of the Missouri river.

On Saturday afternoon, March 12, there was a recurrence of the phenomena, but telegraph circuits were affected to a limited extent only, and in a direction mostly east and west. It is a singular fact that the Morse instruments were to all appearances indifferent on this occasion to the earth currents, which appear to have acquired an intensity sufficient only to visibly affect the comparatively weak signalling currents of the automatic system.

On April 24, 25 and 26 similar occurrences, but more spasmodic in character, interfered to a greater or less extent with certain wires running as usual in an easterly and westerly direction.

Since that time nothing further has been heard from them, though it is not in the least likely that we are altogether rid of their unwelcome visits, judging from past experience.

It has been demonstrated beyond all question that the closest relationship exists between the condition of the

sun's surface on the one hand, and earth currents, auroræ and the phenomena of terrestrial magnetism on the other.

In September of the year 1859 a bright spot broke out on the face of the sun, and exactly at the same time telegraph wires and magnetic needles in all parts of the world were disturbed, followed by auroral displays.

In February and August, 1872, and again in August, 1880, similar phenomena occurred.

The electric storm of January 31, 1881, which was quite cosmical in character, developed earth currents of remarkable intensity. On the same day a disturbance of unprecedented magnitude was observed in the sun's photosphere: one of those violent phenomena of solar excitements which occasionally become visible during the maximum sun spot period. We are passing through that period now, and the usual results may therefore be anticipated for yet some time to come.

In view of this circumstance it may be interesting to discuss one or two of the most plausible theories advanced by scientists to account for these strange and mysterious visitations.

The cause of these periodic solar perturbations is still a matter of conjecture; but since they are so intimately associated with earth-current phenomena, it is not improbable that a study of the vagaries exhibited by the latter may lead to a better understanding of the nature and cause of the former.

It is partly on this account that so much scientific interest is attached to the recurrence of these phenomena, and why it becomes a matter of considerable importance to collect such data and information as can be secured from observations of their effects upon telegraph lines. Records of the recent storms, for instance, show that, generally speaking, the wires proceeding north and south were not nearly so much excited as those extending in other directions. This fact affords us some idea regarding the distribution of the equi-potential surfaces in this section of the globe; or in other words, indicates between what points the electric potentials were nearly, if not quite alike, making it possible to deduce therefrom the direction taken by the originating disturbance.

To make this statement perfectly clear, let us consider what happens when a stone is dropped into a pool of

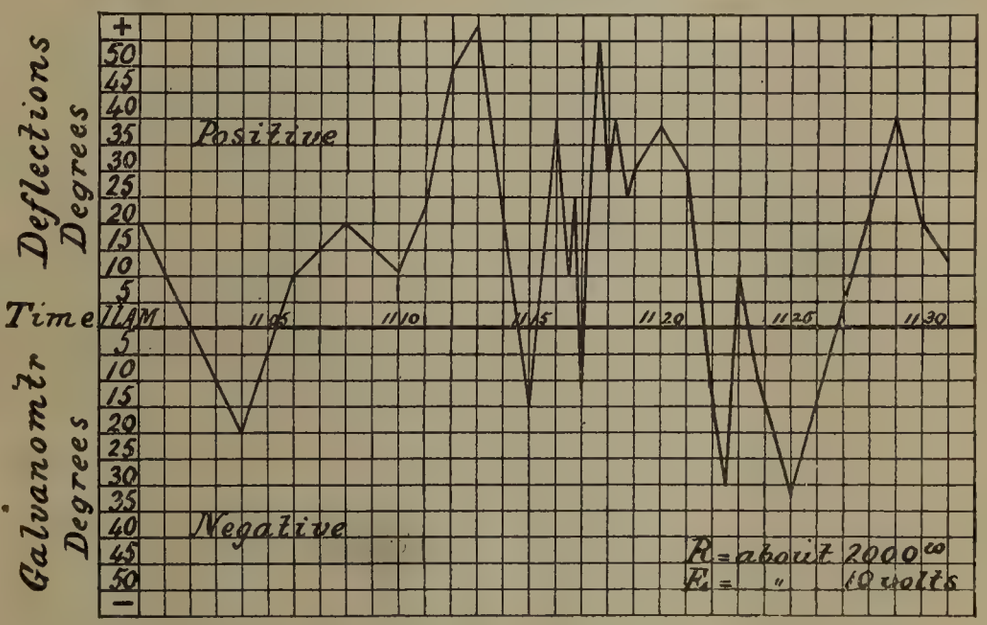


FIG. 2.—VARIATIONS OF ABNORMAL EARTH CURRENTS.

It has been proved by the result of careful observations made upon the electrical condition of our globe that the air is always more or less charged with electricity; so that the earth may be regarded as a highly electrified sphere, with electrostatic lines of induction radiating from it in all directions into space. It may be accepted as highly probable that the sun and other members of the solar system are similarly charged, to a greater or less extent; and that between all planetary bodies an electric force is exerted, which varies with their respective charges and the distance separating them.

Now any alteration in the static distribution of electricity upon a conductor will set up an electric current in it; so that the earth in its motion relatively to say the sun, will have its electricity continually in motion, thus giving rise to electric currents. Under ordinary circumstances these currents would undergo regular periodic changes corresponding with the variations in the relative densities and distances between the charged bodies; but under exceptional circumstances, when great and sudden changes are occurring in the solar atmosphere, we should expect to find sympathetic fluctuations in the magnetic field between the earth and the sun, which would create the conditions requisite for the generation of strong and variable earth currents.

still water. By observing the waves on the surface of the water as they proceed outward from the disturbed centre, it will be seen that they carve the surface into a series of circular waves alternately depressed and elevated. If you select any particle forming a portion of one of these waves, it will be evident that it will form part of a circle of particles all at the same height as itself and equally distant from the centre of disturbance. Between any two points on this circle, therefore, there will be no tendency for water to flow. Moreover, it will be equally evident that the disturbing force acts across these circles in a direction perpendicular to their surfaces.

Now, the equi-potential surfaces created in the case of an electric force may be likened to the series of concentric circles set up by the water disturbance. A body electrically excited may in fact be regarded as a centre from which lines of electric force radiate in all directions. At any distance from this centre a circle may be drawn, all points of which (being equally distant from the centre) will be at the same electric potential. Hence such a circle will represent an equi-potential surface, along which there will be no tendency for electricity to flow. If, then, we find upon the surface of our globe a number of places connected by telegraph lines, where the effects

of the late storms were less marked than on others, or between which no disturbing influence whatever was felt, we should be justified in regarding such points as near the line of, or actually forming parts of equi-potential surfaces.

Such is the deduction drawn in the case of those circuits which were least affected by the late electric storms, and these circuits were found to run mostly north and south.

Since electric forces always act across, or at right angles to the equi-potential surfaces, it is possible to mark the direction taken by the propagating force, and finally to trace it to its origin.

In this way it has been shown beyond peradventure that the sun is mainly responsible for those singularly erratic performances of an electric character, which are more prevalent during the period of maximum sun spots than at any other time.

It is highly probable that at such periods something akin to volcanic eruptions are taking place in the sun. It is a well-known fact that terrestrial phenomena of any such character are always accompanied by electrical discharges and displays, and that these volcanic forces are in some cases characterized by having periods of considerable regularity.

This is what probably happens on a much larger scale in the sun, the excited portion of whose surface is undoubtedly concerned in the production of those peculiar electrical and other phenomena which occur in eleven-year cycles, as well as at other intervals both regular and irregular.

There are other currents of natural electricity which may be found in any telegraph wire, at almost any time (by inserting a suitable galvanometer in the wire) that are the very antithesis of the intense and fitful currents we have just been considering.

These are the *normal* earth currents which differ from the *abnormal* ones in several particulars; they are not transient visitors like them, but permanent residents in the earth; they are very much less intense and variable; show greater regularity in their fluctuations, and appear to be controlled by some invariable and general law. Early observations showed that these currents ebb and flow in a manner like the tides of the ocean, which led many investigators to suppose the cause to be of lunar origin. It was believed, for example, that this tidal action was brought about by the earth's electricity following the moon in her relative motion with regard to places on the earth's surface.

A striking confirmation of this view was apparently afforded by the record of some observations on earth current variations made upon the Atlantic cable in 1858. Readings showing the direction and strength of the current flowing through the cable were taken once every 15 minutes for a period of 36 hours, and compared with the tidal variations during the corresponding period. The curves showed a remarkable coincidence between the earth current variations on the one hand, and the times of high and low water on the other; from which it was argued that the same force which directed the tides was also concerned in the production and variation of earth currents.

I shall not attempt to dilate upon the many other interesting and characteristic features of these normal currents, but proceed to discuss another class of earth current that is not so well known, and which exercises somewhat of a discriminating effect upon the working of circuits.

The abnormal earth current is one whose presence is readily detected on account of its decided action upon the working of the circuit.

The normal earth current on the other hand is exceedingly feeble, and does not as a rule affect the working in the least. (See Fig. 1.)

What may be termed the intermediate class of current is one whose strength does not bring it within the range of visibility, as it were, of the ordinary Morse apparatus, and whose existence is not therefore even suspected, but which has nevertheless a disquieting effect upon Morse circuits, as well as more serious consequences upon other circuits equipped with apparatus of greater susceptibility. This was particularly evident in the case of the storm of March 12, which, as previously mentioned, interfered in a marked degree with the operation of the automatic system without *apparently* affecting the working of the Morse wires.

This circumstance placed the automatic service and those connected with it in rather an unfavorable light; but when the real cause of the trouble was found, it was also discovered that though there had been no *actual stoppage* on the Morse circuits, *there had been considerable bad working*, which had been attributed to everything but the proper cause.

The result of some earth current readings obtained on a wire between New York and Buffalo on the morning of that date is graphically shown in Fig. 2. They were taken some hours prior to the advent of the storm referred to, and were probably much less intense than those subsequently encountered, but yet of sufficient variability to account for the fluctuating "bias," and other annoyances, which so perplexed and worried the chiefs in charge of the Wheatstone circuits at the time.

The writer has many records, taken at various times, of such like variations in the value of earth currents; and while they rarely exceed 4 or 5 milli-ampères, they appear to be sufficiently strong to produce at least some of the unsatisfactory results mentioned.

It is quite certain that a great deal of the trouble experienced on telegraph circuits is never satisfactorily accounted for; and while it is not intended to hold up the earth current as a scapegoat for all the unaccountable troubles that telegraphy seems heir to, there is hardly a doubt but that its influence is frequently exercised to a greater extent than is generally supposed.

THE GENERAL ELECTRIC COMPANY.

The General Electric Company, in accordance with the provisions of the law recently passed by the New York Legislature, granting it the privilege of increasing its stock from $100,000 to $50,000,000, filed with the Secretary of State, on May 2, a certificate of increase of capital to $50,000,000. The documeut is signed by Eugene Griffiin, S. Dana Greene, Joseph B. Ord and James Jackson, a majority of the directors, and recites that the meeting at which the stock was increased was held in the Drexel building on Saturday, April 30. It is believed that the company intends to absorb all of the small companies in the State. The Cantor act, under which the company is incorporated, forbids the formation of a trust. The bill referred to also provided for the payment of a tax of only one-twentieth of one per cent. of the capital, instead of two per cent. exacted by the State. On this basis the corporation tax amounts to $25,000, which the company has paid into the State Treasury.

The first meeting of the General Electric Company, which is the Thomson-Houston and Edison General Electric Combination, took place on May 4, at which the following officers and directors were elected :

Officers : C. A. Coffin, president; Eugene Griffin, first vice-president, and Samuel Insull, second vice-president. A. S. Beves was made treasurer and assistant secretary; E. J. Garfield, secretary; J. P. Ord, controller; E. Clark, auditor, and B. F. Beach, Jr., and W. F. Pope, assistant treasurers.

The directors elected were: J. Pierpont Morgan, C. A. Coffin, Thomas A. Edison, D. O. Mills, F. L. Ames, T. Jefferson Coolidge, Eugene Griffin, Henry L. Higginson, H. McK. Twombly, C. H. Coster and F. S. Hastings. Mr. Twombly was made chairman of the board.

DECORATIVE ELECTRIC LIGHTING AT THE ACTORS' FUND FAIR.

The possibilities in decorative electric lighting were shown in an extremely brilliant and interesting manner at the Actors' Fund Fair, which was held in Madison Square Garden, New York, during last week.

The electric light is unique in that it can be used in situations and under circumstances which preclude the possibility of using any other form of light. For instance, tiny bulbs can be scattered amongst flowers and foliage without detriment to these delicate structures, and they can be combined with the lightest fabrics for artistic effect without danger. With what other light can such beautiful results be accomplished?

The Edison General Electric Company has for some time past been making a specialty of tiny lamps for decorative purposes, and the public is now quite familiar with the beautiful displays in this line that the company has made from time to time in the recent past, notably the towers of light at the Woman's Exchange Fair held at the Lenox Lyceum, in New York City, three years ago, and the industrial exposition held in Minneapolis in the fall of 1890.

At the Actors' Fund Fair just held the electrical decorations were various in their application, and all of great splendor, showing what beautiful combinations may be effected in this style of embellishment. The great brilliancy of the light was remarkable, and yet it was so delicately subdued and rendered so soft that it was totally devoid of any unpleasant features.

On entering the great amphitheatre the first electrical decoration to meet the eye was a signboard placed over the arch erected in the arena, with the words "Actors' Fund Fair," composed of tiny bulbs, with a background of black cloth; and at the farther end was the name "Edison," wrought in red letters; while over the main entrance to the Garden, under the boxes, were the words "Edison Light," in blazing white letters.



ACTORS' FUND FAIR—AMERICAN EAGLE AND SHIELD.

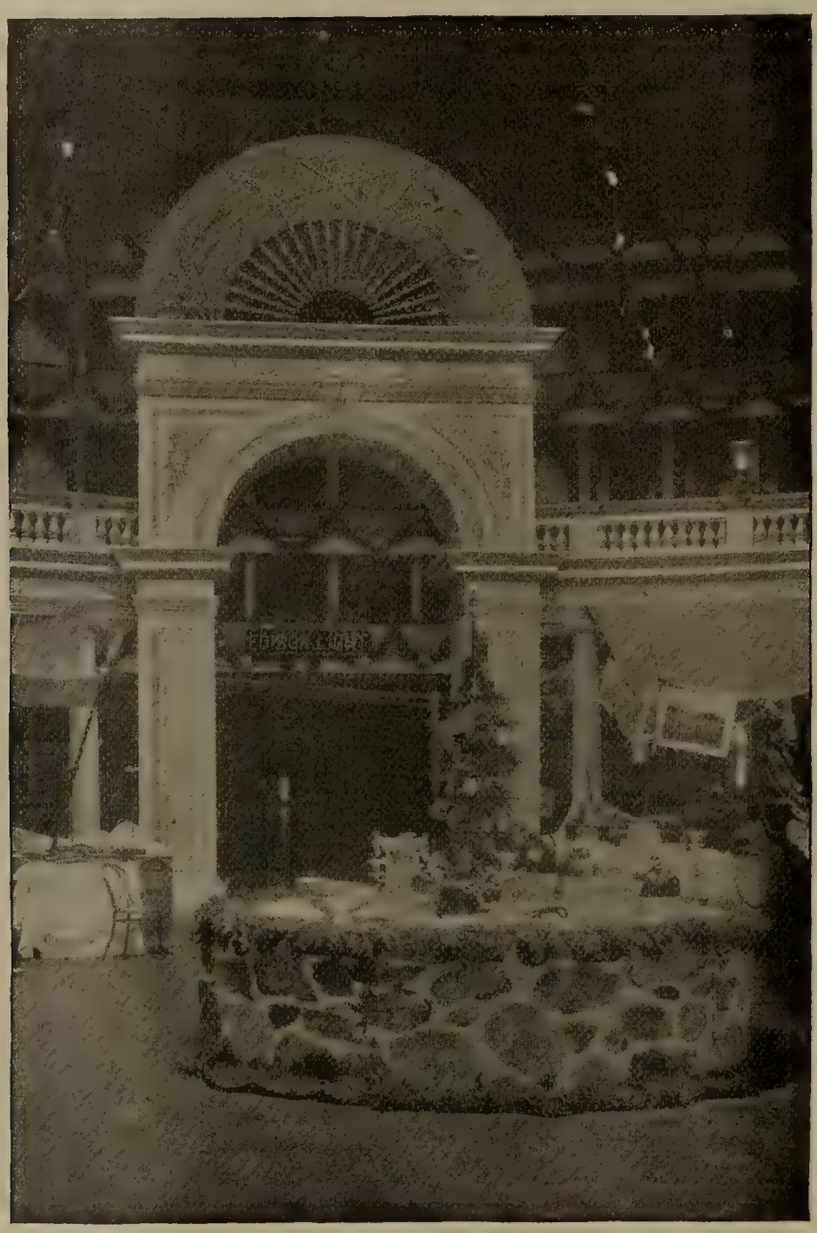
One of the most effective designs was that over the entrance to the booth representing in its exterior the old Globe Theatre. It consisted of a twelve-pointed star of sage-green silk, rayed, on which were the letters "A. F.," of fancy form, composed of tiny blue, yellow and red bulbs the light from which reflected against the green silk, producing a most delightful harmony of color, which could hardly be matched by the painter's brush.

Adjoining "The Old Globe Theatre" was a model of Shakespeare's house, in which the electric illumination

was exceedingly attractive. Around the room were distributed wall-brackets representing candles, the flame of which, instead of being the smoke-producing and fickle light of "ye olden times," was the light of lights, the incandescent lamp. Each bracket was composed of three candles, each of which was surmounted with a tiny frosted bulb from which a soft but brilliant light emanated. In one corner of the room was an attractive novelty in the shape of what might be called an electrical kaleidoscope. It consisted of a revolving wheel on which lamp bulbs of many different colors were arranged spirally, and on each revolution of the wheel the lamps of one set of colors would be extinguished and another set crown of bulbs no bigger than bird eggs, shedding beautiful soft light.

At the silverware booth some beautiful candelabra of chaste designs were lighted with the omnipresent incandescent bulb, with remarkably rich effect. Hanging lamps were displayed around the edges of the booth with small frosted bulbs elegantly combined with the rich metal-work. The "Old Curiosity Shop," immortalized by Charles Dickens, or rather a representation of it, was lighted in its interior by wall-brackets with electric candles in pairs, the bulbs being frosted, which diffused a soft light throughout the room.

In the jewelry booth of Charles Seale & Co. some



ACTORS' FUND FAIR—ELECTRICAL FAN DESIGN.

lighted, the effect of the constantly changing colors being very beautiful. On the counters were pedestals on which were grouped small frosted bulbs, which shed a beautiful soft light on the wares.

Next door to Shakespeare's house stood a model of the exterior of the old Park Theatre, New York, which was built in the year 1796. At one entrance stood a large and beautiful standard lamp, illuminated with a group of small bulbs. The interior was lighted with wall-brackets similar to those in the Shakespeare house, and the upright pole in the centre of the room was encircled with a very pretty effects were produced. The show-cases in which the gems were displayed were lighted on the inside with tiny bulbs of different colors attached to the top of the cases, and scattered amongst the precious stones were other bulbs, the light from which served to show the goods to the best advantage.

Over the entrance to the model of the old Chambers Street Theatre were the words "Chambers Street Theatre," wrought in red and green bulbs, which was very brilliant and attractive. The interior was illuminated with side wall-brackets.

Around the candy booth were frosted bulbs backed with five-pointed stars, the combination of the two being beautiful. The effect was that of many stars of soft white light. Inside the booth were several standard lamps with shades of delicate fabric, the texture of which was clearly brought by the soft electric light underneath.

Five A's, in different colored letters made up of small bulbs, the initials of the "5 A's Club," over the entrance to the model of Harrigan's Theatre, attracted considerable attention.

Probably the most effective display of all was that at the flower-stand of the New York Florists' Club. The flowers and foliage plants were dotted here and there with little bulbs which produced a scene of great beauty, the soft light against the green foliage giving a restful effect to the eyes. Over the stand was the American eagle and shield made up of small bulbs of appropriate colors, and five-pointed stars of blue and red were conspicuous attractions.

Over the wine booth hung a cluster of grapes composed of small bulbs of a purplish blue color.

A unique design in green lamps was that at the Japanese booth. The word "Tea" was made to represent, as nearly as English would permit, Japanese characters.

The principal thing in the line of decorative effect was the representation of a fan over the entrance arch in the arena. On the fan was a sheaf of wheat made up of green and red lamps, and a spider's web, with a huge spider in the centre. The ribs of the fan were of brown bulbs, and the lights were turned on and off in such a manner as to give the effect of opening and closing the fan.

The scene, viewed as a whole, was a most entrancing one, and reflected great credit upon those who had the work of planning and execution in hand. Mr. A. Page and Mr. Wilson S. Howell executed the designs and superintended the lighting effects, while Mr. Martin, the electrician at the Garden, did the wiring, which was an excellent piece of work. Not a wire was visible anywhere, the work being all concealed. Under the skilful management of A. M. Palmer and A. B. De Freece the Fair was one of the most successful ever held in New York.



ACTORS' FUND FAIR—ENTRANCE TO "OLD GLOBE THEATRE."

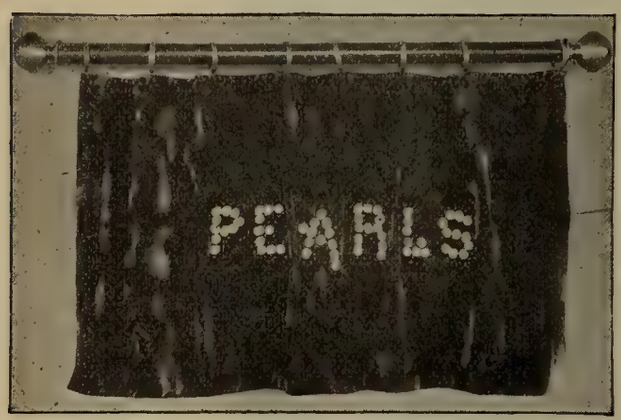
The Columbus Street Railway Co., Columbus, O., was incorporated April 25, with a capital stock of $3,000,000, to construct and operate street railroads in Columbus to be operated by electric or other power. Incorporators: Philip H. Bruck, Edward Dermead, Irvin Butterworth, C. P. L. Butter, Charles G. Lord.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting of the Institute for the reception of yearly reports, the election of officers and other business of a similar character, will be held at the headquarters of the Institute, No. 12 West 31st street, at 4 P.M., Tuesday, May 17. It is expected that the session will occupy about two hours. After adjournment, those who desire to do so will assemble at "The Arena," 41 West 31st street, where a subscription dinner will be served, the price of which has been fixed at $2.00 per plate. This will be a purely social gathering, and it is hoped that all who can do so will be present.

The general meeting will be held at the Grand Pacific Hotel, Chicago, on Monday, Tuesday and Wednesday, June 6, 7 and 8. The following papers are in preparation for that occasion and others are promised, which will be announced in the regular programme to be issued later.



ACTOR'S FUND FAIR—DESIGN IN JEWELRY BOOTH.

1. "*Electric Coal-Mining Machinery*," by MR. ELMER A. SPERRY, of Chicago.
2. "*On the Electro-Magnetic Field*," by M. I. PUPIN, Ph.D., of Columbia College, N. Y. City.
3. "*Long-Distance Transmission for Lighting and Power*," by Mr. CHARLES F. SCOTT, of Pittsburg, Pa.
4. "*A New Rheostat*," by Mr. C. E. CARPENTER, of Minneapolis, Minn.
5. "*A Dynamo Indicator, or Instantaneous Curve Writing Voltmeter*," by PROF. GEORGE S. MOLER, of Cornell University, Ithaca, N. Y.
6. "*Electro Technical Education*," by PROF. R. B. OWENS, of the University of Nebraska, Lincoln, Neb.
7. "*The Magnetic Properties of Sheet Iron*," by MR. MILTON E. THOMPSON, of Cornell University, Ithaca, N. Y.
8. "*Selective or Individual Signals*," by MR. THOMAS D. LOCKWOOD, of Boston, Mass.
9. "*Railroad Train Lighting*," by MR. A. H. BAUER, of Chicago.
10. "*A Discussion of Circuits Containing Resistance, Self-Induction and Capacity*," by MESSRS. FREDERICK BEDELL and ALBERT C. CREHORE, of Cornell University, Ithaca, N. Y.
11. "*A Life and Efficiency Test of Incandescent Lamps*," by PROF. B. F. THOMAS and MESSRS. P. MARTIN and R. H. HASSLER, of the Ohio State University, Columbus, Ohio.
12. "*Notes on Wiping Contact Methods for Current and Potential Measurement*," by PROF. B. F. THOMAS, of Columbus, Ohio.
13. "*Series Electric Traction*," by MR. NELSON W PERRY, of New York City.
14. "*Oil vs. Air as Insulation*," by DR. J. B. WILLIAMS, of New York City.
15. "*On the Electrolytic Refining of Copper*," by LIEUT. F. B. BADT, of Chicago.
16. "*The Photography of Alternating-Current Curves*," by DR. EDWARD L. NICHOLS, of Cornell University, Ithaca, N. Y.
17. "*The Reversal of Polarity in Plating Dynamos*."
18. "*Dynamos for Continuous-Current Circuits*," by PROF. HARRIS J. RYAN, of Cornell University, Ithaca, N. Y.
19. "*The Technical Education of the Electrical Engineer*," by PROF. D. C. JACKSON, of the University of Wisconsin, Madison, Wis.

Papers are also expected from MR. H. WARD LEONARD, MR. NIKOLA TESLA, PROF. ELIHU THOMSON and PROF. GEO. D. SHEPARDSON, the subjects of which cannot be announced at present.

The convention rate of transportation, at one and one-third the regular fare for the round trip, can be secured in case the attendance is sufficiently large to comply with the rules of the Central Traffic Association. Members will be informed subsequently whether such arrangements can be perfected.

All sessions of the general meeting at Chicago will be open to the public and a general invitation is extended to all who are interested in electrical progress to attend this meeting, which on account of the various topics to be considered, has been extended to cover the dates of June 6, 7 and 8. Those who are not at present members of the Institute but who desire to attend are requested to send their names to R. W. Pope, secretary, 12 West 31st street, in order that they may receive copies of the official programme and secure the privilege of reduced rates of transportation in case the necessary arrangements are perfected.

BUFFALO ELECTRICAL SOCIETY.

A class-meeting of this Society was held May 2 in the lecture-room of the Library Building, and the study of physics was continued under the direction of Mr. Frank Kitton, of the Western Union Telegraph Co. On May 16 a meeting will be held at which interesting galvanometer tests of incandescent lamps will be made, and Mr. Kitton will at the same meeting lecture on the use of the voltmeter and ammeter in practical work.

EDISON TELEPHONE PATENTS ISSUED.

On May 3 the Commissioners of Patents issued to Mr. Thomas A. Edison three patents on "Speaking Telegraph." One application was filed April 27, 1877, and the other two on July 20, 1877. These patents are better known as Edison's Telephone, and were assigned to the Western Union Telegraph Company.

The granting of these patents terminates a long-standing contest. The improvements covered by them have been in use by the Bell Company for ten years. Two of them are embodied in the Blake transmitter. The other is for a microphone in which the electrodes have broad surfaces. There were applications pending from other persons for the same inventions, so that the Edison patent could not issue until the rights of the others had been determined. Foreign patents for the Edison invention have been issued, some of which have expired, and there will be a question whether an American patent issued after a foreign patent has expired is valid. As it has already passed through various Circuit Courts, it is likely that the question will be brought up before the United States Supreme Court for final disposition.

ELECTRIC TIME CALL.*

Any one who has arrived at an hotel late at night after a long journey, tired out and anxious to retire, well knows how annoying and exasperating it is to have to stand on a long line with a number of others who have arrived on the same train, before the hotel clerk waiting for his turn. Nearly every one desires to be called or have attention at some particular time, and the clerk is kept busy writing these instructions in his blotter, while those on the rear end of the line grow impatient and irritable. It was during such an experience as this that the apparatus designed and illustrated herewith had its inception, the inventor being forcibly impressed by the slowness of the old method in handling things. His impressions were still further increased by an experience of the risk a guest takes in depending upon the clerks having him called at a specified time. Wishing to catch

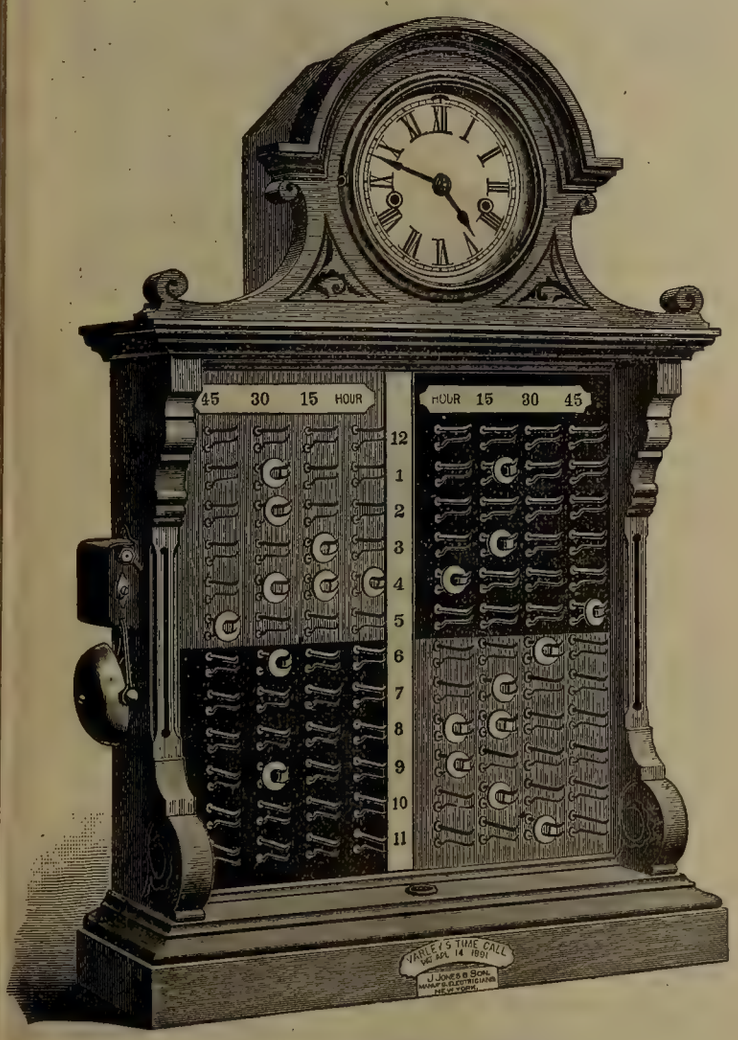


FIG. 1.—ELECTRIC TIME CALL.

a train at 9 A.M. the following morning, he instructed the clerk to have him called at 8 A.M., but was not awakened. Investigation developed the fact, that while the room had been correctly entered in the blotter, a mistake had been made in transferring to the paper handed to the bell boy. All this can be avoided by the use of the apparatus above mentioned. It is known as the Varley Electric Time Call, and has been designed as a labor-saving apparatus and to make absolute, calls and service in hotels, livery stables, and other places in which it is desired to give prompt attention and security to customers.

The Time Call is of use also in hospitals, factories, offices, sleeping-cars, steamboats, public institutions, schools, railroad stations, and in fact in any place where punctuality is necessary.

The general arrangement of the Call is shown in Fig. 1. Beneath the clock are the pins arranged in line with the hour, quarter, half and three-quarter hour lines. When a guest desires to be called at 5:45 A.M., the clerk takes the tag Fig. 2 numbered in accordance with his room from the key board, slips it over the two metal pins under the figure "45" and to the right of the figure "5," these two forming the hour for call. Nothing further is required until the clock reaches the time of 5:45, when the bell will ring, and continue to ring until the tag is removed. This tells at once the room to be called, and there is no possibility of mistake if there is any one about to hear the bell. Fig. 3 shows the diagram of connections.

When ten guests are to be called at the same time, ten little room tags are placed on pins in the same manner as one. The dark portions of board represents night and the light portions day.

The machine is within reach of all, small as well as large hotels, as it is not a large and elaborate article, and is as useful in one as in the other. In stands 28 inches high, is 18½ inches in width, and is 6 inches deep. It is complete within itself, with the single exception of

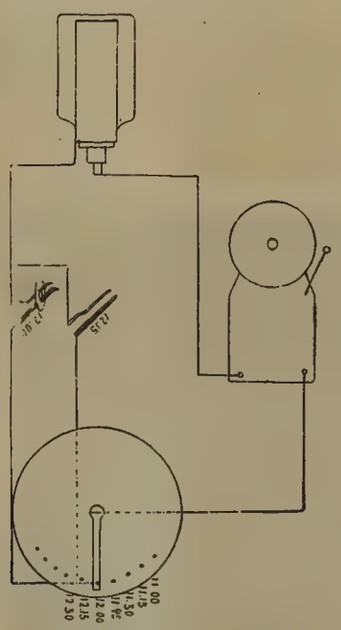


FIG. 3.—DIAGRAM OF CONNECTIONS.



FIG. 2.—TAG.

battery, which may be placed in any convenient locality near the machine, or at a distance from it.

The number on the tag as will be seen in the cut is very plain and distinct, thus overcoming the trouble of mistakes caused by the difference in handwriting.

The many different uses to which this apparatus can be applied will be readily suggested to the reader, and we have no doubt but that after it becomes generally known any hotel not using one will be looked upon as being behind the times.

*J. Jones & Son, 602-604 West 22d street, New York.

TO LOCATE THE MAGNETIC POLE.

A movement is on foot to organize an expedition to locate the north magnetic pole, and it is quite probable that the result will be successful. The American Geographical Society is taking great interest in the matter, and is putting forth every effort to ensure success. Part of the money estimated that will be necessary to carry the work to a completion has been subscribed, and owing to the general interest manifested in scientific circles the the balance, it is thought, can easily be secured.

A few words concerning the magnetic pole will be of interest. It is located about 1,200 miles south of the

geographical pole, somewhere in the neighborhood of King William Land, and it may be under water. Several years ago efforts were made to determine the true position of the magnetic pole by English and other European explorers, and it is said they got within a few miles of the spot. This fact was proved by the position of the magnetic needle, which stood at an angle of 89° 59′, or very nearly vertical. It will stand vertically directly over the magnetic pole. It is believed, however, that the pole is unstable, that is, it is not always in exactly one locality, but it is thought that the change of position occurs through regular periods which can be determined by observation.

It will be a valuable addition to our knowledge on this subject to know just what variation to allow at any time, and surveyors and mariners will appreciate its importance.

With greater experience and improved instruments there would seem to be no difficulty of great magnitude in the way of the success of such an expedition.

CROCKER-WHEELER PIVOTED FAN MOTOR.

Those who, during the past summers, have enjoyed the artificial breeze stirred up by an electric fan outfit, and the better ventilation which results therefrom, will thoroughly appreciate the merits of this recent invention of the Crocker-Wheeler Electric Company, New York. The illustration almost explains itself.



CROCKER-WHEELER PIVOTED FAN MOTOR.

The pivoted fan motor is mounted upon an ornamental base of dark red wood and swings slowly around the circle upon a pivot, throwing the breeze to every corner and part of the room. It will be readily understood that the ventilation is therefore complete, while the motion imparted to the atmosphere more closely resembles the cooling breezes of nature than the steady blast from a stationary fan. The pivoted fan motor is equipped with the Crocker-Wheeler Variable Speed Switch, thus giving either a gentle zephyr or a strong breeze, as may be desired. These outfits are furnished, 1-12 H. P., 115 volts, and 1-6 H. P., 115, 230 or 500 volts, with self-oiling bearings. The 1-6 H. P. 500 volt motor has only one speed.

Orders have already been booked for a number of these outfits, and those wishing to enjoy the luxury and comfort during the heated term which the employment of such a device insures, will find it advantageous to get into line with their orders early. For use in offices, restaurants, kitchens, sick-rooms and badly ventilated apartments, these fan outfits should prove of great value.

BIOGRAPHICAL SKETCHES.

JOHN A. SEELY.

We present to our readers herewith the features of one well known among the electrical fraternity, and who hardly needs any introduction—Mr. John A. Seely.

Mr Seely is a Virginian by birth, and is quite young, being thirty-six years of age. His first appearance in the electrical field was in 1879, when he held a position with the American Union Telegraph Company. The following year, 1880, he became connected with the City and Suburban Telegraph Company, of Cincinnati, O., as its electrician. This position he filled until 1882 with marked ability, when he resigned to accept a place with the Metropolitan Telephone and Telegraph Company of



JOHN A. SEELY.

New York. He entered the service of this company as general inspector, and filled this position from 1882 to 1883, when he was promoted to the position of electrician.

In 1889 Mr. Seely resigned from the telephone business to enter the electric-light field, in which he has already made for himself a name as an engineer of marked ability.

During his connection with the Telephone Company as electrician he wonderfully simplified the telephone service under his charge, and during the construction of the great Telephone Exchange, at 18 Cortlandt st., New York, he introduced many novel features, which will always be of great value in telephony.

Mr. Seely is a well-known and active member of the New York Electric Club, and is also identified with other institutions of like nature.

That he is a busy man may be inferred from the fact that he, at the present time, fills various positions as follows: General manager of the Complete Electric Construction Company, of New York; secretary of the Heisler Electric Light Company, Union, N. J.; secretary of the Rockaway, N. J., Electric Light Company; president of the F. M. Ricketts Cable Laying Company, of New

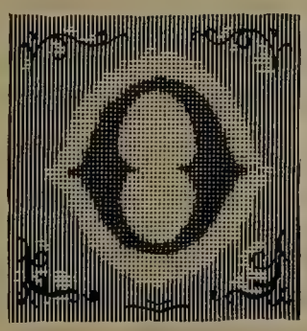
York; president of the Seely & Taylor Manufacturing Company, of New York, and president of the Newtown Electric Light Company. In all of these organizations Mr. Seely is a stockholder to a considerable extent, besides filling the position of consulting engineer for several large corporations and municipal bodies.

Mr. Seely is a prominent member of the National Electric Light Association, and is always ready to take part in its deliberations. He is a man of varied and extensive ability, and has a host of friends in the electrical fraternity.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electrolysis.



ONE of the most interesting phenomena in the science of electricity is that of electrolysis. This name was given by Faraday to the effect produced by passing an electric current through water and many other liquid chemical compounds. This effect consists of a chemical decomposition of the liquid, and such decomposition is always in proportion to the current.

The term electrolysis is derived from the Greek λνω which means to loosen or separate, combined wit ηλεκτρον, *electron*, and Faraday gave the name of *electrolyte* to substances capable of decomposition by an electric current. He also gave the name *ions* to the products of such decomposition, and those which appeared at the positive pole, or anode, of an electrolytic cell he designated as *anions*, while those appearing at the negative pole, or cathode, he called *cations*.

The transfer of the atoms of an electrolyte in opposite directions is supposed to occur in accordance with a theory proposed by Grotthuss in 1805, and afterwards modified by Clausius. In every electrolyte the molecules and atoms of which they are composed are supposed to mutually interchange relationship constantly, producing motion in every possible direction, old groups being continually dissolved and new ones formed.

In the accompanying illustration a graphical idea of this action is given. On line 1 each oval represents a molecule of water, the two hydrogen atoms which compose the hydrogen molecule being shown by the shaded part and the oxygen atom by the unshaded part; infinite number of such chains making up the mass of the liquid.

In line 2 these molecules, under the influence of an electric current from A to B, are supposed to be reduced to a symmetrical phase, in which the oxygen part of each is turned towards the anode and the hydrogen part towards the cathode. Now a new grouping is supposed to take place, the oxygen of each molecule moving to the left to recombine with the hydrogen of the adjoining left-hand molecule, and the hydrogen moving to the right to recombine with the oxygen of the adjoining right-hand molecule; the new formation being represented by line 3, in which the oxygen part of the molecule at the left end of the chain and the hydrogen part of the molecule at the right end are each left without a mate, and being prevented by the electric action from combining with each other, each is given off as a gas. Thus, while an interchange of atoms and molecules is taking place all along the infinite number of lines of electric action throughout the entire mass, the opposite ions make their appearance only at the electrodes.

The decomposition of every other electrolyte is supposed to take place in a similar manner.

Different compounds vary greatly in their relations to electrolysis. Thus, in some cases the feeblest current will produce electrolysis, while in others the most powerful current fails to effect decomposition; pure water, for instance, possesses the power of resistance to electrolytic action to the greatest degree, while water slightly acidulated with sulphuric acid becomes one of the easiest combinations to decompose. The acid itself seems to remain unchanged, but its presence reduces the electrolytic resistance of the water.

It has been maintained that the electrolysis of water is influenced by pressure, and that under a pressure of 300 atmospheres, equal to about 4,500 pounds to the square inch, even acidulated water cannot be decomposed, while in vacuo its decomposition may be effected by comparatively weak currents. On this point, however, authorities do not agree.

Electrolysis depends upon the existence of certain conditions. The electrolyte must be liquid, a conductor of electricity, and a compound. Ice, though of the same chemical constitution as water, cannot be decomposed by the current because it is solid

The temperature has a very important influence on electrolysis, and both the electrolytic action and the



Fig. 158.

THEORY OF TRANSFER OF ATOMS IN ELECTROLYTE.

electric conductivity of the liquid are increased by an increase of temperature and conversely decreased by a decrease of temperature.

Referring to the hypothesis of Grotthuss, Clausius sought to bring the ideas of the former into conformity with the modern kinetic hypothesis of the constitution of liquids. This is, essentially, that in the usual state of liquid the molecules are always in motion, and their constituent atoms, also in motion, are continually separating and recombining into similar groups, their movements taking place in every possible direction throughout the liquid. Under the influence of an electromotive force, however, these actions are controlled in *direction*, so that when, in the course of the usual movements, an atom separates from a group it tends to move either toward the anode or cathode, and if the electromotive force be powerful enough to prevent recombination, these atoms will be permanently separated and will accumulate around the electrodes.

AN EVERY DAY MEMORANDA.

The American Telephone and Telegraph Company (the Long Distance Telephone Co.), 18 Cortlandt street, New York City, is distributing a very original and useful every day memoranda from May '92 to May '93, gotten up in book form, which is sure to be appreciated by all who are fortunate enough to secure a copy. There is a page for each day, and the book is very beautifully and substantially bound.

COMBINATION OF INTERESTS.

A dispatch from Chicago states that a combination of interests has been effected between the Westinghouse Electric Manufacturing Company, of Pittsburg, Pa., and Siemens & Halske, the great German electrical manufacturers, who recently opened offices in Chicago, for the purpose of opposing the Edison-Thomson-Houston combination. It is expected, the dispatch says, that a war of prices, especially in street-railroad devices and decorative illumination appliances, will be the result of this move. It is also said that President Harrison and Secretary of War Elkins are stockholders in the new concern.

This announcement was followed on May 2 by a dispatch from Chicago which states that George Westinghouse, Jr., and the Westinghouse Electric Company have $550,000 at stake with the directors of the World's Fair. Mr. Westinghouse, the dispatch states, was not satisfied with the award of contracts for incandescent electric lamps at the Fair. The Edison Company, a branch of the Thomson-Houston combine, got the work at $5.95 per lamp Mr. Westinghouse has offered to put up a personal bond of $50,000 that he will furnish a lower bid than that of the electric combine, and he agrees to deposit an additional bond of $500,000 to insure against any raise of the bid of the Trust. The propositions were accepted.

EQUIPMENT CONTRACT AWARDED.

The Short Electric Railway Company, of Cleveland, O., has closed a contract for the construction and equipment of an electric road in Fort Wayne, Ind., for the Fort Wayne Electric Railroad Co., which is composed principally of a number of gentlemen interested in the Cleveland Cable Company, of Cleveland, O., who secured a franchise for that purpose. The Short Company feels quite elated over having secured this contract, in view of the fact that strong efforts had been made by all the electric railway companies in the country to induce the Cable Company before it installed its plant in Cleveland, to adopt electricity as a motive-power without avail. Having succeeded in inducing them to adopt electrical propulsion on the Fort Wayne system is quite a feather in the cap of the Short Company. The installation will consist of 32 car equipments complete, comprising 64 20 H. P. single-reduction motors and ten miles of overhead construction. Shipment of the apparatus has already begun, and the work will be vigorously pushed, every effort being made to have the road completed and ready for operation by June 1.

EXHIBITION OF PATENT MODELS AT THE WORLD'S FAIR.

A circular, of which the following is a copy, has been issued by the Commissioner of Patents, inviting patentees to contribute toward an exhibition of models of patents at the World's Fair:

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., March 8, 1892.

To the inventors and manufacturers of the United States:

It is the intention of the Patent Office to make at the World's Columbian Exposition at Chicago in 1893 an exhibit which will show that great advance in the several arts, which is due, in large measure, to the encouragement and support afforded by our patent system. This exhibit is to consist of models of patented inventions, which will be carefully selected, to show as far as is possible the inception of each art, the stages through which the art has advanced, and the final development reached at the present time. This display of typical inventions, embodied in concrete form and properly arranged, will, it is believed, constitute a grand historical exhibit of the progress of the useful arts, and one which will be of great interest not only to inventors and manufacturers, but to the public generally.

The office collection of models has been seriously impaired by fire, and is further incomplete by reason of the fact that models have not generally been required or received during the last ten years. The office is not, therefore, in possession of the models of many valuable inventions which might properly be included in such an exhibit, and without which, indeed, the exhibit would be incomplete. The limited appropriation for this exhibit will not permit the office to make such models. An urgent appeal is therefore made to all inventors and manufacturers to come to the assistance of the office in this matter, either by loans of models already built or by the construction of such models not in the possession of the office as should properly be placed in such a collection. Of course, where models are loaned to the office all proper credit will be given both in labels and catalogues to the parties by whom the loans are made, and such disposition will be made of the models after the close of the exhibit as the owners shall direct. Many inventors and manufacturers have already indicated a williness to co-operate with the office in this matter, and it is confidently expected that such a response will be made to the general appeal as will assure the unparalleled success of this attempt to graphically and concretely show the development of American invention.

W. E. SIMONDS, *Commissioner.*

"An outline history of invention in model form" is what, according to Mr. James Q. Rice, the special agent of the Patent Office, will be attempted, and it must be accomplished within the next six or eight months. It will be a painstaking classification such as has never been attempted with the models in the halls of the Patent Office, and it will be immeasurably easier to look over it and apprehend its significance as a page of history. The task of doing this work would be comparatively easy if the Patent Office possessed a complete set of models of the inventions patented in the last hundred years. But besides that few models have been required or filed since 1880, the fire of 1877 destroyed many of the older models, and made great breaches in some of the most important parts of the collection. To fill the gaps for the purposes of the projected exhibit a Patent Office Committee, working under an appropriation of $7,500 from the Exposition, has a force of fifteen men at work cleaning and burnishing old models, and making new ones when that can be done with little expense.

They are also appealing to inventors and manufacturers all over the country for assistance in their work. They have already received promises from some of the large manufacturing companies of models of great value that have been carefully preserved for many years, and others have expressed a willingness to make, at whatever cost, such models as the committee may desire. We are authorized to say that the committee will be glad to receive suggestions from any one who may wish to communicate with them without a direct application on their part. The object is to make the exhibit fulfil its purpose, and the committee will welcome assistance from every source.

There will be from 3,000 to 4,000 models exhibited in the space (6,000 feet floor) assigned for the display. It promises well for the high educational value of the collection that the examiner in charge of each class is called upon to select the inventions which mark the successive stages of growth. In the class of sewing-machines the principal models are already arranged, beginning with the Greenough model of 1842 and running down to date. We urge all our readers who can to co-operate with the committee in securing the best exhibit

possible. The representative of the department is Mr. H. A. Taylor; John M. Ewing is chief special agent, and the Patent Office Committee consists of James Q. Rice, special agent; J. B. Marvin, R. C. Gill, Malcolm Seaton and A. P. Greely. Correspondence should be addressed to Mr. James Q. Rice, United States Patent Office, Washington, D. C.

SPECIFICATIONS FOR WIRING.

The following specifications for wiring for electric light employing the conduit system of the Interior Conduit and Insulation Company, of New York City, will be of general interest.

SYSTEM.

The building to be thoroughly equipped from the source of supply to each outlet with the metal-sheathed insulating conduits of the Interior Conduit and Insulation Co., in such manner as to provide continuous insulating channels or race-ways for the wires. The continuity of each tube employed for this purpose shall be such as would be required if it were to be used for conveying water or gas.

Strict compliance with this requirement will be demanded, since one of the chief advantages of the system herein specified is to exclude water and gas from the wires, and therefore to afford adequate protection against their injurious effects.

ACCESSIBILITY.

To the end that each and every wire may be at all times accessible for inspection, repairs or renewal, the location, sectional division, joining, intermediate and terminal elbowing, the placing of switches, cut-outs and junction-boxes, and the final emergence of the tube beyond the finished surface at the fixture outlet must be done in strict compliance with the rules and regulations herein contained.

APPLIANCES.

In order to secure safety, durability and convenience, and to give a finished character to the work, all appliances employed shall be such as are designed especially for use in conjunction with this system.

SUBDIVISION OF RISERS.

The building must be divided into a number of sections, and each section provided with an independent group of risers, thus avoiding the multiplication of elbows, intersection boxes and long runs of the taps or branches.

Every conductor in each group of risers must be provided with an independent tube.

BRANCHES.

For all branches, the standard twin or the standard triple conductor (according to the system of distribution employed) of the Interior Conduit and Insulation Co., requiring but one tube, must be employed. The current limit of the branches must be that fixed by the Fire Underwriters' rules.

SIZE OF TUBES.

All tubes must be of sufficient size to allow the wires to be readily drawn in, withdrawn and reinserted at will.

A quarter ($\frac{1}{4}$) inch tube will be permitted only where space is extremely limited, as under a thin plaster finish, and even in such cases the $\frac{5}{16}$ tube should be used when possible.

CLIPS.

Tubes, whether concealed or on the surface, must be held in place by metal "clips;" the use of staples for such purpose will not be allowed where it can be avoided.

JOINTS.

The tubes must be cut squarely and then reamed out smoothly and the ends joined in the manner and by the use of the special tools and couplings designed for that purpose.

ELBOW LIMITATIONS.

Where more than four elbows are unavoidable an intersection box must be inserted to relieve both the wires and the tubes of strain when the wires are being drawn in.

OUTLETS.

All tubes must emerge at outlets in terminal boxes, thus leaving the outlets so protected as not to be injured by the plasterers.

FIXTURE SUPPORTS.

Where no gas-pipe or other support for the fixtures exists, the special form of terminal box designed to furnish such support must be employed, and must be substantially fixed to a suitable foundation in the ceiling or walls.

JUNCTION BOXES.

Main circuit junction boxes must be placed on each floor in each section; from these junction boxes all branches in that section must ramify.

CUT-OUTS.

Standard non-combustible cut-outs must be used within the junction boxes, and each branch wire leading from the same must be protected by a safety fuse.

FLOOR WORK.

To guard against mechanical injury and the destructive action of cement, all tubes used under floors must be our metal-covered conduit tube. In case of contact with cement under tile floors and in like places, brass-covered conduit tube must be used and must be further protected by being laid in a bed of plaster of Paris.

As a further protection against mechanical injury, all floor tubes must be covered during construction with a light board.

WIRES.

For mains, a conductor having a standard insulation, and for branches, the standard twin or triple conductor of the Interior Conduit and Insulation Co. must be used.

ANNUNCIATOR WIRING.

All annunciator or bell wires must be placed within conduits, and such of the foregoing rules and regulations as are applicable to rendering them accessible and affording suitable protection shall be followed.

INSERTING WIRES.

After the conduiting is completed, powdered soapstone must be blown into the tubes in order to facilitate the drawing in of the wires.

INSPECTION AND ACCEPTANCE.

As a guarantee that the wiring will be properly done, it is required that the contractors, in event of their being unfamiliar with the system, communicate with the Interior Conduit and Insulation Co., of New York, or their authorized representatives, and obtain the requisite instruction. The right is reserved to subject the work of the contractor to the inspection and approval of the Interior Conduit and Insulation Co. as a condition of acceptance and final payment.

HOW OUR NEW FORM IS APPRECIATED.

The following letter from Mr. J. Stanford Brown, the well-known electrical engineer of this city, represents the sentiments expressed in the trade generally on the new form of the ELECTRICAL AGE:

May 6, 1892.

The ELECTRICAL AGE, New York:

GENTLEMEN: Permit me to congratulate you on the present *convenient* form of your paper.

I hope it may result in a large increase in your already well-established circulation.

Very truly yours,

J. STANFORD BROWN.

HAULING TRAINS WITH ELECTRIC LOCOMOTIVES.

The Baltimore Belt Railroad has accepted a proposition presented by the Thomson-Houston Electric Co. to install electric locomotives and the necessary plant for the purpose of operating freight and passenger trains on a portion of that road.

The following details of the plans will be of great interest, since this project may be regarded as the first instance where electricity will be applied to heavy traction work.

That part of the road upon which it is proposed to employ electricity as a motive-power begins at Henrietta street, its southern junction with the Baltimore and Ohio Railroad, and extends to Huntingdon avenue, a distance of 14,700 feet. From this beginning it descends from the surface with a grade of 7 per 1,000 in an open-walled excavation for 2,000 feet with four tracks. Here the two western tracks, devoted to freight, enter one portal, and the two eastern ones, devoted to passengers, enter another adjoining. The first continue on a straight line and a uniform grade of 8 per 1,000 under the centre of Howard street to the northern portal at Brevard street, a distance of 7,070 feet. The second diverge toward the east and become parallel with the first after passing for 450 feet in tunnel. From this point they remain parallel with the first for 800 feet under the roof of a passenger station 200 feet wide, after which they enter the bell-mouth at Lombard street, the front of this passenger station, and become common with the two freight tracks in the tunnel under Howard street. Calling this entrance a portal, the length of the tunnel between it and the northern portal will be 6,250 feet.

After passing the Brevard street portal, the two passenger tracks branch out and deviate again to the east far enough to allow a fifth track to be laid between the two pairs, all being parallel through the north passenger station, which will extend between Brevard street and Mt. Royal avenue, a distance of 650 feet. After passing under Mt. Royal avenue through two adjoining arches, the four tracks continue to Huntingdon avenue, the two pairs remaining separated by the same distance as that required at the two arches. The distance from the north end of the station to Huntingdon avenue is 4,980 feet, 480 feet of which is on the same grade as that of the tunnel, 8 per 1,000; the remainder 4,500 feet is ruled by a grade of 15 per 1,000, terminating at Huntingdon avenue, from which point to the northern junction with the Baltimore and Ohio, and thence to Philadelphia, the ruling grade is 8 per 1,000.

The arrangement for operating the motors is, in the case of freight trains whose maximum weight is specified at 1,200 tons, to get connected at the rear of the train at Henrietta street and to descend the grade with the steam locomotive connected in front with a full head in the boiler, but with the furnace door open and no steam used. The motor will then do all the work through the tunnel, pushing up the grade at the rate of 15 miles per hour, a pressure or draw-bar pull of 32 thousand pounds being specified. This train will pass without stop and without steam through the northern passenger station shed on the west side, but after passing this the steam locomotive will get into operation 480 feet in advance of the 15 per 1,000 grade so, that upon reaching this grade both steam and electricity will be at work, the motor taking the place of a steam helper, which would otherwise be required. Upon reaching the 8 per 1,000 grade at Huntingdon avenue the motor will fall back on the south-bound passenger track immediately before or behind a passenger train, and after passing Mount Royal avenue will pass on the fifth track around any south-bound passenger train waiting in the station, thence on the south-bound tunnel track alone, unless there is a freight train going in that direction, in which event the motor will be coupled to the rear and act as brake down the grade.

If the motor is going for another freight train it will proceed to Henrietta street; if for a passenger train it will enter the south-bound passenger station from the bell-mouth at Lombard street and couple to the steam locomotive at the head of the train, pulling both to the north end of the north station, when the motor will fall back to the fifth track in that station. For passenger trains the steam locomotive is sufficient for the 15 per 1,000 grade.

The descending grade from Henrietta street to the southern end of the south passenger station will enable the trains to enter it with steam cut off and the furnace door open. All through trains will stop at this station for passengers bound north, who have arrived by local trains south and west, and local trains south and west will start from it, while local trains north and east will start from the north station, so that the tunnel will be used only by through trains. If a through passenger train stops only at the south station the motor will act in the rear, as in the case of freight trains, but go no further than the north station. The motors will be used promiscuously with either passenger or freight, as the greater speed specified for the passenger trains, 30 miles per hour, will require much of the power required for the greater weight at 15 miles per hour.

The motors are to be constructed in simplest manner; the armatures to be fastened directly to the axles of the driving-wheels, so that all gearing is dispensed with and each driver can act independently of the other, and can be multiplied indefinitely and carry all the weight. The power-house will be located at a point about 6,000 feet from each limit of the expenditure of the power, and the engines will indicate 2,400 horses, supplying more power than will be required for propelling two maximum freight trains up the grade at the rate of 15 miles per hour, and a greater number of lighter trains. This section of the road will be operated on the most perfect block system, so that the available electric power will be more than sufficient to propel the trains determined by the block system. It is estimated that three motors, each capable of a draw-pull of 32,000 pounds, will be more than ample for every requirement of the passage of 200 trains a day, one of them being provided as a reserve.

The tunnel is to be thoroughly lighted with incandescent lamps at short distances on each side, so as to illuminate not only the tracks but the interior of the passenger cars.

The Thomson-Houston Company will erect and equip the power-house with steam engines and boilers of the most approved character, and furnish motors and all the electrical appliances for their most perfect operation, and guarantee a thoroughly practical and successful operation of the entire plant after a successful trial period. Mr. Richard Randolph is the chief engineer of the Maryland Construction Company, which is building the Belt Railroad. As far as we can learn the belief seems to be general that the electrical enterprise will result successfully.

OPENED FOR TRAFFIC.

The Yonkers Electric Railroad was opened for traffic on May 2, and has been running continuously since then, without a hitch or break, and is pronounced a complete success, much satisfaction having been expressed as to the smooth and noiseless working of the cars.

The station is fitted with two Edison 100 K. W. generators, belted directly to Ball high-speed engines. Eickemeyer-Field 20 H. P. gearless motors are used, and by directly driving from the slow-speed motor to both car-wheels through means of parallel rods, the wear and

tear and all other disadvantages incidental to high-speed machinery are thus avoided.

The old horse-car rails which have been in use for many years are still employed after being bonded, it not having been deemed necessary to substitute heavier ones, as with the gearless motor of the Eickemeyer-Field pattern the whole weight rests upon the car-springs, and in this manner avoiding the destructive blow which otherwise would be given to the rails by the momentum of the motor.

NEW INCORPORATIONS.

The Kankakee Electric Light Co. (incorporated in W. Va.), New York, N. Y., was incorporated April 23, with a capital stock of $10,000. Incorporators: J. F. Moffett, Watertown, N. Y.; J. V. Clarke, New York, N. Y.; H. C. Hodgekins, Syracuse, N. Y.

Waldon Electric Light and Power Co., Montgomery, N. Y., incorporated April 13, with a capital stock of $10,000. Incorporators: Joseph Broadhead, West Cornwall, N. Y.; Nicholas J. Fowler, Irving H. Longhran, Walden, N. Y.

The Oxford Electric Light Co., Oxford, N. Y., incorporated April 14, with a capital stock of $10,000. Incorporators: Frederick L. Gamage, Charles A. Gilman, James G. Van Wagenen, all of Oxford, N. Y.

Van Choate Electric Car and Light Co., Portland, Me., incorporated April 23, with a capital stock of $6,000,000, to manufacture and deal in electrical appliances and machinery of all kinds. Incorporators: C. Henry Kimball, Chelsea, Mass.; Oscar Lowe, Boston, Mass.; Edward H. Hill, Brookline, Mass.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, May 7, 1892.

BARONESS BLANC obtained an execution in the Supreme Court to satisfy a judgment held by her against Baron Frederic N. Blanc's Litofuge Mfg. Co., 62 John street, the property of which has been levied upon by the sheriff.

MR. J. W. MCLAREN, the well-known electrician and general construction man, called to see us the other day. Mr. McLaren is at present unemployed, having recently completed his last contract. Here is an opportunity for some concern to pick up a live man.

MESSRS. A. and F. BROWN, who lately moved from Park place to 17 Dey street, have much larger space in their new quarters for the display of the shafting, pulleys and friction-clutches manufactured by them. Purchasers will do well to give them a call.

THE MANHATTAN ELECTRICAL SUPPLY CO., 38 Cortlandt street, city, has its new factory in operation. The factory is situated at 14 and 16 Morris street, Jersey City. Last week the company was moving its machinery and manufacturing supplies, and the sales-rooms were somewhat in a disordered state in the process of enlarging and fitting out with a new line of supplies.

PAUL HOENACK, of 191 and 193 Worth street, this city, is a very busy man at the present time. He is about finishing a set of 4 double-plug high-tension Italian marble switchboards for the Mount Morris Elec. Lt. Co. There are, all told, 288 plugs in the 4 boards. Mr. Young, the superintendent of the Mt. Morris Elec. Lt. Co., is very proud of these switchboards, and we are inclined to believe that he has every cause for feeling good. Mr. Hoenack has lately done some fine model-work, for which he deserves great credit. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Engineering Co., N.Y.	1,000,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	85 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	108 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	154 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	79 75
Edison General	15,000,000	100 00	103 00
Edison General Receipts		100 00	106 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 50
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 25
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	53 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*05
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s, Ark.	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	63 00
Thomson-Houston pref.	4,000,000	25 00	29 25
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Universal Arc Lamp Co	100,000	100 00	
Western Union	86,188,852	100 00	93 00
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	29 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	46 00
Westinghouse Ass. Rects.		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

DAMAGE BY LIGHTNING.

During a heavy electrical storm which occurred at Pittsburg, Pa., on the morning of May 3, the works of the Allegheny County Electric Light Company were struck by lightning, burning out seven dynamos, and injuring the plant to the extent of $7,000. Five hundred telephones were also burned out and numerous buildings struck, but so far as known no lives were lost.

FINANCIAL.

The dividends paid to bond and shareholders in New York for the current month are quite satisfactory to those receiving them, and are estimated to reach the fair sum of $27,640,980, as against $22,817,500 for May, 1890, and $24,625,665 for the month of May, 1891. The earning qualities of the many industrial corporations are accountable for the increase, and stands as a lesson to investors. We are at the beginning of the flood-tide, which will bring up a great and prosperous floating of this class of securities. They will include all which will profitably employ combined or amalgamated capital over personal credit and energy. As in nearly all other matters, we are following in the footsteps of Europe, where a company is formed on the shadow of an opportunity, and the general management being educated, it is simply a question of the first capital being obtained. That being subscribed and in sufficient quantity for the business in view, the rest is plain sailing. There are, and no doubt always will be, a few who will wait, tempting the Canadian tourist until his moral nature gives way; but the foregoing figures speak in thunder tones in favor of our advice, to invest in these securities while young and reap the whole benefit. The interest and dividends paid this month by the state and municipal organizations will swell the total for the month in this city to quite $35,000,000. Boston will disburse about $3,600,000, which is a fair improvement on 1891. If the legislature of this State would pass an equitable statute governing the tax on corporations as corporations, the headquarters of a great many more companies would be in this city. Governor Flower has got the wedge entered in the exception of the electric corporation just at the close of the session, but I contend there should be only a general law under which all should be permitted to incorporate at a minimum charge, then collect the regular tax on all real and personal assets. To the State the result will be at least as large an income, and the right of the citizen to exercise his judgment will be enhanced.

About a year ago it was suggested in this column that the quickest way to make money in heavy electric traction was for one of the wealthy corporations to manufacture a generator and motor of sufficient size, take it out on the plains where long distances were available, and practice a season with the heavy freight trains. For some unknown reason this was never acted on. Now I am happy to state that the proposition of the T.-H. Co. to run trains through the Baltimore Belt Railroad Co.'s tunnel has been accepted and is expected to be carried out about the end of the year. Eighty-ton electric motors will be used, and if successful it will be the death-knell of the steam locomotives. There is a vast sum of money in locomotives, and they will disappear as quietly as the horses on the street lines. I don't believe any money will be lost in either case. A new industry will be created, also new or enlarged securities for investors. The life of the electric will be greater than the departed steam-motor, and being in every way more economical will produce larger dividends, besides giving increased speed and luxury to a cinder, smoked and oil-scented public.

The following, condensed from the *Investor's Guardian*, the leading public company authority published in London, carries with it a lesson worthy the study of all who are interested in Stock Exchange business wherever located: "Whatever may have been the profits (or losses) made by the individual members of the Stock Exchange during the past year, those made by the managers of the Exchange on behalf of the proprietors show no signs of falling off. The total available balance this year is £129,648, out of which dividends amounting to 50 per cent. have been declared on the paid up capital of £240,000. The rent paid by the company is £11,575 per annum. No diminution has taken place in the membership of the Exchange during the year. On the contrary, there has been an increase of twenty-nine in the number of members, and of thirteen in the number of clerks, so the totals are now, members, 3,332; clerks, 1,923. Only 966 of the members are shareholders or proprietors of the building." It will be seen from this that the corporation is in a happy financial condition.

AN INTERESTING EXHIBIT AT THE WORLD'S FAIR.

One of the most notable features of the World's Fair at Chicago next year will be a complete model of the entire plant of the H. C. Frick Coke Company, of Scottdale, Pa. This company employs about forty million dollars capital in its business, and is the largest of the kind in the world. The contract has been let to the Jones Bros. Company, of 30 Court street, Cincinnati, Ohio, who is expert in the making of models. The estimated cost of this model is between three and four thousand dollars. The plant will occupy a space about 20 x 50 feet, made on a scale of one-twentieth of an inch to the foot, and will be an exact fac-simile of the original, including boilers, engines, piping, elevated tracks, cupolas, cars and all other machinery, and will be in operation; the motive-power, however, will be electricity.

SOUVENIRS.

We have to acknowledge the receipt of a copy of the beautiful souvenir pamphlet just issued by the Brush Electric Company, of Cleveland, O. As a specimen of the lithographer's and engraver's art, it is without doubt one of the finest we have ever seen. It is profusely illustrated and descriptive of six complete incandescent electric light plants in six of the largest office buildings in the country installed with the company's system. The souvenir may be well considered as an exemplification of the remarkable development of electric industries and the growth of electric lighting, and also as a demonstration of the success of the Brush system.

We have received a handsome celluloid envelope opener and paper cutter from the Perkins Electric Lamp Co., Boston, Mass., manufacturer of incandescent lamps for all purposes and systems.

CATALOGUES.

The Electric Engineering and Supply Co., Syracuse, N. Y., is out with a handsome illustrated catalogue and price-list of its specialties, prominent among which are a variety of sockets for incandescent lamps, cut-outs, switches of all descriptions, hoods for incandescent and arc street lamps, line equipments, testing apparatus, motors, etc.

The New York Insulated Wire Co., 13–17 Cortlandt street, New York, is out with a new illustrated and descriptive price-list of the Vulca wire ducts, of which it is the sole manufacturer, porcelain cut-outs, couplings, elbows, junction angle and distributing-boxes, Vulca insulating coupling compound, etc. The last three pages are devoted to a short résumé of the value of its system for electric-light wiring installations.

In the new illustrated catalogue and price-list of the H. W. Johns Mfg. Co., 87 Maiden Lane, New York, N. Y., will be found full details of the large range of insulators sufficient to meet every requirement, manufactured from its celebrated vulcabeston and moulded mica preparations.

TRADE NOTES.

The Railway Equipment Company, 617–619 Pullman Building, Chicago, Ill., has, through its general manager, Mr. W. R. Mason, purchased the capital stock, merchandise and, in fact, the entire business of the Electric Merchandise Company, the affairs of which will hereafter be conducted under the name of the Railway Equipment Company.

The following letter explains itself :

HOTEL MARLBOROUGH, NEW YORK, October 21, 1891.
Messrs. W. R. FLEMING & Co.
New York office Hbg. Foundry and Machine Works,
174 Fulton street, N. Y. City.

GENTLEMEN: About one year ago we placed two of your 70 H. P. Ideal Self Oiling Engines in this hotel for driving two No. 16 Edison Dynamos, on your guarantee that they should run perfectly smooth and entirely free from noise or vibrations to the hotel building anywhere outside of engine-room. After running these continually since installing same, we can assure you of our entire satisfaction with them.

We have never shut these engines down from any cause whatever due to the engines, nor have they cost us one cent for repairs. So pleased are we with their perfect regulation and efficiency that we have decided without hesitation to place with you a second order for another 100 H. P. Ideal Engine, which we desire to have delivered as speedily as possible.

We do not think there is a plant to equal ours in New York City. Hotel service is, as you are aware, extremely exacting. Yours truly,

C. A. BLANCHARD & Co.

The Electrical Age's Illustrated Patent Record.

Issued May 3, 1892.

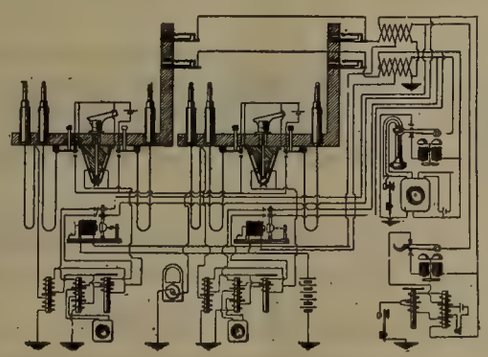
473,911. Telephone-Exchange Apparatus. John J. Carty, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 25, 1889.

473,929. Solenoid and its Electrical Connections. Henry H. Hosford, Cleveland, Ohio. Filed June 3, 1891.

473,932. System of Electrical Conductors. Charles J. Kintner, New York, N. Y. Filed April 18, 1890. Renewed Sept. 30, 1891.

473,955. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor, by direct and mesne assignments, to the Standard Electric Company, of Illinois. Filed July 16, 1890.

473,956. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor, by direct and mesne assignments, to the Standard Electric Company, of Illinois. Filed Nov. 13, 1890.



473,911. TELEPHONE-EXCHANGE APPARATUS.

473,960. Electric Clock-Motor. Anthony Reckenzaun, Stockwell, England, assignor of one-half to James A. Pentz, Philadelphia, Pa. Filed Dec. 16, 1889.

473,966. Telephone-Switch. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Aug. 19, 1884. Renewed Oct. 16, 1891.

473,975. Electrical Annunciator. Frederick W. Steeg, St. Paul, Minn. Filed Oct. 24, 1890.

474,003. Electric-Lamp Hanger. Elbert Dills, Sprague, Wash. Filed Sept. 8, 1891.

474,037. Trolley-Wire-Circuit Breaker. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Andersen, same place. Filed Nov. 11, 1891.

474,049. Insulating-Support for Electric-Railway Wires Abraham A. Shobe and William Embley, Jerseyville' Ill. Filed Oct. 29, 1891.

474,050, Electric Switch. James J. Wood, Fort Wayne, Ind. Filed Nov. 3, 1891.

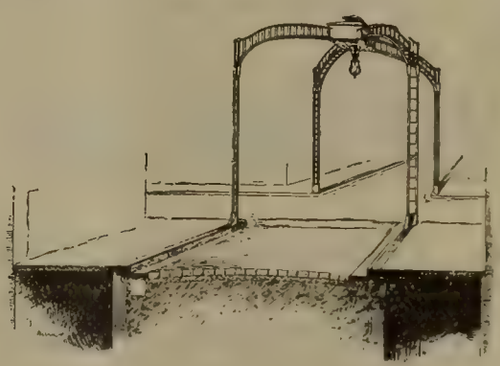
474,067. House-Telephone System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 22, 1889.

474,073. Electric Resistance-Box. Aloys Wirsching, New York, N. Y. Filed March 18, 1891.

474,091. Electric-Arc Lamp. William B. Luce, Brookline, Mass. Filed Aug. 8, 1891.

474,165. Regulator for Dynamos and Motors. William H. Elkins, Boston, Mass., assignor to Henry E. Irvine, New York, N. Y. Filed Feb. 6, 1890.

474,166. System of Electrical Distribution. William H. Elkins, Cambridge, Mass. Filed July 11, 1891.



473,932. SYSTEM OF ELECTRICAL CONDUCTORS.

474,214. Telephone-Receiver. Arthur T. Collier, Caterham Valley, England. Filed June 30, 1891.

474,218. Conduit-Trolley. James J. Cosgrove, Jr., Philadelphia, Pa. Filed June 3, 1891.

474,230. Speaking-Telegraph. Thomas A. Edison, Menlo Park, N. J., assignor to The Western Union Telegraph Company, New York, N. Y. Filed April 27, 1877. Patented in England, in Canada, in France, in Belgium, in Austria-Hungary, in Italy, in Germany, in Spain and in Russia.

474,231. Speaking-Telegraph. Thomas A. Edison, Menlo Park, N. J., assignor to The Western Union Telegraph Company, New York, N. Y. Filed July 20, 1877. Patented in England, in Canada, in France, in Belgium, in Austria-Hungary, in Italy, in Germany, in Spain and in Russia.

474,232. Speaking-Telegraph. Thomas A. Edison, Llewellyn Park, N. J., assignor to The Western Union Telegraph Company, New York, N. Y. Original application filed July 20, 1877. Divided and this application filed Feb. 18, 1886. Patented in England, in Canada, in France, in Belgium, in Austria-Hungary, in Italy, in Germany, in Spain and in Russia.

474,266. Electrical-Arc Lamp. Alfred L. Shepard, London, England. Filed Aug. 6, 1891.

474,319. Insulator. Charles F. Goodrich, Chicago, Ill., assignor of one-half to John G. Thompson, Milwaukee, Wis. Filed Dec. 29, 1891.

474,323. Telephone-Circuit. Hammond V. Hayes, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Jan. 13, 1892.

474,328. Electric-Motor Mechanism. Samuel E. Mower, New Haven, Conn., assignor to Henry G. Thompson & Sons, same place. Filed May 21, 1891.

474,331. Bicycle Electric Car. Eben M. Boynton, West Newbury, Mass. Filed April 20, 1891.

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ELECTRICAL ENGINEERS' MEETING AT CHICAGO.

The preliminary programme of papers to be read at the general meeting of the American Institute of Electrical Engineers, which is to be held this year in Chicago on June 6, 7 and 8, indicates that the meeting will be of unusual interest. The subjects of the papers, so far announced, are most practical and instructive ones, and as many members as possible should attend. If a sufficient number of members from the Eastern cities attend the meeting, reduced rates will be given in accordance with the rules of the Central Traffic Association.

The members will have an excellent opportunity to witness the progress on the World's Fair buildings at Jackson Park; and the Electricity Building, particularly, will have an attraction for them.

Members should make a special effort to be present in person, and thus guarantee a successful meeting.

THE GREAT TOKIO FIRE.

Japan is a country of earthquakes and fires, and between the two the inhabitants are kept pretty busy repairing damage. It is but a few months ago that our Japanese correspondent gave some details and illustrations of the damage done at Nagoya, Japan, by the great earthquake during the latter part of last year, and in this issue we give from the same source some details of the great fire in Tokio on April 10 of this year, which destroyed over 4,000 buildings. A station of the Tokio Electric Light Company was burned with the other buildings, and it is natural to presume that the Japs who depended upon that station for their light never before saw such darkness as they did at this time, in the absence of the electric light.

Other electrical interests as well suffered more or less by the fire. Telephone poles were burned down and the musical "Hello" (or its equivalent in Japanese) of the Central girls was not heard by many of the subscribers for several days.

THE GENERAL ELECTRIC COMPANY.

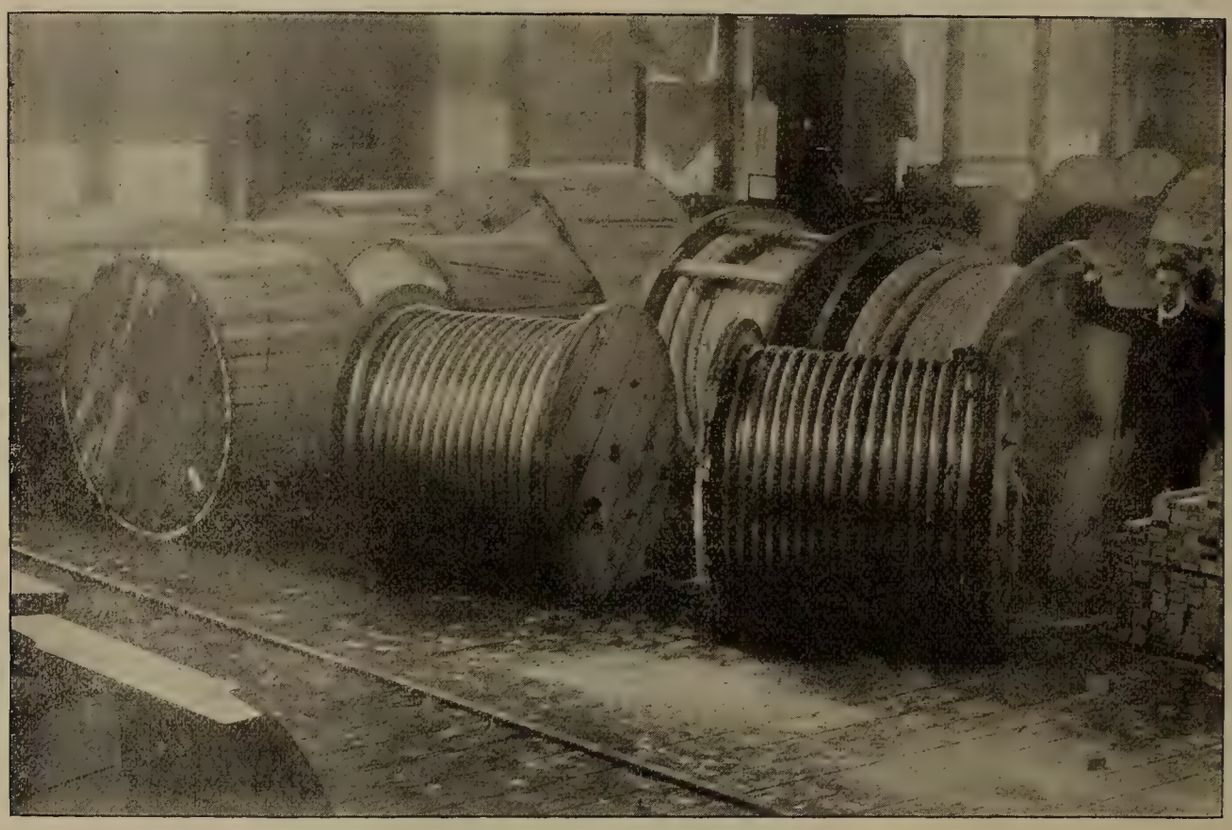
Probably very few can realize the vastness of such an undertaking as the consolidation of two very great interests. In the combination of the Edison General Electric Company and the Thomson-Houston Company a task of stupendous proportions has been accomplished with a skill that is rarely equalled in these days of large enterprises. To adjust all the parts and departments of two great concerns like these, so that they will work together in harmony and without friction, requires the direction of a master mind, and very few, indeed, are equal to such a task. Gradually the identity of the two great partners in this combination has been disappearing, and now we hear the use of the new name, "General Electric Company," very frequently. On account of its likeness with the name "Edison General Electric Company," it requires a little mental effort to determine the difference between the two, but the potency of the name, General Electric Company, will soon assert itself, and there will be no more ambiguity.

It is evident that the Edison General Electric Company, as far as its name is concerned, will be more completely absorbed by the new name than will the Thomson-Houston, on account of this very similarity of titles. The name Thomson-Houston is so intimately associated with a system and apparatus, unique in many respects, that it is doubtful if the name will ever be dropped completely.

Whatever may happen, it is certain that the combination is one of the strongest of the day, and there is no doubt that under the guidance of Mr. Coffin, the newly elected president and general manager of the new company, this vast concern will greatly prosper.

LEAD-COVERED TELEPHONE CABLES.

As electrical knowledge progresses and becomes more widespread, and the manufacture of electrical apparatus rises towards perfection, customers become increasingly fastidious and anxious that their requirements should not only be satisfied, but even surpassed. Fully posted as to the new developments which are now being constantly manifested, and provided with the latest measuring devices as they are invented or perfected, their demands call forth new efforts on the part of the manufacturers. This has been especially true of wires and cables. Considerable difficulty has been experienced in lowering the static capacity to the figure stipulated in the specifications of the telephone and other companies. A short time ago a figure of .20 or .21 microfarads was considered satisfactory, but this has been decreased year by year, until now .080 microfarads is required.



LEAD-COVERED TELEPHONE CABLE READY FOR SHIPMENT.

Although the Edison General Electric Co. has for many years past been manufacturing telephone cables, it has only recently put in the immense lead presses which now enable it to turn out complete lead-covered cables. With these new facilities the difficulties in the direction just mentioned have been overcome, and several cables lately shipped have shown a static capacity of not more than .075 microfarads. In striving to lower the static capacity the matter of insulation has not been neglected, and a remarkably high insulation has been obtained in the case of every cable which has left the works.

While these points are excellent in themselves, they do not alone constitute superiority when compared with the best cables of other manufacturers. The one feature, however, in which they may be considered to excel all others is their lead cover. It has been customary, and indeed is still the custom with all manufacturers of cables in this country, except the Edison General Electric Co., to press the lead over the core in a semiviscous state, the molten lead being poured into the press. Lead in this condition in every case carries on its surface a thick scum consisting of various impurities, oxides, etc. This can be partially removed by a ladle, but it is impossible to remove it entirely, and even when pouring the lead into the press considerable oxidation necessarily takes place, as lead oxidizes immediately on contact with the air, especially when in a melted condition.

Recognizing that such a cover could not be homogeneous and would be far more subject to attack by gases and acids than a pipe consisting of pure lead, the Edison Company determined to adopt the process of Siemens & Halske and their presses, and use absolutely cold lead. From the slugs of lead every particle of oxide is removed before insertion in the press, and as the atmospheric pressure is increased the lead is pressed out over the cable, enclosing it in an armor which is impermeable either to air or water. Comparison between cables armored by the cold-press process and those covered by the hot-lead process redound to the credit of the former in every instance. It is an undisputed fact that if two pipes filled with water be taken, one made by the hot process and the other by means of the cold press, and subjected to high atmospheric pressure, the fluid will ooze through the former while the outside of the latter will remain perfectly dry. This has been very prettily shown by coloring the water in the pipes with aniline, which could be plainly seen on the outside of the hot-press pipe after subjection to great pressure.

Cable recently supplied to the Metropolitan Telephone Company, of New York, has received unqualified approval, and although dry core was used, the cable could be handled as well as one made with the saturated core. The uniform gauge of the cable and its smoothness were also matters of appreciative comment.

The Pacific Telephone and Telegraph Company, of San Francisco, recently placed a large order for this

cable, the lead sheathing enclosing no less than 100 pairs of wires.

We show in the cut a corner of one of the cable shops at Schenectady with several drums of this cable awaiting shipment. The larger drums are 5 feet 16 inches in diameter by 3 feet 6 inches wide, the smaller ones 4 feet 8 inches in diameter and 3 feet 6 inches wide. Telephone companies all over the continent are now alive to the special advantages of the Edison telephone cable, and the Schenectady Works find it a difficult task to keep abreast of the demands upon them.

BIOGRAPHICAL SKETCH.

H. C. ADAMS.

The subject of this sketch, H. C. Adams, was born in Schuyler county, New York, on September 29, 1845. He attended school until the breaking out of the rebellion, when he enlisted in the United States Army, in August, 1861, being at the time less than sixteen years old. Mr. Adams served in the army until the close of the war, and was mustered out in August, 1865, after a service of four years. He then entered Lowell's commercial college at Binghamton, N. Y., from which he graduated, and on March 9, 1867, accepted a position



H. C. ADAMS.

with the well-known firm of Holmes, Booth & Haydens, as collector, and remained in their employ until 1887, having been with the firm for a period of over twenty years, during which time he had risen to the very responsible position of New York agent. He left their service to accept a position with the American Electric Manufacturing Company, which was at that time becoming a factor in electric lighting circles. With this company Mr. Adams became successively factory manager and purchasing agent, secretary, treasurer, and finally president. In 1888 he took charge of the New York office of the Fort Wayne Electric Company, at 115 Broadway, which position he now holds.

ELECTRO-PLATING DYNAMOS.

In electro-plating it is found, in practice, that there is a limit to the magnitude of operations capable of being carried to a successful issue with current obtainable from batteries. The current is not constant, even from the most constant battery. From the time of setting up the cells in the morning, up to the conclusion of the day's work in the evening, there are forces at work inside the cells which tend towards a gradual diminution of the current in the working circuit. These are, mainly, increased internal resistance, due to alteration of the exciting liquid consequent upon its increasing charge of zinc salt, and a similar alteration in the depolarizing liquid caused by an abstraction of its oxygen and conversion of this, together with hydrogen, into water. These alterations are most rapid when the resistance of the outer circuit is low, as when a number of articles to be plated are placed in the vats at one time. Therefore, just as a larger volume of current is needed to meet the larger demand, it falls lower from a battery, because of increased internal resistance of the cells. Batteries also entail the employment of much time and labor in setting up the cells and in putting them away after the work is finished. They are also costly in working, since the price of zinc and its excitants is high, and the wear and tear very great.

All these objections to the use of batteries have led to the adoption of dynamo-electric machines as generators of current whenever the work in hand has demanded a large and constant current. The current from a dynamo, when properly constructed and driven, is constant, varying only with the speed at which it is driven, or with the resistance of the bath. The volume of current obtainable from a dynamo constructed specially for electro-plating purposes is very large, and the tension of the current is so arranged as to be just high enough to deposit the metal in good condition. When the machine is so constructed as to have its field magnet coils connected in shunt with those of its armature, the strength of its current (within a certain limit) is self-regulated by the work to be done in the outer circuit. This provision makes the dynamo a most valuable generator of current for electro-plating purposes.

In designing a plating dynamo, as in all others, the resistance of the outer circuit has to be taken into consideration. The probable resistance of the plating solution, slinging wires, and wires conducting the current from the dynamo to the vat being known, the armature must be wound with a coil of wire offering a resistance of $\frac{1}{20}$ the working resistance of the outer circuit. This being done, we must wind the field magnets with coils of wire having a total resistance 400 times that of the armature, or 20 times the total working resistance of the outer circuit. The armature coils should be connected in shunt with the coils of the field magnets, to insure constancy in the current under varying loads, and to prevent reversal of the magnetism in the dynamo by the current being sent through the field magnet coils in the wrong direction. It should be understood by every plater that all solutions through which a current has been passing form in themselves a galvanic battery, with the articles being plated and the anodes as elements. As a rule, the plated articles are the positive elements, and the anodes the negative elements, in this battery. The current generated by these is, therefore, opposite to that employed in the work of electro-plating. If the coils of the field magnets of a dynamo are connected in series with those of the armature and the outer circuit, this back current from the solution will rush around the coils immediately on stopping the machine, or on slowing it down, and will reverse the poles of the field magnets by inducing in them an opposite condition of magnetism to that existing whilst the machine is in proper working

order. After such an accident, the machine will generate a current flowing in the opposite direction, or in unison with the solution current, and thus dissolve off the metal deposited on the plated articles. This is prevented by connecting the field magnet coils in shunt with the armature; should the back current from the solution become sufficiently powerful to pass round the field magnet coils, it passes in the same direction as it is sent by the dynamo itself, and therefore does not reverse the sub-permanent magnetism of the field magnets.

In a machine wound for electro-plating, with the coils connected in shunt, the magnetism of the field magnet cores will be proportionate to the resistance in the outer circuit. If there are several articles suspended in the solution, and a proportionate surface of anode, the resistance of the outer circuit will be low, and the greater volume of current will flow by the path offering least resistance, which will be, in this case, through the solution. As a consequence, only a small portion will pass around the field magnet coils, and thus the magnetic intensity of the fields will be low. If, on the contrary, the resistance in the outer circuit is high, as when only a few articles are immersed in the solution, the path of least resistance will be by way of the field magnet coils; the armature current will flow by this path, increase the intensity of the magnetic field, and raise the tension of the current, thus enabling it to overcome the increased resistance in the outer circuit. Hence the necessity of having the resistance of the field magnet coils so many times greater than that of the estimated highest resistance likely to be placed in the working circuit.

IMPROVEMENT IN ELECTRIC BELLS.

A cheap way of assembling bells is known as the Varley method. In the old system of attaching an adjusting screw to a bell eight parts were necessary, but by this new method it is accomplished with the use of three only, consisting of a flexible rubber stopple, an adjusting screw and a combination washer and clamp. A hole is passed through the entire length of the stopple, admitting the adjusting screw, and in the inner portion there are two other but smaller holes into which the prongs of



FIG. 1.



FIG. 3.

the combination washer-clamp fits, and on the round or side surface is a depression to hold about the edge of the hole in the side of the box, or that in the upright, if a skeleton bell. In applying this method, which is shown in Fig, 1, the operation consists, first, of forcing through the hole the rubber stopple, which is simply done by giving the stopple a slight twist, either to the right or left, at the same time pushing it inwards. After it is once in it is firmly locked by the expansion of the rubber, and great difficulty will be encountered in any attempt to withdraw it. The stopple in position is there to stay, and no amount of jarring or vibration will move the screw, as it is always firmly locked by compression of the rubber. In connection with these bells a dust-protecting device has been lately introduced, which consists in having the contact points enclosed in rubber.

Fig. 2 shows a bell fitted with the rubber dust-proof attachment, and Fig. 3 shows the attachment in detail. It is claimed that this dust-excluding device greatly improves the service of electric bells, since the accumulation of dust on the contact points seriously interferes with their operation. It is evident, therefore, that if the cause of the trouble is prevented the trouble itself will not exist.

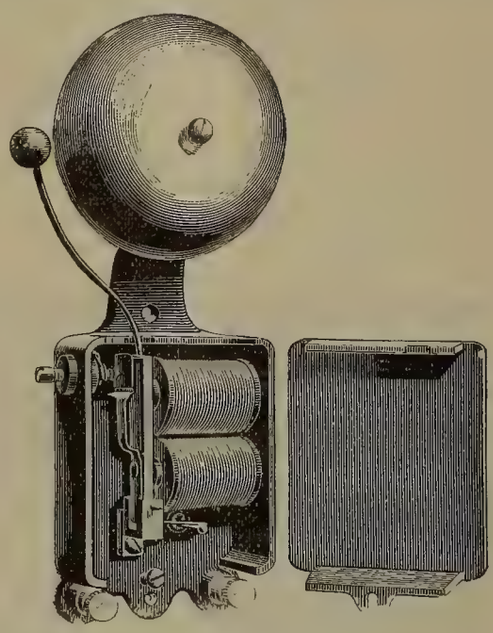


FIG. 2.

J. Jones & Son, 602 W. 22d street, New York, are the manufacturers of these devices, and apply them to the bells they make.

NOTES FROM JAPAN.

FROM OUR OWN CORRESPONDENT.

The fire which occurred in Tokio on April 10 last, and which destroyed over 4,000 houses, did a great deal of damage to electrical interests.

The fire occurred in that district of Tokio known as Kanda, which is a pretty busy quarter of the city.

In this district the fourth station of the Tokio Electric Light Company was situated, and the fire completely destroyed it. It was a one-story brick building, and the plant consisted of three engines, which supplied the power to drive 2 Hopkinson alternate current dynamos and 5 Edison No. 10 dynamos. The damage to this station was about $150,000.

The fire destroyed 28 telephone poles, cutting off the means of communication with 66 subscribers. The poles carried No. 17 copper wire. Telegraph and fire alarm lines also suffered to a considerable extent.

There are now about 1,000 subscribers in the Tokio telephone exchange. The telephone business in Japan is on the increase, and the government intends to open new exchanges at Kobe and Osaka.

Long distance telephony has been tried in Japan with much success. Tokio and Osaka were connected and the results were entirely satisfactory. The distance between the two cities is about 350 miles.

From the report of the Tokio Electric Light Company up to the end of last year the following figures will

be of interest : The number of Edison dynamos installed was 30. Besides these there were 5 Hopkinson 1,000-volt alternating current machines, 2 2,000-volt alternating current Brush machines and 3 Brush arc dynamos. There were at the end of the year 9,222 incandescent and 114 arc lamps in use. The capital stock of the company is 668,520 yen ($467,964).

There are three other companies in Tokio city, but they are comparatively small, each operating about 1,000 incandescent lamps.

The electric light business is quite rapidly expanding, and the Japanese people are very enthusiastic over it. The outlook for the companies is good. The alternating system of lighting is much favored in Tokio.

The Thomson-Houston system is now being introduced, and taking it altogether, we think we have good reason to be proud of our progress and enterprise in the use of electricity. K.

Tokio, April, 13, 1892.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electromotive Force.

THE most terrifying term in the electrical vocabulary to the uninitiated and beginner is the word "potential.' This word has been discussed by scientists and electricians to such an extent that many students regard it as possessing a meaning inexplicable by ordinary language and utterly undefinable, and that it can only be comprehended by the development of a sort of special sense, which enables us to understand things without being able to explain them.

There is no reason, however, why any more mystery should attach to the word "potential" than to the word "motion," and, to be more general, there is no reason why any of the technical terms used in the electrical science should be enshrouded with mystery ; they are all easily understood if a little thought is bestowed upon their meaning. The mere verbal *expression* of a technical term, whether it be volt or megohm, does not necessarily convey its meaning. Thought is required, as well as an expression, and in this respect the study of electricity is no different to the study of the multiplication table.

The definition of "potential" is, briefly, *possessing latent power;* that is, stored power which may be utilized to perform work under proper conditions. If we take a weight *w* (Fig. 1) weighing, say 10 lbs., and haul it up from the ground a distance of 10 feet, it will be endowed with a certain amount of power to do work, which it can be made to perform by its descent to the ground. This work can be applied in a great many ways. For instance, the end of the rope *a* might be attached to a train of clockwork which would be set into motion by the descent of the weight ; or it might run a fan, a sewing-machine, or do any other kind of work, providing the weight was sufficient to overcome the friction of the mechanism. The weight then at a height of 10 feet from the ground has a *potential energy* of a given amount—potential energy, meaning latent energy, which is transformed into work when the weight descends. Should the friction of the train of clockwork *c*, and the pulley *p*, be so great as to prevent the weight *w* from descending, no work will be performed ; but if the total friction is slight, then the energy of the weight can be utilized to perform work in some form or another.

Now if we make the weight *w* 20 lbs (twice its original weight), it will have twice the potential energy at the height of ten feet that it did before, and consequently, all things being equal, will perform twice the amount of work ; it has twice the power to overcome resistance that it formerly had.

It is evident from these considerations that the greater the friction the less will be the amount of useful work available, and, on the contrary, the less the friction the greater the work. The same idea as to potential, or potential energy, is applicable to electric currents to express the power of a current to do work.

It is a difficult thing sometimes for beginners to get a clear conception of work done by electricity, but when it is remembered that work is required of the electric

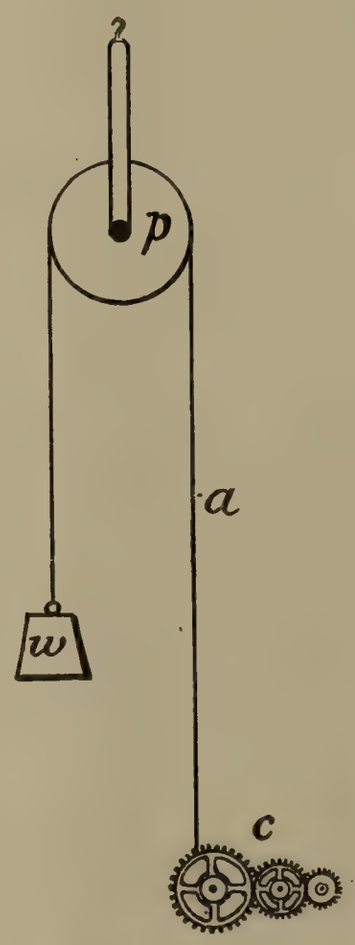


FIG. 1.

current to overcome the resistance of the conducting wire, to produce light in the electric lamp, to deposit metals in the plating bath and to propel street cars and operate machinery, just as work is required of the weight in the example, to overcome the friction of the pulley and clockwork, a better idea of it will be possible. In an electric circuit of great resistance and with little potential energy at the source of current little or no useful work will be performed, because all or most of the power of the current is wasted in overcoming the resistance of the wire, which is analogous to the friction of the pulley and the wheels of the clockwork in Fig. 1. It is evident, therefore, that in order to get the greatest amount of power or work from a given electric current, the resistance to the current must be made small, so as to enable us to deliver as much of the current as possible at the point where the work is to be performed.

Electric potential, or electromotive force, is the power an electric current possesses to do work. All its energy

may be spent in overcoming the resistance of the conducting wire, in which case none will be available to operate a telegraph instrument, give us light or drive an electric fan motor to keep us cool in hot weather, and it is the business of the electrical engineer to so regulate the conditions that everything else is subordinated to the one central object, namely, to get as much current as possible from a given source to the point where it is to be used.

The phenomena of electrical potential can be represented graphically in a way that will give us some conception of its nature.

Electricity, however, is something that cannot be seen or felt; therefore it cannot be represented by visible characters, so that we can get some idea of its nature through the eye. For this reason we are compelled to resort to analogy when we desire to illustrate the phenomena of electrical action.

It has been found that water, to a great extent, obeys laws which are very similar to those governing electric currents, and for this reason it is customary to illustrate the action of electric currents by analogy with the action of water under similar conditions.

Fig. 2 shows a tank of water *t*, to which is connected a pipe *p*, having at the opposite end a stop-cock *s*. Along the horizontal limb of the pipe are erected other pipes, *a*, *b* and *c*, in which the water can rise. Now when the stop-cock is closed and the tank is full of water, the water in the pipes and in the tank will be at the same height; under these conditions the same potential exists in the water in the tank and the pipes, but the moment we open the stop-cock and allow the water to escape the conditions are greatly changed, as will be seen in Fig. 3. The potential of the water in the tank will remain the same as it was before, provided that the supply is equal to the waste, to keep it at the same height, but the potential in the pipes decreases to the extent represented by the diagonal line *d*. When the water reaches its lowest level *g*, its potential is said to be zero, and if we tap the pipe *p* at any point along its horizontal length and insert other pipes perpendicularly, the water will rise in each of these to exactly the point where the diagonal line crosses (Fig. 3).

By actual measurement it will be shown that the water in pipe *b*, is exactly one-half the perpendicular height

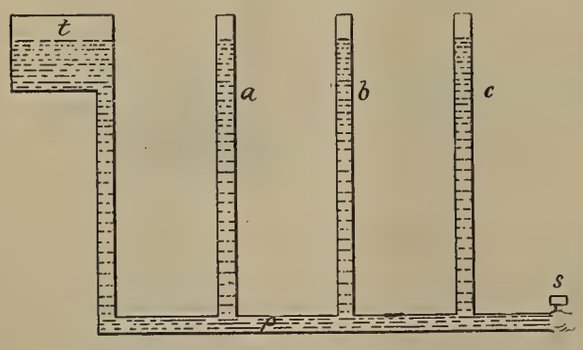


FIG. 2.

of that in the tank, therefore the potential of the water in that pipe is one-half of that in the tank; the potential in pipe *c* is only one-fourth that of the original, and the potential at *a* is three-fourths.

To the beginner this water illustration may seem irrelevant to the subject of this article, but such is not the case, because what is true of the action of the water in these examples is equally true of electricity under analogous conditions. If we now substitute the word "electricity" for "water," and go over the same ground, we have the exact facts before us as to an electric current. In the place of the tank *t* we put the dynamo or battery, or whatever the source of current may be, and connect thereto one end of a wire which will take the place of the pipe *p*, and insulate the further end of the wire; that is, not connect it with anything, but leave it free, hanging in the air for instance, the electric potential at the free end, or at any point along the wire between that end and the source of the current will be the same as that of the source itself, as in the case of the water illustration (Fig. 2). If, however, we connect the free end with the ground or earth at *g*, the potential or electromotive force will drop at the rate indicated by the diagonal line in Fig. 3 until it reaches the earth, where it will be zero—the potential of the earth being zero.

By taking measurements at any point along the wire the potential will be found to be exactly that shown by

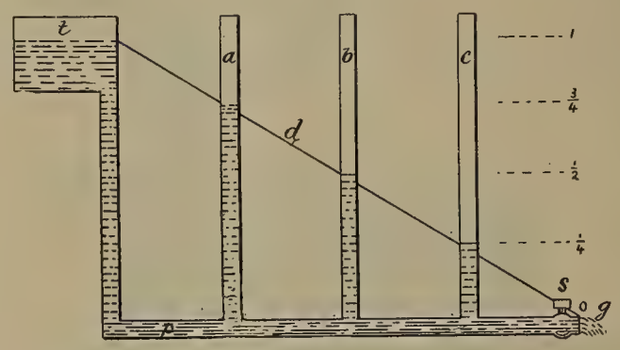


FIG. 3.

the intersection of the diagonal line (drawn from the point of highest to the lowest potential) with a perpendicular drawn from the point of measurement.

We have endeavored in this article to give as clear an idea as possible of the meaning of the term "electric potential" or "electromotive force," and having thus started from the very beginning of an electric circuit, we will in our next article consider a subject which naturally follows the one discussed here, namely, *resistance.*

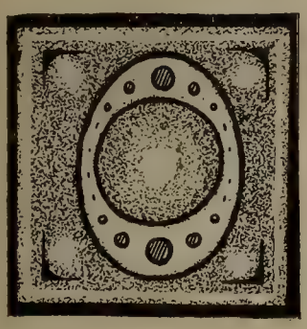
FIRE.

The Northern Car Company's plant at Robbinsdale, Minn., was recently destroyed by fire. The loss is estimated at $125,000, with a total insurance of $80,000; but as $18,000 of this amount represents insurance on the paint-shop and paint-room, the insurance on the burned buildings is reduced to $62,000, less than three-fourths of the loss. Between 150 and 200 men were employed by the company, and the plant, which had a capacity of one car per day, had been running steadily for some time past, and had orders booked that would have kept it going in full blast until the middle of next July. The company was reorganized last fall with a capital of $150,000 and was doing a very prosperous business. It is expected that the directors will decide to rebuild.

THE ECHO TELEPHONE.

This telephone, which is the property of the Echo Telephone Company, 15 Cortlandt street, is a magneto telephone consisting of five magnets and is operated without the aid of a battery, carbon contacts or induction coils. The voice acting upon the five magnets, the vibrations are brought to a control magnet, which in turn acts upon the transmitter and is greatly multiplied. The telephone is a success in every respect, the voice being very readily and clearly transmitted long distances. We understand that the company is now prepared to confer with reliable parties for exclusive rights, after the expiration of the Bell patents in March, 1893.

GOVERNING DYNAMOS.



ONE of the earliest discoveries in the evolution of the dynamo was that the position of the brushes upon the collector or commutator might be made to determine the output of electricity therefrom. When the brushes were set exactly upon the neutral line, the current was found to be at its strongest. When they were moved to one side or the other the current fell off in stren.gth But although this plan was often resorted to in the early machines, it was not always satisfactory. Such a method may probably be left to control the current, but it is not sufficient to maintain a fairly constant electromotive force.

Hence, regulation by means of shifting brushes was soon found better adapted to the case of running arc lamps in series than to that of incandescent lamps in parallel. In the former case, a fairly constant current is very desirable and the E. M. F. may be allowed to vary somewhat. In the latter case, unvarying potential is of the greatest importance, and this cannot be secured by merely shifting the brushes.

Many attempts have been made to utilize the brush shifting method for lighting purposes. A great difficulty had, however, to be overcome. The real effect of shifting the brushes is to upset the electrical balance of the armature. Since its two halves are connected in multiple (in most armatures), each half yields an equal share in the potential and current. This occurs when the brushes occupy the neutral, or "line of best collection." When, however, they are moved away, the current in certain of the coils upon one side begin to oppose the current in equal coils upon the other side, the result being neutralization of the output of those coils. But those coils are still active. The result of moving the brushes is to rupture their circuit before the proper time, and a great increase in the sparking is the result. Normally, with the brushes upon the neutral line, one at least of these coils on each side will be short circuited by the brush; to shift the latter is to give these "dead" coils life, which is discharged in a shower of sparks.

This destructive sparking soon deterred inventors from introducing the method of shifting brushes, even for arc lighting. But the designers of the Thomson-Houston machine saw a way out of the difficulty which was at least applicable to their dynamo. The chief objection to the sparking was its destructive effect upon both brushes and collector segments. This could, however, be obviated by blowing out the sparks by means of an air-blast, and to this automatic device alone is due the success of the Thomson-Houston dynamo in its feature of self-regulation. It is probably the only form of machine in which brush shifting has proved a success. In this dynamo the automatic moving of the brushes is performed by means of a regulating magnet.

The output of a dynamo may be controlled to some extent by changing or varying the speed. This fact has led several inventors to devise gear the function of which is to control the speed by governing the steam-engine. This method has not, however, come into general use, and it has many defects.

Scarcely less satisfactory is the old method of maintaining a certain resistance in the circuit, and varying this to meet the exigencies of the work. This method involves waste of energy in proportion to the otherwise useless resistance included in the circuit, and is generally so crude that it is seldom resorted to.

It may be said generally that the most successful method of regulating the output of a dynamo consists in varying the density of the lines of magnetism in the field. This has a direct result upon the electromotive force evolved by the armature. It may be done in several ways. The most obvious method is, of course, to vary the "strength" of the field-magnet by controlling its excitation. This opens up a wide field of inquiry, as it is possible to effect the required object by different methods, as separate excitation, shunt winding, compound winding and the later composite windings. All of these we shall briefly describe, although some of them have already been spoken of.

Mr. O. Firth devised a method of regulation by varying the width of the air-gap, which consists, briefly, in so arranging the two halves of the field-magnet upon suitable slides, that they may be separated or brought together, so varying the distance between the pole faces and the armature. The separation is effected by means of a screw gear composed of a single shaft, upon the two halves of which are cut right and left-handed threads. These work in nuts attached to the magnet cores. The arrangement is extremely simple. From experiments made with a dynamo of this kind it is shown that when the field magnet is closed up, and the machine is yielding its full output, as shown upon the voltmeter, a considerable separation of the two halves can be made before an appreciable effect is shown upon the E. M. F.

Governing by hand consists in varying a resistance placed in the field-magnet circuit by that means. It usually refers to separately excited dynamos. Since the exciting current is never very great, the loss involved in controlling it by wasting the surplus in the resistance coils in the form of heat is more than counterbalanced by the advantages gained. This may be effected automatically, although it does not appear that automatic regulation carried out in this way has met with general approval. Governing by hand may be applied to shunt-wound machines. This is Edison's device. The magnets being shunt-wound have a certain power of self-regulation. But in order to meet extreme demands for E. M. F., a set of resistance coils are kept in the shunt circuit. These are switched out as the potential of the dynamo begins to fall (by reason of the switching in of lamps). This method, like every other depending upon resistance, is to a certain extent wasteful. Edison has also operated this device by means of an automatic governor.

In cases of separate excitation the usual practice is to vary the resistance of the exciting machine's magnet windings. Separate excitation is becoming very common in the running of large dynamos. A small continuous-current dynamo is reserved for the purpose. The method of governing the output of the main dynamo by controlling the exciting current of the exciter is considered one of the best. Resistance coils are employed for this purpose. Since the current exciting the small dynamo is but a fraction of the whole to be controlled, the loss in resistance is sufficiently small to be of little moment. This control is generally exercised by hand. But it is a very common practice to arrange matters so that one continuous-current dynamo shall furnish the current required for exciting the field-magnets of several dynamos. It will be obvious, therefore, that the above method will not always be applicable to such a case as this, for any variation in the current given by the exciter will react impartially upon all the dynamos fed by it. This may be desirable or not, according to the nature of the case. It may answer if all the dynamos are feeding into a common circuit, and call for an augmentation or decrease of magnetism simultaneously. But if they are feeding into independent circuits such a method cannot be other than confusing. In the latter case, therefore, the control must obviously apply to each working dynamo separately. Hence variable resistances are placed in their field-magnet circuits for this purpose.

Resistance regulators consist in most cases of coils of iron wire. The wire is sufficiently thick to prevent overheating. (Nos. 8 to 16 of the standard wire gauge are generally used.) It is coiled upon some incombustible substance, with the turns well separated. One of the most usual methods is to coil the wire upon iron gas tubing, a layer of asbestos millboard being interposed between them to prevent short-circuiting. The coils may vary from a fourth of an ohm up to several ohms, rising by fourths. A series of studs with a contact-lever working from a centre are then arranged so that any resistance from zero to the full effect may be switched into the circuit. The coils will heat. Care is therefore to be taken that (1) they are arranged upon an incombustible base, preferably slate ; and (2) that they are so wound and separated that the heat may pass off into the surrounding air. Soldered joints are to be avoided in such apparatus. It should be so constructed that danger from fire is impossible, even if the coils should by accident be fused. Such arrangements are known as rheostats or resistance frames, according to the forms they assume. In many cases ribbon iron is used instead of round wire. This form of conductor presents more surface to the cooling effects of the air than round wire. The ribbon is generally arranged in a zigzag or corrugated form, so that a considerable length of it may be included between the sides of the "frame," the conductors being arranged in a number of parallel lengths across a square or oblong framework. In such forms of rheostat, contact plugs are generally used to throw in and out of the circuit the lengths of ribbon. This form of rheostat is now not so generally used as formerly. In some special cases German-silver is employed instead of iron to form the conductors.

Series dynamos may be said to be regulated by one of two methods. The first of these, that of shifting the brushes, has already been spoken of. The second is the more generally practicable. It consists in establishing a shunt wire across the magnets—that is, a variable resistance is connected across from the terminal where the main current flows into, to the terminal from which the main current leaves the magnet's circuit. This constitutes a short circuit, but it must present sufficient resistance to obviate the cutting off of too large a proportion of the current. When the dynamo is required to work at its full capacity, the resistance of the shunt would be equal to infinity, or no current would pass through it. When the dynamo is required to work at a small proportion of its capacity, resistance of the shunt would be very much less, and a considerable proportion of the main current would flow through it. This method of governing a series dynamo is preferable to the old plan of varying the resistance of the main circuit, but is distinctly inferior to the device of winding the magnets themselves with wire so fine that it may in itself constitute a shunt. This is, in fact, shunt winding, and it is intended to act as a self-regulator of the potential. The magnets of the machine are wound with coils of wire so fine that the resistance of this circuit is frequently 1,000 times that of the armature. The result is that very little current flows in the shunt when the work portion of the circuit presents comparatively little resistance. Hence, if the dynamo is feeding one arc lamp, the resistance of this compared to that of the shunt being small, leads away the greater portion of the current generated, and very little flows around the magnets. If another lamp be switched into the work circuit, the resistance of that portion will be increased ; less current will flow in it, but more current will flow across the shunt and so strengthen the magnet. The dynamo will thus begin to evolve a stronger current. If another lamp be switched in a still greater proportion of the current will flow in the shunt and the dynamo will evolve a still greater current. In this way a shunt dynamo may be said to regulate perfectly with regard to current (although, for other reasons, a constant-current dynamo has not yet been invented). Similarly, if the dynamo be feeding incandescent lamps connected in multiple across the mains, its electromotive force will be fairly maintained, even within wide limits of load. But it is impossible in such a machine to prevent the electromotive force from falling slightly. As more and more lamps are switched across the mains, the resistance external continues to fall, and the current to increase. Now increased current in the mains implies diminished current in the magnet's circuit, and the result is, of course, a slight drop in the electromotive force evolved. This is shown by the "characteristic" of such a dynamo having a falling tendency. But this slight falling off in the power of the machine may be very easily regulated by inserting a variable resistance in the shunt circuit. This is operated, as before, by hand. When a small load is on the dynamo the whole of this resistance is in circuit. As the load increases the lamps will begin to dim. It may here be mentioned that a drop of five per cent. in the potential will show greatly upon the lamps. The variable resistance is then diminished, allowing a greater proportion of the current to flow in the magnet's circuit, and so restoring the balance. A very little variation of the shunt resistance will suffice to regulate a shunt dynamo. This is especially the case if the armature's resistance is small. If the latter presented no resistance there would be, theoretically, no drop in the potential.

Although a shunt dynamo regulates so well under varying conditions of load, it is found to perform badly under variable conditions of driving. If the steam-engine be unsteady a shunt machine will be less satisfactory than a series machine in feeding arc lamps. This is due to the great self-induction of the shunt coils, wound as they are upon iron cores. It takes time to effect a change in such a circuit. While an increase or diminution of speed will instantly disturb the lamps, it will not so quickly affect the current in the shunt. Hence the lamp circuit is much more sensitive to the variations of the speed than the magnet's circuit. If the changes were slow, the shunt would presently recover its balance and meet the exigencies of the moment; but, as it performs but sluggishly, it fails to meet momentary variations. Shunt dynamos are, therefore, unsuited generally for feeding arc lamps, especially when the driving speed is apt to vary. On the other hand, a shunt machine performs excellently when the only changes involved are those of current and electromotive force.

It has been said that the slight drooping tendency of the characteristic by a shunt machine may be obviated by employing a variable resistance in the shunt circuit. Many attempts have been made to render this part automatic, and with the greatest success. But a still better method of regulation has been obtained by combining the attributes of the series dynamo with those of the shunt.

The series dynamo has the merit that it is almost free from the evils due to self-induction mentioned above. The storing-up tendency of the long shunt coil is absent, or nearly so, in the short, thick series windings. The effect is that the self-induction of lamp circuit and magnets are more nearly equal. This allows of considerable variations in the driving or speed, without their being apparent in the lights. In other words, the magnet part of the circuit responds to a change of speed as quickly as the lamp part of the circuit, and both feel it equally.

When a dynamo is "compounded" by furnishing its magnets with a few turns of series winding in addition to the shunt coils, it immediately partakes of the character of the series dynamo in respect of non-sensitiveness to inequalities in driving. The real effect and function of the series turns is to compensate for the slight tendency to lose electromotive force when there is an increased demand for current in the lamp circuit.

If a shunt dynamo could be provided with an armature having no resistance, it would yield a constant electromotive force, whether the exterior resistance was small or great. This condition is, however, impossible, although dynamos have been constructed having conductors so thick in the armature that the resistance of this part is merely nominal. Nevertheless, these machines will lose some of their electromotive force when the external current becomes a maximum, because the volts in the working portion of the circuit are but a proportion of the whole, and not the whole.

This fault can, however, be overcome by sending the main current round the magnet so as to reinforce the field as soon as the current in the working part of the circuit becomes large enough to cause a drop in the electromotive force. It has been said that the falling off is due to the increased current. This increase of current, if it be sent round the magnet, however, reinforces the magnetization, and in this way it is possible to make a compound wound dynamo increase in power faster than the load can be switched on, provided we are dealing with incandescent lamp lighting in parallel, and that the load is gradually increased. The "characteristic" of a compound machine would show a perfectly straight line—that is, the volts would be maintained the same while the ampères of current varied from light to full load. It is, indeed, comparatively easy to give the characteristic any desired shape. But most makers prefer to give the electromotive force a slight rise at full load. A well-designed compound machine will, therefore, show a slightly upward-sloping characteristic.

The composite field dynamo consists in taking an ordinary series-wound machine and adding thereto additional exciting coils fed by an independent source. It is, indeed, a combination of series and separate excitation.

One of the most interesting examples of the composite field method, applied as it has been to an alternating-current dynamo, occurs in the new "composite" field machine of the Thomson-Houston system. The armature of the dynamo is wound for alternating currents, and it revolves in a multipolar field for that purpose. These currents pass direct to the lamp circuit. But below the alternating-current windings (sometimes, however, side by side with them), and directly placed upon the core of the armature, occur a few turns of conductor forming an independent winding. The (necessarily alternating) current from these turns are passed to a commutator upon the shaft. The function of this is to commute them to a continuous direction. They then pass into the exciting coils of the field, and constitute a self-excitation. The field-magnets are, however, provided with two sets of coils. The second set is reserved for the current from a separate exciting machine. The self-exciting current may be regarded as a shunted portion of the main current. The machine may be regarded as a "compounded" alternating-current dynamo. In another form of the machine the self-exciting coils are wound upon all the armature cores except two. These are situated directly opposite to each other. They are excited by the current from the separate-exciting dynamo. The main object in all such combinations is to secure an initial and independent field, which, being independent of the variations in the main current, affords every facility to render the dynamo self-regulating.

It will be observed that most of the methods of governing here described have for their object the maintenance of a constant potential, and are therefore adapted more especially for incandescent lighting. But many attempts have been made to regulate for constant current. So far these endeavors have not been attended with success. Electromotive force is the attribute of the dynamo, and can be predetermined. Current, on the other hand, depends entirely upon the total resistance in the circuit. The nearest method we have to constant-current governing consists in the combination of a shunt machine with a separate source of excitation, acting in independent coils.

AMPERE'S THEORY OF MAGNETIZATION.

From observation of various electromagnetic phenomena, Ampère deduced the theory that electric currents are in constant circulation around the molecules of all bodies capable of acquiring magnetism, so that every such molecule is the centre of a field of electric force; and that when the body is unmagnetized these currents circulate in different directions, and hence no external effect is produced; but that under the magnetizing influence they are all made to circulate in the same relative direction, and hence between the adjacent sides of any two molecules they are in opposition and neutralize each other; and as this must be true of every interior molecule on all its sides, all interior circulation must cease; while the currents from the interior sides of the surface molecules, having no opposition, and all now circulating in the same direction round the mass at right angles to its length, produce the effect called magnetism.

In tempered steel the currents retain their harmony of movement after the magnetizing influence is withdrawn, but in soft iron they resume their irregular movement and the magnetism disappears.

This theory, so far as it relates to the external or field currents, is in harmony with the theory of molecular motion, while the latter accounts more satisfactorily for the origin of the currents, their permanency in tempered steel and want of permanency in soft iron, by ascribing them to the motion of the molecules themselves, and their change of position under the magnetizing influence. Ampère's theory gives an effect without an adequate cause, while, if molecular motion is regarded as a natural condition of all bodies, which seems to be well established, we have, in its various forms, ample cause not only for those manifestations of energy which we term magnetism and electricity, but also for other kindred physical phenomena.

In 1831 Faraday made the important discovery that an electric current can be induced in a conductor, forming a closed circuit by the movement of a magnet in proximity to it, and also that the same effect can be produced by the similar movement of a current-bearing conductor; both results furnishing additional proof of the close affinity of electric and magnetic induction and of the correctness of Ampère's theory of the circulation of electric currents round the magnet.

ITS SECOND YEAR.

The American Association of Inventors and Manufacturers, which was organized during the celebration of the Patent Centennial in 1891, has entered upon its second year with large opportunities of usefulness and encouraging prospects.

The objects of the association are the diffusion of information regarding inventions, the improvement of the patent laws, and enlarging the facilities for the prompt and thorough examination of applications for patents, and generally for *the promotion of harmonious relations and just dealings between inventors and the users of inventions.*

The officers of the association are: President, Dr. R. J. Gatling, Hartford, Conn.; first vice-president, Gardiner G. Hubbard, Washington, D. C.; second vice-president, Thomas Shaw, Philadelphia, Pa.; third vice-president, Prof. W. A. Anthony, Manchester, Conn.; fourth vice-president, Benjamin Butterworth, Cincinnati, O.; secretary and treasurer, Geo. C. Maynard, Washington, D. C.

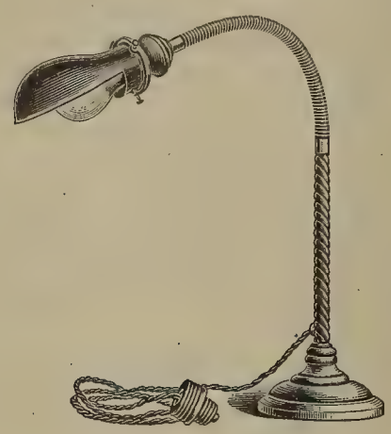
Arrangements have been made for holding an international congress of inventors, under the auspices of this association, at Chicago during the World's Columbian Exposition.

The headquarters of the association are at the corner of Eighth and H streets, N. W., Washington, D. C., in the Inventive Age Building.

NEW PORTABLE LAMP.

The McCreary Electrical Specialty Co., 136 Liberty street, New York, has just brought out a new specialty which will be appreciated by users of stand electric lights. It consists of a portable electric lamp-stand with flexible arm, and is shown in the accompanying illustration.

The base is made of either polished brass or nickel-plated, as desired, and the stand is fitted with the company's "almond" flexible arm, enabling the user to place



NEW PORTABLE LAMP.

the light in any desired position. Over the lamp is placed one of the aluminum half-shades made by the company, which can be moved around the lamp at will, throwing the light in any direction. These aluminum shades have the advantage of being non-breakable and non-tarnishable, and are powerful reflectors.

The portables are fitted with key socket, attachment plug, 12 feet of silk cord, shade holder and aluminum half-shade, all ready for use. This specialty is known as No. 20, and will be found very desirable and convenient. It is artistic in design and durable in service.

MOTORS.

If the terminals of a dynamo in motion be connected with the terminals of a dynamo standing idle, the current from the active dynamo will traverse the circuit of the idle machine and cause its armature to revolve. The first machine acts as a generator; the second machine becomes a motor. The conductors employed to convey the current from the generator to the motor exemplify the principle of the electrical transference of energy. Since the efficiency of such a system is very high, the transmission and distribution of motive-power by means of electricity is being rapidly utilized for various purposes, among which the electric railway occupies the first place.

If a straight wire be placed in a magnetic field with its length perpendicular to the lines of the magnetic force, and a current passed through it, it will experience a force tending to move it perpendicularly to itself and to the lines of the field. Provided the wire be free to act under the influence of this moving force, it will tend to cut the magnetic field, and a counter, or opposite current is induced in it. Hence, while the wire (or armature) is impelled to move across the magnetic lines, it acts to a certain extent also as a generator. The counter electromotive force induced in it greatly diminishes, or dams back, the moving current. The more rapid the motion of the armature the greater does this counter current become. Its strength is also dependent upon the strength of the magnetic field.

This magnetic reaction of the armature of a motor is a matter of the greatest importance in the electrical transference of power. The current in the coils of an iron-cored generator armature tends to make that core become a magnet, having poles opposed to those creating the magnetic field. This is well known as the reaction of the armature. In cases where the field magnet is weak it becomes a serious source of loss and other drawbacks. In dynamos, however, it is the builder's aim to set up so powerful a field relative to the possible counter action of the armature core that the latter is entirely overpowered.

Let us now consider the case of a dynamo becoming a motor.

Let a current be passed into it so that the polarity of the field is the same as when the machine acts as a dynamo. It will be found that the current in the armature is in a direction the reverse of that induced in it as a generator. The polarity of the armature will also be reversed—that is, it will exhibit poles the reverse of those of the field. These poles will mutually *attract* or *strengthen* one another. Hence the reaction of the armature's magnetism in a motor is contrary to what it is in a generator. But, as in the case of a generator, this is not an advantage, but on the whole the reverse, and it is the aim of the motor builder to employ so powerful a field magnet that the armature's magnetic reaction may be left almost out of account. As in the case of a generator the reaction tends to distort the direction of the lines of force in the field, and this distortion is the main cause of the necessity for "lead" in the brushes as employed in the case of generators.

Hence it is important to remember that in a perfect motor the twist (torque) communicated to the armature shaft is due not to the magnetism of the iron core but to the currents in the coils enveloping it. Mechanically considered, therefore, the means of attaching the latter through the core to the shaft demand considerable attention, otherwise the coils are not apt to be pulled backwards from their proper position upon the core. Such faults were of constant occurrence in both the earlier dynamos and motors.

The electrical transference of motive power has been found to be more efficient than transmission by ropes, water, or compressed air. This fact alone has sufficed to bring electric motors into use, in many cases to the displacement of every other workable system.

The whole of the power supplied electrically to the motor is not, however, converted into mechanical effect. There are various unavoidable sources of loss. There is first, the resistance of the connecting wires. This may be regarded as the loss due to transmission. There is, in the second place, a certain loss due to resistance, which appears as heat in the motor. Thirdly, there is the loss due to friction, mechanically considered, of the motor. There is also the invariable magnetic friction giving rise to eddy currents in the motor, but this is frequently so small in the best types that it may be left out of account.

The electrical power put into the motor is most conveniently expressed in watts. If C be the current, expressed in ampères, which actually flows in the circuit of the motor, and E be the electromotive force, expressed in volts, at the terminals of the motor, then the electrical power (per second) in watts, P, is found by multiplying together the ampères and volts, and dividing by 746 to obtain the electrical horse-power.

$$\text{Electrical horse-power} = \frac{EC.}{746}$$

Since only a proportion of the electric power supplied to the motor is returned as mechanical effect at its pulley, it is convenient to express the efficiency of the motor as follows: If C is the current (in ampères) that flows through the motor, and E the electromotive force (in volts), the watts, P, of mechanical effect is

$$P = EC.$$

The counter electromotive force of the armature varies with different motors. In the best types it is from five to ten per cent. less than the E. M. F. measured at the terminals of the motor.

The simplest case is that in which the dynamo at one place is connected in circuit with a dynamo (motor) at another place. The conductors between the machines must be insulated in the usual way. That is, if they are of naked copper they must be suspended above the ground and attached to insulators. If they are of the nature of heavily protected cables they may either be laid along the ground or buried beneath it. In many cases they are laid in water, as across streams. In the case of simply running a dynamo and a motor in this way, the machine should be adapted to the work to be done. In most cases the generating dynamo is moved at a constant speed. In that case both the generator and the motor should be series-wound machines. When the generator is run at a constant speed the motor will also maintain an approximately constant speed under all conditions of load. The speed in this case depends entirely upon the E. M. F. The torque depends, on the other hand, entirely upon the current. This is known as simply series transmission.

But in case of motors being run off circuits used also for lighting, where, instead of constant current, constant potential is required, as on an incandescent light circuit, series motors are found to be unsuitable; they will not maintain a constant speed under varying loads. But any shunt-wound or compound motor will do this under the above conditions, because the current through the shunt does not vary, and there is less variation of the strength of the field. Shunt-wound motors, if they are to maintain a constant speed upon a constant potential circuit must be furnished with armatures of low resistance. The field magnet must be relatively very powerful. If a shunt motor, on the other hand, be put upon a constant current circuit (such as the running of arc lamps) its speed will increase with its load, and will always fall off as the load is diminished.

There is this distinction to be remembered in the cases of setting dynamos to work as motors, or motors as dynamos. Taking the case of an ordinary series machine with brushes set (and having forward "lead") it will, when worked as a motor, run in the wrong direction, or against its brushes. It is usual in this case to reverse the direction of the current in the field magnet by changing the connections, or leaving the field magnet to reverse the connections of the armature. The machine will then run with its brushes. If these connections be left standing the brushes must be reversed and set with the lead in the other direction.

Shunt dynamos, however, are not subject to the same rule, for it is evident that while the current in the armature is in the same direction as before, that in the shunt will necessarily be in the reverse direction, and the machine will run as a motor without further change.

The case of a compound machine is somewhat different. It depends upon the relative magnetizing effects of the shunt and series coils whether it will behave as a series or as a shunt dynamo in the direction of its motion. If the shunt, as is usually the case, have a greater magnetizing effect than the series turns, the machine will act as a shunt dynamo, inasmuch as it will run as a motor in the same direction as it does as a generator. If, however, as is sometimes the case, the series coils preponderate in determining the magnetic polarity of the field, the machine will run against its brushes, and it must be reversed by altering the connections, as in the case of a series motor. Since the compound dynamo has the polarity of its field determined by the *combined* effects of both shunt and series coils, it is evident that when used as a motor the current in the shunt will oppose that in the series coils. Hence the *difference* between the magnetizing powers of the two coils will determine the polarity and strength of the magnetic field. Such a machine is known as a *differentially-wound* motor.

The self induction due to the armature of a generator chiefly determines the lead of the brushes. If it is great, and the field is weak, the lead will be considerable. If it is small, and the field be powerful, the lead will be small also. But in the case of a motor exactly the reverse is the case. Here the self induction, being in the reverse sense, tends to diminish the lead. When a motor is desired to run in a particular direction the lead must be determined to give, in that direction, the strongest mechanical effect. If the brushes be set with no lead the armature will be apt to run in either direction, as it may happen to be started, but without exerting its maximum effect. In cases where the motor is required to reverse its direction of running, by reversing the current (as is frequently done) the brushes must not be given any lead. There is, however, an element of uncertainty, in many cases, that the motor shall reverse its direction of turning upon a reversal of the current. It is immaterial whether (in the case of a series motor) the current is reversed in the armature or in the field magnet.

Althqugh almost any type of continuous current dynamo may be used as a motor, yet makers usually produce specially built machines for this purpose. As a rule, motors, especially if used for propelling vehicles, must be more heavily built than dynamos. They are subject to greater strains, and the mechanical arrangement of the induction coils, the core and the shaft of the armature must be as solidly constructed as possible. This is especially true of the connections between the coils and the core. The wires are preferably sunk permanently, with hard insulation, in channels in the core, as in the Weston and the Westinghouse armatures. The core, if built of plates, must be properly keyed or "feathered" upon the shaft.

Government of regulation by differential winding appears to be the most suitable method adapted to the case of motors. It has the great advantage that no breaks in the circuit are required. A great number of ingenious regulators have been invented in which the current is admitted to the circuit of the motor during a proportion only of the time of each revolution. The chief drawback of this system lies in the fact that break and make of circuit are necessary, involving a great deal of destructive sparking at the points of rupture.

The proportions between the shunt and the series windings of the field magnets vary in different motors, but those expressed in Ayrton and Perry's formula have produced motors almost perfectly self-regulating. Let S stand for the number of turns of the series coils, Z for those of the shunt coil, R_z for the resistance of the shunt, R_a for the resistance of the armature, and R_s for that of the series turns (expressed in ohms). Then:

$$\frac{Z}{S} = \frac{R_z}{R_a + R_s}.$$

A method of governing applicable to the case of a motor with more than one pair of poles has been proposed by Professor S. P. Thompson. He uses as field magnets a double set of poles set at different angles with respect to the brushes of the motor. One pair of magnet poles, having a certain lead, is actuated by series coils; the other pair, having different lead, by shunt coils. When both shunt and series are working there will be a resultant pole having some intermediate lead. If the load of the motor is diminished, it will tend to run faster, increasing the current in the shunt part, decreasing it in the series part, and therefore altering the effective lead and preventing the increase of speed.

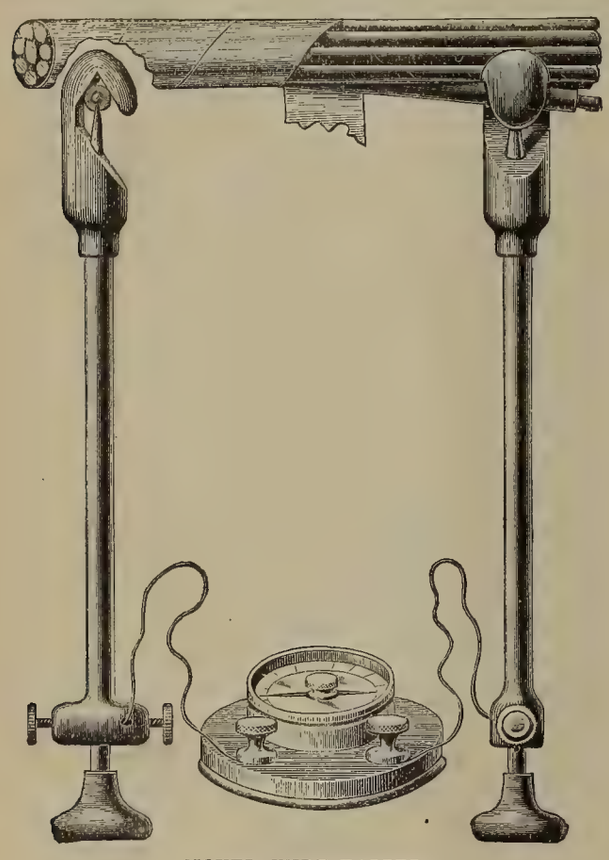
It can easily be shown, however, that in point of efficiency a differentially-wound motor must be inferior to a

motor either plain series or shunt wound. This shortcoming is due to the fact that the energy required to magnetize the field magnet is greater in the case of employing two opposing coils, as when the series and shunt machines are combined in one. The great advantages, however, of the differential method of winding in motors, combined with the fact that the loss due to the opposing coils is always relatively small, will probably lead to the almost universal adoption of compound motors for regular running. The energy consumed in magnetizing the field is always a small proportion of that supplied at the terminals, series or shunt, of the motor, and even if the opposing coils in a compound motor consume fifty per cent. more, it is still advantageous to employ this method of regulation.

LIGHTNING WIRE-TAPPER.

A very handy device for testing and locating trouble on insulated electric wires is shown in the accompanying illustration. It is specially adapted to finding trouble on annunciator, burglar-alarm, telephone or telegraph wires and for testing out cables of every description.

It is customary in testing and in locating faults to remove the insulation from the wire to be tested, and frequently this is attended with considerable inconvenience, besides impairing the insulation itself. The Menu Lightning Wire-Tapper, however, removes all these objectionable features and accomplishes the same result without detriment to insulation.



NOVEL WIRE-TAPPER.

The illustration is clear enough to tell its own story. By simply placing the wire to be tested in the V-slot and pressing the pin through the insulation, contact is made with the wire, and on the removal of the pin the perforation closes again, leaving the insulation in practically the same condition as it was before.

This tapper can be used on any size wire from $\frac{5}{16}$ diameter to the smallest magnet wire.

Wires otherwise inaccessible can be readily tested by the use of this device. The rapidity with which work can be carried on with this tapper is one of the main features of the instrument, which will be appreciated by all who are engaged in work of this class.

The Lightning Wire Tapper is manufactured by the John Simmons Co., 110 Centre street, New York City, and as it is of low cost it should find a very large sale.

NEW INCORPORATIONS.

The Mountain Bank Coal Co., New Whatcom, Wash., incorporated April 29, with a capital stock of $300,000. Among other things it will operate electric-light plants. Incorporators: Jerry Neterer, C. L. Snell, S. A. Calvert, J. L. Heron, A. W. Dresser, J. M. Hitt, New Whatcom, Wash.

The Cumberland Development and Improvement Co., Castle, Mont., incorporated April 26, with a capital stock of $60,000. Among other things it will manufacture and use electricity for light, heat and power. Incorporators: Charles E. Severance, Charles B. Carr, Oka, Mont.; A. J. Huncke, Castle, Mont.

The Jefferson Electrical Co., Steubensville, O., incorporated April 29, with a capital stock of $50,000. Incorporators: George A. Maxwell, George P. Dravo, Wilson McKee, George N. Henry, William S. McCauslen.

The Arnold Novelty Co. (this company succeeds Arnold Novelty Company of same place), Tacoma, Wash., incorporated April 25, with a capital stock of $12,500. Incorporators: A. F. Esperson, W. S. Arnold, J. E. Small, S. L. Rau, Ruch W. Kimball, F. W. Hicks, Tacoma, Wash.

Venture & Ojai Railway Co., San Buenaventura, Cal., incorporated April 25, with a capital stock of $250,000. Among other things it will deal in water, develop power, electricity, etc. Incorporators: W. S. Chaffe, Richard Robinson, E. P. Foster, E. S. Hall, G. W. Chrisman, W. H. Wilde, A. D. Barnard, A. Bernheim, all of San Buenaventura, Cal.; Joseph Hobart, K. P. Grant, J. K. Greis, Ojai Valley, Cal.

The Standard Electric Co., Castle, Mont., incorporated April 13, with a capital stock of $100,000. Incorporators: Elmer J. Anderson, Hanson H. Barnes, John L. Fraser, William A. Roots, Nahum T. Dinsmore, Charles E. Miller, all of Castle, Mont.

Seth B. Smith Electric Co., Butte, Mont., incorporated April 13, with a capital stock of $50,000. Incorporators: John O'Rourke, George T. Schmetzel, Seth B. Smith, Butte, Mont.

Pennsylvania Mining and Improvement Co., Everett, Wash., incorporated April 23, with a capital stock of $80,000. Among other things it will operate telephone and telegraph lines. Incorporators: Edward Mills, Everett, Wash.; Lincoln F. Gault, Tacoma, Wash.; B. W. Brintnall, Olympia.

Buffalo and East Aurora Electric Railroad Co., East Aurora, N. Y., incorporated April 20, with a capital stock of $150,000. Incorporators: Cicero J. Hamlin, Sandrock, Buffalo, N. Y.; Henry H. Persons, East Aurora, N. Y.

The Cardarelli Electric Light Crane Co., Sumter, S. C., incorporated May 7, with a capital stock of $6,000. Incorporators: H. J. Harby, R. M. Wallace, E. Cardarelli, Charles T. Mason, Jr., Horace Harby, all of Sumter, S. C.

The Kersmeyer Plumbing and Heating Co., Lincoln, Neb., incorporated May 6, with a capital stock of $27,000. Among other things it will deal in electric-light fixtures. Incorporators: F. A. Kersmeyer, G. H. Wentz, N. H. Howard, Lincoln, Neb.

The Commercial Electric Light Company, Columbus, Ind., incorporated May 7, with a capital stock of $20,000. Incorporators: Levi J. Lehman, A. Strauss, S. A. Essix.

The Hammond Electric Railway Co., Hammond, Ind., incorporated May 7, with a capital stock of $100,000. Incorporators: Miner Wamsley, Charles M. Story, Harry Wurzgurger, Joseph M. Finn.

Okiah Electric Company, San Francisco, Cal., incorporated May 5, with a capital stock of $30,000. Incorporators: George Johnson, C. B. Johnson, John Cosgrove, John W. Smith, Frank Boyd, all of San Francisco, Cal.

The Haverhill and Amesbury Street Railway Company, Haverhill, Mass., incorporated April 28, with a capital stock of $250,000. Incorporators: Charles Goss, Dudley J. Marston, William G. Ellis, Albert W. Goss, Adam Scott, N. Emory Collins.

The Jordan Electric Train Signal Co., Portland, Me., incorporated May 7, with a capital stock of $150,000. Incorporators: Henry B. Burnett, Frank D. Rogers, Herbert A. Clay, Portland, Me.

The Railway Equipment Co., Chicago, Ill., was incorporated May 3, with a capital stock of $100,000. Among other things it will equip electric, steam and horse railways. Incorporators: C. Metterhausen, A. E. Woodward, Ralph Bottemus.

National Construction Co. (incorporated in W. Va.), New York City, N. Y., incorporated May 5, with a capital stock of $1,500,000. Among other things it will build and maintain electric, steam, cable and horse railways. Incorporators: W. J. Foster, M. C. Steinrich, New York, N. Y.; H. W. Summex, Brooklyn, N. Y.

The Columbus and Magnetic Springs Electric Railway Co., Magnetic Springs, O., incorporated May 5, with a capital stock of $25,000. Incorporators: Edwin R. Hotsenpiller, Dunbar C. Kilbury, John W. Newhouse, William M. Warren, Solomon Hill.

The Dewey Electric Heating Co. (incorporated in W. Va.), Syracuse, N. Y., incorporated May 4, with a capital stock of $200,000 Incorporators: Emil Laass, Charles H. Duell, M. W. Dewey.

The Western Electric-Therapeutic and Alarm Co. (incorporated in W. Va.), Washington, D. C., incorporated May 3, with a capital stock of $500,000. Incorporators: A. J. Curtis, A. T. Smith, Washington, D. C.; J. T. Williams, St. Paul, Minn.

MULCTED IN DAMAGES.

Hannah T. Jackson secured a verdict for $5,000 damages against the Wissahickon Electric Light Company, Philadelphia, Pa., in the Court of Common Pleas. While out driving with her husband in Fairmount Park, the horse became entangled in wires of the company which were dangling along the drive and became unmanageable. Mrs. Jackson was thrown out, receiving severe injuries, and brought suit against the company for damages with the result as above stated.

ELECTRIC LIGHT IN QUEBEC.

The road committee held a meeting on May 6 to consider the tenders for the contract of lighting the city streets by electricity. Two proposals were submitted, one from the Quebec and Levis Electric Light Company, at $80 per light per annum, and the other from the Edison Electric Light Company, at $100 per light, for a contract of twenty years, the plant to become the property of the city at the end of that time. The merits of each company were presented through its counsel.

Mr. Lavery, representing the Edison Company, set forth the merits of the tender of his company, dwelling at length on the fact that with the expiration of the twenty-year contract the plant would become the property of the city, and that it would then be able to furnish light to private residences for $4.80 per light, instead of $6.00, as charged by the present contractors. The company asked the city to give its debentures to the amount of $80,000.

Mr. Gustave Stuart then spoke for the Quebec and Levis Electric Light Company. He said that the tender of the Edison Company was not the same as called for, and no doubt if such a thing was thought of, other companies would have sent in similar tenders. So far as the Edison Company's claim was concerned, that at the end of twenty years the plant would lapse to the city, he had it from practical and experienced electricians that at the end of that time it would not be worth $20,000, or even $10,000, and yet that company wanted to be given water-power free from taxation, and virtually asked the city for capital with which to erect its plant.

The committee then went into secret session, and finally decided to recommend that the tender of the Quebec and Levis Electric Light Company be accepted as the most advantageous in the interest of the city.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Secretary Pope, of the Institute, announces that on account of the death of the mother of Mr. Nikola Tesla, that gentleman will not be able to attend the Chicago meeting of the Institute on June 6, 7 and 8 next.

CATALOGUE.

The Eickemeyer-Field Company, Yonkers, N. Y., has just issued a second edition of its illustrated catalogue, the object of which is to direct the attention of that portion of the public interested in street car-electric traction, to its system of apparatus. The catalogue is profusely illustrated and contains an exhaustive description of the company's various manufactures.

WARD ARC LAMPS.

"Ward" street-railway arc lamps, made by the Electric Construction and Supply Company, 18 Cortlandt st., New York, are performing excellent service, and sales of the same are good. Electric street-railway companies are beginning to appreciate the great advantages of these lamps, as is shown by the increasing demand for them.

The new ornamental "Ward" arc lamp is also meeting with excellent success, and it takes well in the trade. Large orders invariably follow when buyers see these lamps.

The Electric Construction and Supply Company has just brought out a new ceiling lamp about three feet high, which burns for seven hours. This lamp will no doubt meet with excellent success and demand.

The new double-carbon lamp, recently put upon the market, is made and sold under license by this company to the Brush Elec. Co. They are designed for constant potential circuits, and large numbers of them have been put out.

The company reports an active demand for "Ward" arc lamps, 300 being sold on Tuesday and Wednesday of last week alone. There are now over 1,000 in use in Brooklyn, and the number is constantly increasing. Several hundred have lately been installed for general commercial use. Seventy-five of these lamps were installed by the company in the large establishment of C. B. Rouss, on Broadway, New York, and are giving excellent satisfaction.

All the principal theatres and many large dry goods houses and other mercantile establishments in New York City and Brooklyn are using large numbers of these lamps with entire satisfaction.

PORTER & LEAVITT ELECTRIC MOTOR CO.

A visit to the works of the Porter & Leavitt Electric Motor Company, Providence, R. I., was made by a representative of the ELECTRICAL AGE last week, which proved to be very pleasant as well as interesting. At the head of this concern is Mr. Leavitt, who showed the writer through the new works, situated at 124 Mitchell street, where the company recently removed. The works are fitted up with the most improved modern and special machinery for the manufacture of electric fan motors, of which this company makes a specialty. The motors are made in four regular sizes, from 2 to 10 volts, and finished in first-class style with enamel finish, brass trimmings, with ⅜ inch grooved brass pulley, and mounted on a nicely finished moulded-edge cherry base, having brass binding-post for connections. These motors are also suitable for running sewing machines, dental drills, jewellers' lathes and all kinds of light machinery. Mr. Leavitt has just perfected a new fan motor to be operated by gravity-cells. These motors will be cheaper and require less attention than any other motor in the market, and are especially adapted to warm climates where the continual use of fans are necessary. These motors will shortly be placed on the market. Mr. Leavitt is also getting out patterns for a new 110-volt fan motor, which is a new construction of perfectly ventilated armature designed by himself. Notwithstanding the fact that this company has been in business but one year, it has built up a trade and reputation that any one might envy. In consequence of the great demand for its motors, the company was compelled to run over-time until very recently.

"WITH EDISON AT SCHENECTADY, 1892."

Mr. W. H. Butler, of the General Electric Company, Schenectady, N. Y., has just got out a collection of photographs in book form of the Schenectady works of the General Electric Company, which is one of the most elegant and complete pieces of work of this class that we have ever seen. There are 125 photographs in all, giving as many different views of the works, and they are arranged in a most artistic manner. The book is elegantly bound, and will no doubt be of great value and interest to every one connected with the company. The title of the book is that at the head of this article, and this work is an elegant example of the photographer's and bookmaker's arts.

The idea of the book is to give a panoramic view of the Schenectady works, and the photographs, which were taken and arranged by Mr. Butler himself, are exceedingly clear and artistic. The price of the book is reasonable, considering the labor and workmanship involved in its production.

THE "HARRISBURG" IDEAL ENGINE.

W. R. Fleming & Co., formerly at 174 Fulton street and now removed to the new Mail and Express Building, corner Fulton street and Broadway, this city, are installing two of their now celebrated "Ideal" self-oiling high-speed engines in the new Naval Observatory at Georgetown Heights, Washington, D. C. As is well known, there is no more exacting customer than the government, and these engines were selected by Lieutenant A. V. Zane, of the Naval Department at Washington. After bids were received, he visited this city to investigate the merits of the different engines, and personally visited the engine rooms to see them run. He also visited other cities for the same purpose, and on his return to Washington the "Ideal" engines were ordered. His reason for ordering these engines were, as he expressed it, for their perfectly noiseless running, as the officers in the observatory, in order to use their instruments with accuracy, can have no vibration of any kind in the building, and on investigation Mr. Zane concluded these engines exactly suited to his purpose. The service required is very exacting, but the "Ideal" engine is fully equal to any demands of this kind that may be made upon it, as can be proved by the many fine electric plants now being noiselessly run by the "Ideal" engine in this and other cities.

INVESTIGATION.

A resolution was recently offered in the House of Representatives, Washington, D. C., by Mr. Crain, of Texas, requesting the Attorney-General to furnish information as to whether the Edison General Electric Company, the Thomson-Houston Electric Company or the General Electric Company have violated the provisions of the Anti-Trust Act in submitting proposals for furnishing lighting for the World's Fair at Chicago.

NEW YORK NOTES.

OFFICES OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, May 14, 1892.

THE *Electrical Engineer* has moved into the new Mail and Express Building, 203 Broadway.

THE offices of the Excelsior Electric Company have been removed to 42–44 Broad street.

THE FORT WAYNE ELECTRIC COMPANY, H. C. Adams, eastern manager, has moved its offices to 42–44 Broad street.

THE Eastern office of the Brush Electric Company, Mr. Hamill, manager, has been moved to 42–44 Broad street.

THE offices of the Norwich Insulated Wire Company have been removed from 58 Cedar street to 62 Greene street.

THE INTERNATIONAL THOMSON–HOUSTON ELECTRIC COMPANY has removed from 115 Broadway to 42–44 Broad street.

MR. C. C. SIBLEY is now connected with the Edison Electric Illuminating Company, of New York, Pearl and Elm streets.

W. R. FLEMING & COMPANY have moved from 174 Fulton street to the new Mail and Express Building, Fulton street and Broadway.

MR. J. H. SHAY, of the Munson Belting Co., Chicago, is in town. When last seen by your representative he was in good company and after business.

S. L. BARRIETT has opened a shop at 161 Washington street, having bought out the old Barriett Electrical Company, and is prepared to promptly fill orders for motors, etc.

THE D. FRISBIE COMPANY, manufacturer of elevators and hoists with C. & C. motors, is now occupying handsome and commodious quarters in the new Mail and Express Building.

THE New York office of the Thomson–Houston Electric Company, which is under the management of Messrs. Curtis and Dean, has been moved from 115 Broadway to 42-44 Broad street.

THE headquarters of Day's Kerite wire have been moved to Room 310 new Mail and Express Building, Broadway and Fulton streets. On the door will be a design of a section of Kerite cable executed in beautiful colors, which will be very artistic and attractive.

To show how near the West we are, Chas. E. Chapin, of 136 Liberty street, telegraphed to Warren, Ohio, for a barrel of Packard high grade lamps at noon, May 10, and at noon on the following day an expressman wanted $1 for a barrel that had arrived from Warren, O.

VAN WAGONER & LINN, electrical contractors, 74 Cortlandt street, furnish estimates for electric light works, electric gas lighting, burglar alarms, electric annunciators and all kinds of electric and speaking tube work. They have good facilities for carrying on their trade.

AT a meeting of the Brooklyn Institute a committee of two was appointed to confer with the management of the Claremont Avenue Rink, with a view to securing that building some time during November next for an electrical exhibition to be given under the auspices of the Institute, which has been promised the support of several large electrical companies.

THE COMPLETE ELECTRIC CONSTRUCTION COMPANY, 10 Cortlandt street, of which Mr. John A. Seely is general manager, has secured the contract for putting in the underground cables in Buffalo, N. Y., for the Buffalo Brush Electric Light Company. These cables are being supplied by the Safety Insulated Wire and Cable Co., 234 West 29th street, New York. About twenty-five miles will be used.

THE FORT WAYNE ELECTRIC COMPANY last week sold two 80-H. P. new Wood generators to the Hornellsville Electric Railway Company, Hornellsville, N. Y. The Wood arc system still continues to hold its own. Another 80-light dynamo, making 6 in all, was lately sold to the Manhattan Electric Light Company, New York. An order for a 630-light alternating dynamo for Cartagena, U. S. Colombia, South America, has also been received. All of these sales were made through the New York office of the company.

THE SAFETY INSULATED WIRE AND CABLE COMPANY, 234 West 29th street, has purchased the adjoining building, 50 x 100, 4 stories high, now occupied by the Cary and Moen Spring Company. The company has perfected arrangements to extend its manufactures, so as to include submarine and all other lines of wires and cables. Mr. L. R. Requa, the general manager, is the inventor of the safety system of insulation, and one of the most prominent chemists in this section. He thoroughly understands the requirements of the electric light, telegraph, telephone and cable companies, his knowledge extending over a long period.

STANLEY & PATTERSON, 32 Frankfort street, handle magnet wires, of all sizes, manufactured by the Atlantic Covering Company, and have just laid in a full and complete stock. They are the exclusive agents for Cutter's specialties in aluminum cone reflector shades, flexible fixtures, flush switches, etc. They have just brought out a new double annunciator drop, the magnets being of the same resistance as the bell magnet. The bell is mounted on the top of the back board with the drops, and in this way avoiding the necessity of an extra bell for testing. The annunciator magnets are set one before the other, not side by side, as is usual in other drops. The drop is made of handsomely-stamped finished brass, highly finished, with an ingenious catch, which holds the drop securely and at the same time being readily released. Messrs. Stanley & Patterson have on exhibition a fine Holtzer-Cabot automatic motor, made with resistances in the bottom of the base, for three different speeds.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	86 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	206 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	115 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	15 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	79 75
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	113¼
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 25
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	22 00
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	52 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	14 00
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*05
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	4 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s, Ark.	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	66 75
Thomson-Houston pref.	4,000,000	25 00	30 50
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	92 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	29 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	47 00
Westinghouse Ass. Rects.		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The annual election for officers under whose management the New York Stock Exchange will continue was held on the 9th inst. and created considerable excitement among the members. To us Americans, perhaps, under all circumstances an election is looked forward to with a greater degree of pleasurable feeling than any other people. It is always uncertain; a black horse may turn up at any moment previous to the conceded and accepted nominations; after that war begins, and the Stock Exchange is no exception to the rule. There were two tickets in the field; that which was called the opposition contained the names of John H. Jacquelin and John Hone in place of W. B. Laurence and H. G. S. Noble for governors, and Chas. Stokes and Geo. H. Watson for members of the nominating committee, in lieu of A. G. Hodges and Edward L. Rogers. A healthy interest was taken, as shown by the fact that 652 votes were cast. The regular ticket was successful, and here is the list of those elected, with the offices they will fill: President, F. K. Sturgis; treasurer, D. C. Hays; secretary, George W. Ely; chairman, James Mitchell; members of the governing committee, W. B. Dickerman, A. M. Cahoone, John H. Jacquelin, James Seligman, C. W. Maury, John Hone, F. M. Thieriot, E. C. Homans, R. B. Whittemore, R. P. Doremus; trustee of the gratuity fund, W. E. Strong; members of the nominating committee, H. H. Hollister, George R. Sheldon, Charles Stokes, George W. Watson, H. Duncan Wood.

President F. K. Sturgis was cheered, as only brokers can cheer, when he took his seat just vacated by W. B. Dickerman, and responded in a neat little speech, thanking the members, invoking their aid and promising integrity and impartiality. The other officers were congratulated, and business proceeded as usual. The ELECTRICAL AGE, in tendering its congratulations, calls attention to the activity in industrial securities, and especially the electrics. We predict that on more than one occasion during the year the money articles will contain records announcing that the market was led by one or more electric stocks. At the moment Edison General takes the lead; next month will probably see the General Electric take its place in the business of the Exchange.

The development of successful combination of capital proceeds rapidly, regardless of the opposition of small dealers and others who find it impossible to get an interest or who oppose it on principle. Money is the great moving spirit, and leaving electrical propositions to one side for the moment, glancing at the concentration of capital represented by bonds and shares, we find over $10,000,000 of foreign capital being centred in Cincinnati for the purpose of controlling the distilleries of Kentucky, with a present output of 25,000,000 gallons of Bourbon. The contracts go into effect on June 1. Like nearly all foreign syndicates the control alone is desired, and in this case 40 % will be retained with the local management by the present owners. Liverpool and London furnish the capital, and investors are offered an opportunity to take a reasonable portion. Next comes the safe combination, to be known as the Herring-Hall-Marvin Co., a New Jersey corporation with a capital of $3,300,000. They include the Herring and Marvin Co.'s, of New York; Farrel and Meyers & Smith, of Philadelphia, and the Hall, of Cincinnati. Others will soon be added. Electricity will be benefited by all these combinations of capital in the shape of time-locks, burglar alarms, smelting, refining, telephoning, power transmission, lighting and many other methods.

The electric stock market has been very active this week, and should continue so until the conclusion of the negotiation between the parent companies is settled. On this occasion the shares have changed hands in quantity, over 10,000 Edison being handled in one day; usually these dealings are for a few hundred only. A great many fortunes will be made by investors in the electrics between this and the dull summer season, when the minds of capitalists are turned more on pleasure than business. Now is the time to get in.

THEY ARE APPRECIATED.

We give below a copy of a note received from Mr. J. M. Batchelor, which expresses the general sentiment in regard to the articles he refers to. Mr. Batchelor is a well-known writer himself and has recently contributed some very valuable articles to the ELECTRICAL AGE and STREET RAILWAY NEWS.

RED BANK, N. J.

EDITOR ELECTRICAL AGE: Sir, your articles on "Easy Lessons for Students" (in electricity), which are appearing serially in the ELECTRICAL AGE, are exceedingly interesting and instructive. They should obtain a wide notice. Respectfully,

J. M. BATCHELOR.

PHILADELPHIA NOTES.

THE LA ROCHE ELECTRIC WORKS report business booming, with plenty of orders ahead.

VALLEE BROS. & CO. are the agents for this city and vicinity for the celebrated Paiste Switches and "K. W." cut-outs, the manufacture of which has been taken over by the Bryant Electric Company, of Bridgeport, Conn.

MR. GEORGE WESTON, of W. H. Weston & Co., manufacturers of switches, etc., is laid up from the effects of an accident met with recently while operating a milling machine. He has the sympathy of his friends.

WESTERN NOTES.

LUKE LILLEY, city electrician of Cincinnatti, O., has got the g—b—, having been caught working several little snaps on the outside in connection with his official position.

MR. J. H. COOKE has severed his relations with the Sunbeam Incandescent Lamp Company, Chicago, and taken charge of the Chicago office of the Buckeye Electric Company, of Cleveland, Ohio.

THE GREAT WESTERN ELECTRIC SUPPLY CO., Chicago, has found it necessary to secure larger quarters, in order to satisfactorily comply with the requirements of its rapidly increasing business.

THE Chicago office of the Short Electric Railway Company has been removed from 225 Dearborn street to the new Monadnock Building, corner Dearborn and Jackson streets.

KOHLER BROTHERS, Chicago, representing the Western branch of the Eddy Electric Manufacturing Company, have removed to an elegant suite of offices in the Monadnock Building.

THE office and store-room of the Railway Equipment Company, Chicago, Ill., pending the fitting up of its new and permanent quarters, will be at 11 Adams street, which location is well known as the former headquarters of the Electric Merchandise Company.

TRADE NOTES.

THE engines manufactured by the Ball and Wood Co., New York City, still continue to grow in favor; so much so, indeed, that the Company finds it necessary to consider augmenting its works.

THROUGH the energetic efforts of Mr. Wm. P. Hall, its president, the business of the Hall Signal Company, 50 Broadway, New York, has been wonderfully increased since the first of the year. Orders keep piling in, to the great satisfaction of all concerned.

E. A. WILLIAMS & SON, the proprietors of the Jersey City Smelting Works, 105–111 Plymouth street, Jersey City, are ready to sell standardized fuse wires of all kinds, and are out with a circular giving points as to the carrying capacity, etc., of all their wires.

IN the quarters of the Interior Wiring and Fixture Company, 14 Clinton Place, New York, will always be found a full and complete supply of the various electric light and gas fixtures, of the latest designs, dealt in by it.

THE J. H. MCEWEN MANUFACTURING COMPANY, of Ridgeway, Pa., has completed the installation of two 100-H. P. engines for the Punxsutawney Electric Light Company, of Punxsutawney, Pa.

The Electrical Age's Illustrated Patent Record.

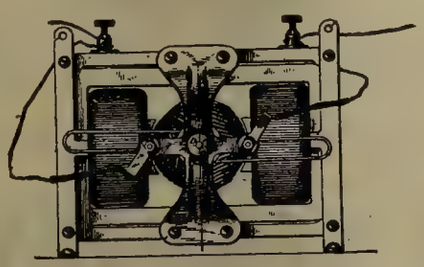
Issued May 10, 1892.

474,388. Dynamo-Electric Machine or Motor. Charles D. Jenney, Indianapolis, Ind., assignor to the Jenney Electric Motor Company, same place. Filed Jan. 8, 1891.

474,398. Electrically-Heated Vessel. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Sept. 5, 1891.

474,403. Truck for Electrically-Propelled Vehicles. Louis Pfingst, Boston, Mass. Filed Oct. 6, 1891.

474,447. Electric Speed-Regulator. John W. Gibboney, Lynn, Mass. Filed Sept. 26, 1891.



474,388.—DYNAMO-ELECTRIC MACHINE OR MOTOR.

474,454. Exciting-Fluid for Galvanic Batteries. Carl Lütcke, Jr., Berlin, Germany. Filed April 17, 1890.

474,468. Electric Conduit. Augustus Bruner, Indianapolis, Ind. Filed March 7, 1892.

474,469. Lightning-Arrester. Malcolm Dickerson, Fort Wayne, Ind. Filed March 14, 1892.

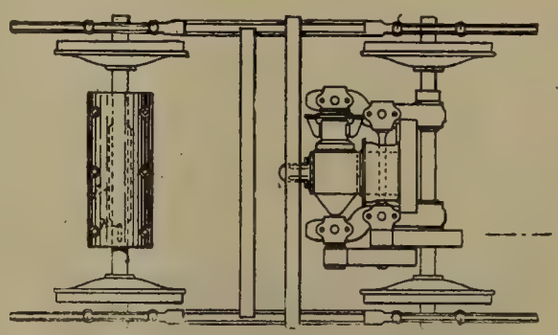
474,472. Cleaning-Brush for Electric Railways. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed March 18, 1886. Divided and this application filed Feb. 8, 1889.

474,473. Electric Snap-Switch. George K. Hutchins Baltimore, Md. Filed Dec. 26, 1889.

474,523. Electrical Indicator. John W. Gibboney, Lynn, Mass. Filed Dec. 10, 1891.

474,541. Electric Switch. Carl A. P. Willing and Richard J. G. Violet, Berlin, Germany. Filed May 26, 1891.

474,542. Thermostat. Archibald H. Brintnell, Toronto, Canada. Filed April 11, 1891.



474,403.—TRUCK FOR ELECTRICALLY-PROPELLED VEHICLES.

474,552. Trolley for Electric Railways. Charles E. Friel, Boston, Mass. Filed March 17, 1892.

474,584. Connection for Electric Conductors. Charles W. Tobey, New Bedford, Mass. Filed Jan. 28, 1891.

474,600. Commutator-Brush. Robert Hirsch and Herman Meminger, Milwaukee, Wis. Filed Dec. 11, 1891.

474,623. Circuit-Controller for Electric Motors. William S. Andrews, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed May 27, 1891.

THE "CLARK" WIRE.



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In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

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Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



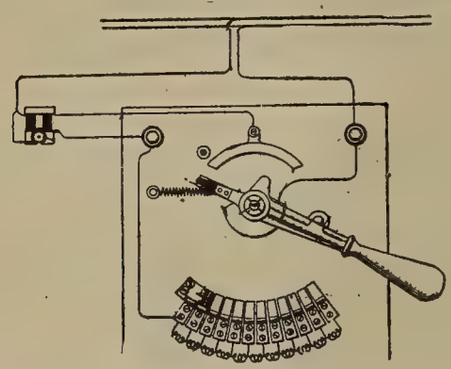
EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

474,624. Dynamo-Electric Machine or Motor. Joseph D. F. Andrews, London, England, assignor, by mesne assignments, to the Curtis Electric Manufacturing Company, of West Virginia. Filed Jan. 18, 1892. Patented in England.

474,632. Electrical Switchboard. Louis A. Fehr, New York, N. Y. Filed Nov. 28, 1890.



474,623.—CIRCUIT-CONTROLLER FOR ELECTRIC MOTORS.

474,670. Automatic Fire-Alarm. Morris Martin, Malden, Mass., assignor, by mesne assignments, to John F. Nielson, Elizabeth, N. J. Filed Feb. 21, 1887.

474,673. Electric Heat-Alarm. Joseph Meyer, Jersey City, N. J. Filed Dec. 14, 1891.

474,735. Electric Wind-Vane Indicator. Henry J. Haight, New York, N. Y. Filed Oct. 30, 1891.

474,787. Electric Machine. Herbert A. Wagner and Ferdinand Schwedtmann, St. Louis, Mo., assignors to the Wagner Electric Manufacturing Company, same place. Filed May 15, 1891.

474,797. Electrical Heater. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Dec. 14, 1891.

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RODS AND PLATES FOR BATTERIES.

CROW FOOT ZINCS.

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THE TROLLEY IN BROOKLYN.

A trial trip was made on Friday, May 20, over that portion of the Brooklyn City Railroad so far completely equipped with the trolley system. This section of the line extends from Third avenue and 25th street to Fort Hamilton. President Lewis and a party of guests boarded the first electric car over the line, and the run was made without a hitch. Everything worked in a very satisfactory manner. Rapid progress is being made in changing to the trolley system, and the work is being done in the best manner possible.

IN DARKNESS.

On the night of May 17 Detroit was in total darkness through an accident to the steam-plant at the electric-light station, and on the same evening a portion of Brooklyn was threatened with the same fate. A fire in the station of the Citizens' Electric Light Company, Brooklyn, caused the lights supplied therefrom to be extinguished for about 15 minutes. The fire was brought under subjection and the lights again turned on.

FIRST ANNUAL DINNER.

The American Institute of Electrical Engineers is to be congratulated on the unqualified success attending the introduction of a new feature at its annual meetings, namely, a dinner. At the first annual dinner of the institute, which was held on the evening of May 17, there was a large attendance of distinguished persons engaged in the electrical field, and the affair passed off in an exceedingly pleasant manner. The after-dinner speeches were extremely interesting and full of suggestions, and the compliments paid to the enterprise of his American co-workers by Prof. George Forbes, of London, were received with great satisfaction and applause. The professor always sees much to admire every time he comes to America, particularly in electrical development, and he is afraid that his English brethren will question his loyalty to the British crown when he relates to them the wonderful advances made in America. It was, indeed, pleasant to listen to the sincere utterances of the professor regarding the position America occupies in reference to electrical progress, particularly in the electric railway line; and he was forced to admit that England would be far better off if her people had a part of the spirit of enterprise possessed by Americans. We think the professor would do better if he should transfer his allegiance to the great country over which the Stars and Stripes float. He has too progressive a mind to be held in subjection by the slow, methodical English way of doing things. Yet, perhaps, he can do more good in his present position. He can make an occasional visit to America to see how things are getting on, then go back home and shake things up for a while.

A social dinner will be one of the features of the annual meetings hereafter, and there is no question that it will accomplish a vast amount of good for the institute. It will bring members together and get them better acquainted with each other, and in this way promote interest and fellow-feeling in the association.

The election of Mr. Frank J. Sprague as president of the institute for the ensuing year was a happy one. Mr. Sprague is a man of great energy, enterprise and experience, and he will exert himself in every way to make this year the most successful one in the history of the institute.

We congratulate Mr. Sprague on his election, and the institute in having secured so worthy a gentleman to preside over its affairs.

POWER GENERATOR.

The generator shown in the accompanying illustration is of recent production by Mr. James J. Wood, the well-known inventor of the arc-light system operated by the Fort Wayne Electric Company, and electrician of the same concern.

This generator is well designed and constructed and possesses features that are not found in other generators for electric-railway purposes. One of these features is the light weight for output; a 60 H. P. machine weighing but 3,600 lbs., and the 120 H. P. machine about 13,000 lbs. In the matter of economy of space these generators are extraordinary, the 120 H. P. machine occupying a floor space of only 91 x 97 inches.

The capacity of the 120 H. P. generator is 120,000 watts.

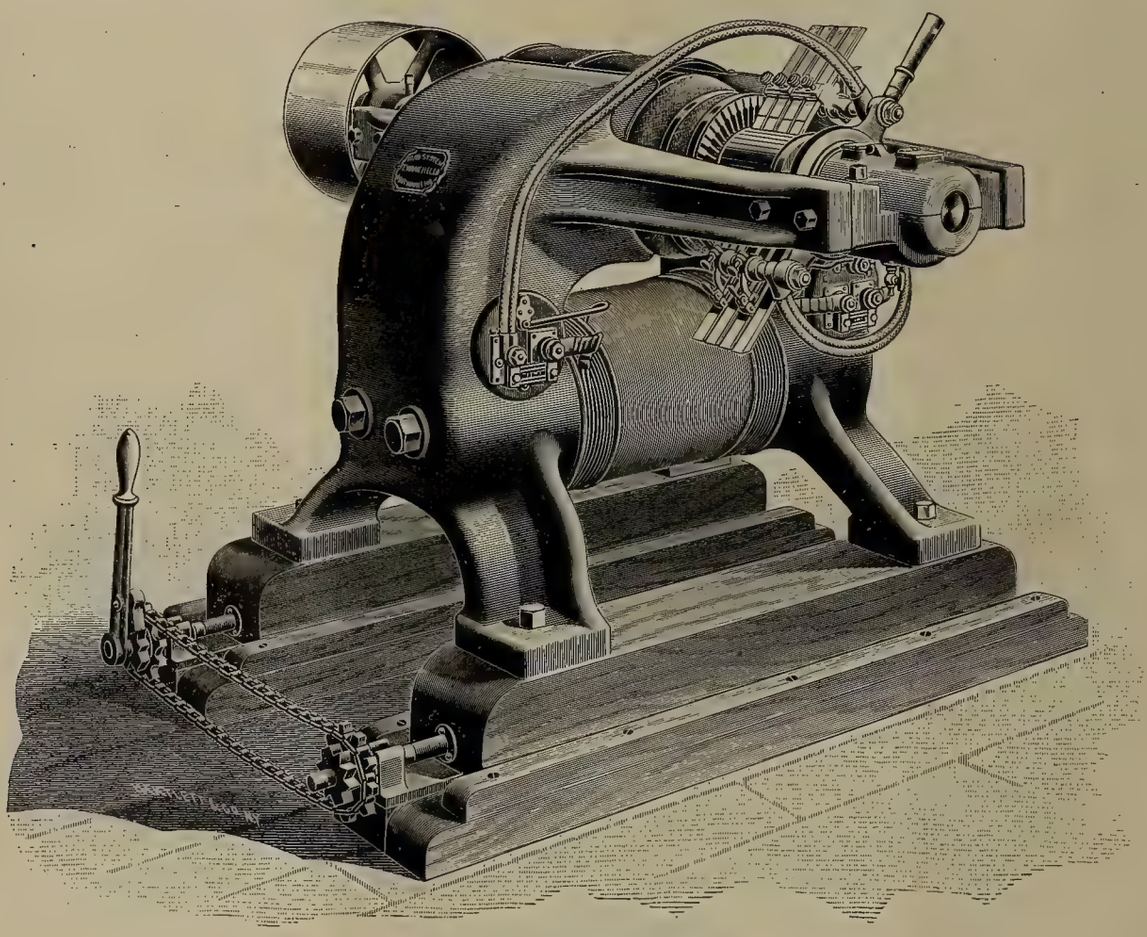
The Fort Wayne Electric Company manufactures these generators from 10 H. P. up to 120 H. P.

ELECTRICAL EXECUTION.

Joseph L. Tice was executed by electricity in the prison at Auburn, N. Y., at 8:39 o'clock on the morning of May 18. The execution is said to have been a success in every particular, lasting but two and one-half minutes from beginning to end. There was a largely increased voltage over that used at the previous executions, and some changes were made in the method of applying the electrode.

Tice walked to the chair without assistance, and after he had seated himself the straps were hastily adjusted. The head electrode consisted of a metal cap filled with sponges which brought the current to both temples. The other electrode was fastened to the calf of the left leg. At a signal from Dr. Daniels, Warden Brown turned on the salt water to the electrode sponges, and electrician Davis moved the switch, 1,720 volts being driven through Tice's body. The current was kept on for fifteen seconds. After an intermission of three seconds the current was again turned on for another period of fifteen seconds. There was a cessation for five seconds, and then a contact for ten seconds, with another interval of five seconds, and finally ten more of contact. The execution had occupied exactly one minute and three seconds. The appearance of the victim was perfectly natural, the face retaining the same appearance as when he had sat down.

The crime for which Tice was executed was the killing of his second wife on July 11, 1891. Tice was the ninth man executed under the new law.



RAILWAY POWER-GENERATOR.

The generator has self-contained multiple fuses for each end of the circuit and also an equalizing connection, the object of which is to connect several machines in multiple, and it is so arranged that all the machines can be kept working at the same potential irrespective of the load.

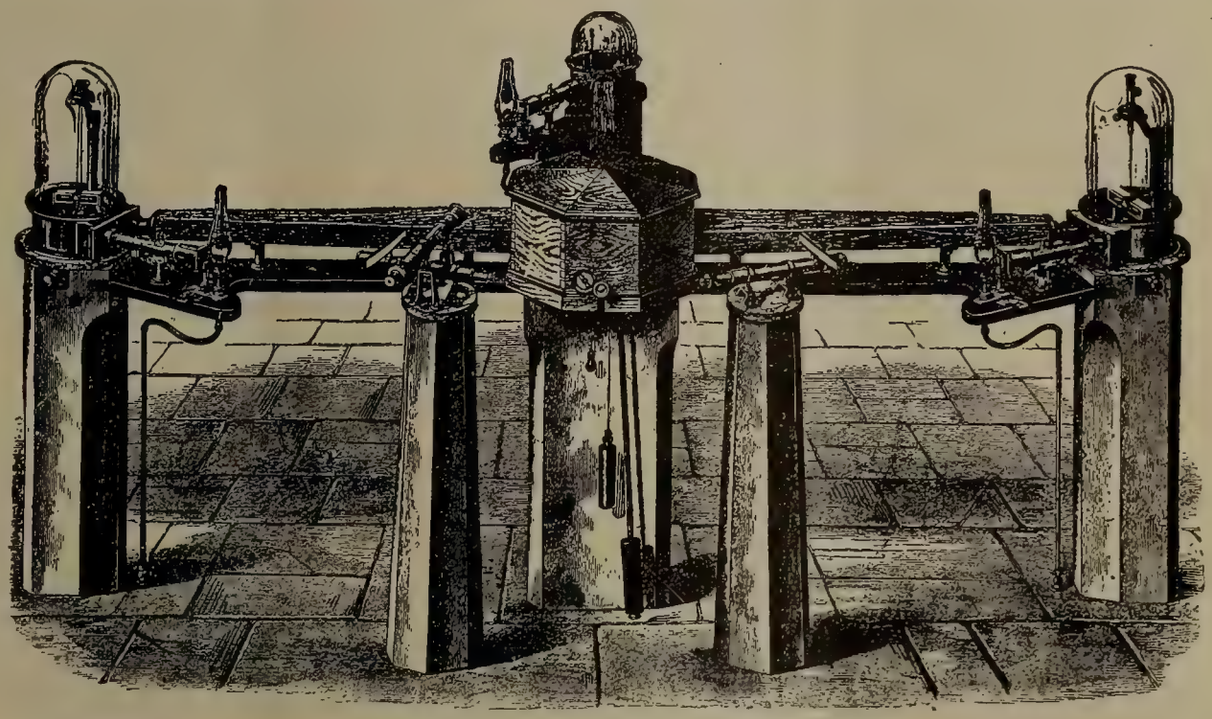
For the purpose of facilitating its operation the machine is set on a patent anti-friction and insulating sliding base, which keeps the motion positive irrespective of slackening or tightening the belt.

In the construction of these generators only the best of material and workmanship are employed, and in electrical efficiency they are about all that could be desired. They are perfectly self-regulating on all changes of load with an entire absence of sparking at the brushes.

These machines are fitted with self-oiling expansion-boxes, and in every respect represent the highest degree of perfection, both mechanically and electrically.

SELF-RECORDING MAGNETIC APPARATUS.

At Kew and other magnetic observatories the daily and hourly variations of the magnet are recorded on a continuous register. The means employed consist in throwing a beam of light from a lamp on to a light mirror attached to the magnet whose motion is to be observed. A spot of light is thus reflected upon a ribbon of photographic paper prepared so as to be sensitive to light. The paper is moved continuously forward by a clock-work train, and if the magnet be at rest the dark trace on the paper will be simply a straight line. If, however, the magnet moves aside, the spot of light reflected from the mirror will be displaced, and the photographed line will be curved or crooked. Comparison of such records, or "magnetographs," from stations widely apart on the earth's surface promises to afford much light upon the *cause* of the earth's magnetism and of its changes, of which hitherto no reliable origin has been with certainty assigned.

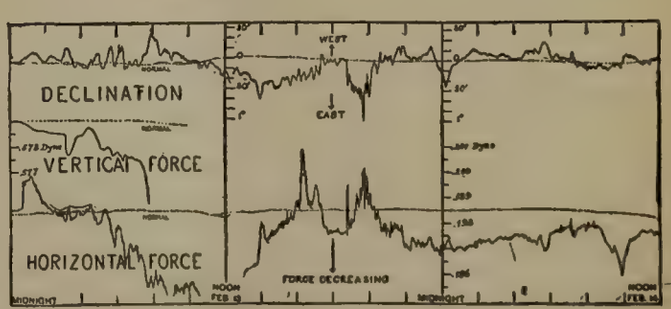


NEW MAGNETOGRAPH AT THE NAVAL OBSERVATORY, WASHINGTON.

The phenomenon of earth-currents appears to be connected with that of the changes in the earth's magnetism, and can be observed whenever there is a display of aurora and during a magnetic storm; but it is not yet determined whether these currents are due to the variations in the magnetism of the earth, or whether these variations are due to the currents. It is known that the evaporation always going on in the tropics causes the ascending currents of heated air to be positively electrified relatively to the earth. These air-currents travel northward and southward toward the colder polar regions where they descend. These streams of electrified air will act like true electric currents, and as the earth rotates within them it will be acted upon magnetically. Whether this will account for the gradual growth of the earth's magnetism is an open question. The action of the sun and moon in raising tides in the atmosphere might also account for the delicate magnetic variations which occur daily. It is important to note that in all magnetic storms the intensity of the perturbations is greatest in the regions nearest the poles; also, that the magnetic poles coincide very nearly with the regions of greatest cold; that the region where auroræ are seen in greatest abundance is a region lying nearly symmetrically round the magnetic pole. It may be added that the general direction of the feeble daily earth-currents is from the poles toward the equator.

STARTING SHUNT MOTORS.

A shunt motor, without any auxiliary starting arrangement, may refuse to begin to rotate of itself if standing idle when the current is switched on. This defect is due to the fact that the current, finding a path of comparatively low resistance through the armature as compared with the shunt windings, flows almost entirely in that path. Only a small proportion of the current flows in the shunt. The lower the armature's resistance the less current will flow in the shunt, and there will be little or no magnetism in the field. When, however, the motor is started, the revolution of the armature immediately sets up in its coils an opposing or counter-electromotive force, as before explained. This being, in the case in point, equivalent to increasing the resistance of the armature,



RECORD OF MAGNETIC STORM, MADE BY MAGNETOGRAPH.

a proportionately larger current will at once flow in the shunt and the field-magnet will become energized. As the speed increases, more and more current will be diverted round the shunt, because the counter-current of the armature is nearly proportional to the speed. The greatest effect will therefore be exerted by the motor when the magnets are magnetized to saturation.

ELECTRO-MAGNETS.

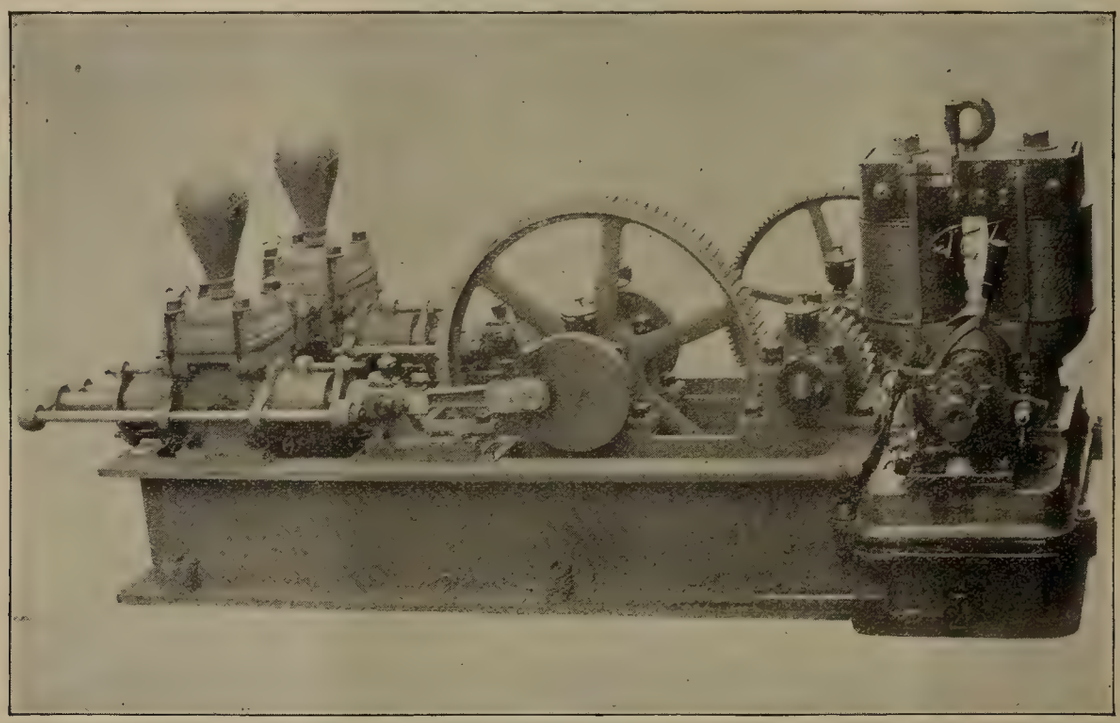
A very important factor to be considered in the construction of an electro-magnet is the length of the coil and of the core, as compared with the diameter. It is generally conceded that the maximum or outside diameter of coil should not exceed three times the diameter of the core, and while it has been said that the best results will be obtained by having the length of the core six times its diameter, there does not appear to be any universal reason for such a proportion. In a bar-magnet, however, where there is a desire to employ but one pole only, and get rid of the effects of the other, a decided advantage is to be gained by using a core of much greater proportional length, and should there be any restrictions as to the amount of wire to be used, fewer layers can be wound over a long piece of iron than would be over a shorter one. In this way the distance between the iron and the wire would be reduced, and having the same resistance the number of lines of force would consequently be correspondingly increased. If the same proportion were to be maintained between the respective diameters of the lengthened core and its coils, and the gauge of the wire so increased as to maintain a constant resistance and constant number of turns, the polar strength developed close to one end of the core will vary as the square of the length of the core—that is, if the core is not lengthened so extensively as to permit a leakage of the lines of force at the sides of the coil. This limit will vary with different qualities of iron in accordance with the relative permeability, or in other words, capability of conducting lines of force.

The above description treats only of electro-magnets in which the wire has been evenly wound its entire length; but for some purposes it is preferable to vary the method of winding.

We will suppose, for example, that it is desired to construct a bar-magnet which shall develop close to its extremities a very powerful field, and yet at the same time not exert any force at a comparatively greater distance. In such a case it should have the wire coned up near the ends; that is to say, it should have a larger layer of wires over the ends, the number gradually decreasing towards the middle and with few or none being wound over the central position of the core. As a rule, the wire should not at any point be wound more than three times the diameter of the core. In such a magnet the lines of force will be powerfully developed near the ends and have but little tendency to leak out. On the other hand, much smaller curves will be made than would result from an equal length of wire wound evenly along the entire length of the core.

ELECTRIC PUMP.

A good combination of a pump operated by an electric motor is the equipment which the Edison General Electric Company is about to put on the market. This consists of an Edison standard motor of the type '85, with a Deane duplex double-acting pressure-pump upon one and the same special bed-plate. These pumps have outside packed plungers, with the valves arranged above the cylinder in such a manner that they can be uncovered for examination or repair without removal of any pipes. The covers of the valve chests are held down by swing bolts. To remove these covers it is only necessary to loosen the nuts and swing the bolts away without removing them. The pump is operated by the motor by means of a double gear. The details and arrangement are shown in the cut.



PUMP OPERATED BY EDISON MOTOR.

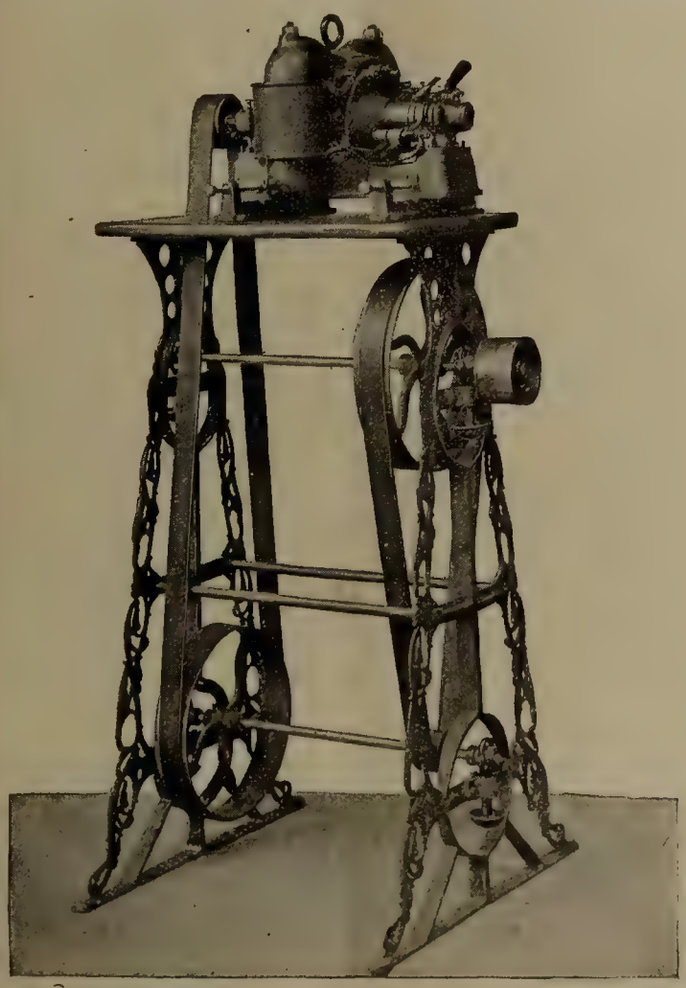
CONVERSION OF MECHANICAL INTO ELECTRICAL ENERGY.

It has been found that to produce a given electromotive force and current a certain expenditure of power is indispensable, since electricity itself is but another form of motion, which requires power to produce it. It is also found that whether we seek to produce 1 volt and a current of 1,000 ampères or 1,000 volts with a current of only 1 ampère the power expended will be the same; so for the convenience of calculation the term *watt* has been introduced to indicate the amount of electrical energy contained in 1 volt x 1 ampère. One horse-power of mechanical energy, which is equal to the work done per minute by 1 lb. falling through 33,000 feet, or by 33,000 lbs. falling 1 foot, is equivalent to 746 watts. This means that if we could convert directly, without any loss through

friction or any other imperfection, 1 horse-power of mechanical energy into electrical energy, we should obtain 746 watts. As we can subdivide the watts into ampères and volts at our discretion, so we could at will obtain either 746 ampères at 1 volt pressure or 1 ampère at 746 volts pressure, in exchange for our horse-power, or any two factors of volts and ampères which multiplied together produce 746. In practice the best modern dynamos waste in conversion from 2½ to 5 per cent. of the energy put into them as motive-power; in other words, it is possible to obtain from 95 to 97½ per cent. of electrical energy from a dynamo absorbing 100 per cent. of mechanical energy to drive it.

FAN-MOTOR STAND.

Messrs. McLeod, Ward & Co., 91 Liberty street, New York, have just brought out a novel fan-motor stand of iron about five feet high. The motor is set on top of the stand and belted down to the counter-shafting for the purpose of reducing the speed of ceiling fans. This stand was designed to do away with the use of unsightly counter-shafting and belts, etc., on ceilings. It is made



SPEED-REDUCING STAND FOR FAN-MOTORS.

of ornamental iron, and can be finished in bronze, brass, etc., as may be desired. This firm has lately completed an installation of 1,500 lamps in the building of the New York Biscuit Company, 16th street and 10th avenue. The plant consists of one Billberg dynamo, made by Thomas H. Dallett & Co., Philadelphia, and a 100 H. P. Billberg motor, said to be the largest now running in New York city. Six "Ward" arc lamps were also installed to run on this circuit. The firm is kept busy installing its ceiling fan, which was recently illustrated in the ELECTRICAL AGE. Messrs. McLeod, Ward & Co., besides being manufacturers of fans, blowers and exhaust systems, are also manufacturing electricians and contractors for the installation of electric light and power plants.

ANNUAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting of the American Institute of Electrical Engineers for the election of officers was held at the institute headquarters, 12 West 31st street, New York, at 4 P.M., May 17. There was a good attendance of members and considerable interest manifested. The result of the election was as follows:

President, Frank J. Sprague.

Viee-Presidents, A. E. Kennelly, Nikola Tesla and O. T. Crosby, who succeed F. B. Crocker, Frank J. Sprague and Joseph Wetzler.

Managers, Charles Wirt, A. S. Hibbard, M. I. Pupin and C. P. Steinmetz, in place of Dr. F. Benedict Herzog, Dr. William E. Geyer, H. C. Townsend and Francis R. Upton.

Secretary, Ralph W. Pope.

Treasurer, George M. Phelps.

The following-named gentlemen were elected honorary members: Lord Kelvin (Sir William Thomson), Dr. Werner Siemens and Cyrus W. Field.

The report of council showed the membership to be 615, a net increase of 74 over last year.

The officers holding over from last year are as follows: Vice-presidents, Thos. D. Lockwood, Carl Hering, Wm. J. Hammer; managers, J. C. Chamberlain, P. B. Delany, H. A. Foster, H. Ward Leonard, Dr. Louis Bell, Herbert Laws Webb, Prof. A. G. Compton and James Hamblet.

The general meeting of the institute will be held at Chicago June 6, 7 and 8.

After the elections were over Mr. Sprague assumed the chair and made a few remarks thanking the members for the honor bestowed upon him, and at once settled down to business.

The business of the meeting was concluded at 5:30, and at half-past six the members assembled at "The Arena," across the street, where a subscription dinner was served. This certainly was one of the most delightful affairs the institute ever participated in, and at the close of the post-prandial exercises it was decided that the annual-dinner feature of the institute should be continued, and that this one would be known as the "First Annual Dinner."

There were between 60 and 75 members present at the dinner, and the greatest enthusiasm and cordiality prevailed. Among those present were: Prof. George Forbes, of London, England, who sat at the left of President Sprague; E. E. Higgins, general manager of the Short Electric Railway Company, Cleveland, Ohio; O. T. Crosby, H. Ward Leonard, Franklin L. Pope, C. A. Benton, A. S. Hibbard and Dr. Louis Duncan.

After the dinner had been disposed of and cigars lighted, President Sprague arose and made a few appropriate remarks, invoking the co-operation of all the members in his effort to carry on the work of the institute this year, which was to be an important one.

He then called upon Mr. T. D. Lockwood for some remarks, and that gentlemen kept the party in extremely good humor for a few minutes with his witticisms. After getting down to the serious part of his remarks he called attention to the significant and interesting fact that auroras had occurred exactly every 27 days since the first of the year. He spoke of the several theories proposed concerning the nature of electricity, but thought we should be cautious about the acceptance as an ultimatum what any man says electricity is.

Mr. O. T. Crosby was next called upon. He spoke of the electric railway, and predicted that radical changes in the industrial and social conditions in our cities would be brought about by electricity. He believed rapid transit would have a wholesome effect on communities by eradicating many of the existing evils in city government. This he thought would be brought about by spreading

the population and relieving congestion. Those engaged in the electrical art, he thought, were going to be the forces which would produce these changes. He spoke very enthusiastically of the important part the electric railway would play in bringing about these great social and industrial changes, and his sentiments were generously endorsed by the hearty applause they evoked.

After Mr. Crosby, appropriate remarks were made by Mr. C. E. Emery and Mr. Oberlin Smith, who were followed by Prof. Forbes. The professor spoke in a complimentary manner about the great progress made in America in matters pertaining to electricity, yet in England in some things we were surpassed. Electric lighting, for instance, he said, was conducted there in a more substantial and satisfactory manner than in America. All the stations in London are of a high class and put up to stay. In electric traction, however, they were lamentably behind-hand in England. This the professor said was due to the great opposition there to the overhead trolley system, but the time would soon come when they would take hold of electric traction the way they did electric lighting, and make a good job of it. During his recent travels throughout the country he had paid particular attention to electric traction in American cities, and had studied the various systems on all sides. He thought the progress made in this country in this industry was simply phenomenal, and when he returned to England and made his report they would accuse him of disloyalty, as they had done before when he had made reports of American enterprise after former visits here.

The slowness in England of introducing new electrical enterprises, he said, was due to the fact that they were waiting for substantial conditions. All the experimenting was being done in America, and when Americans had settled down to a solid basis, England would take hold, and with all the benefit of American experience, come to the front. He admired American enterprise, and thought that England would be greatly benefited if the people there had some of America's go-ahead spirit.

He referred to the Niagara Falls tunnel enterprise and was surprised at its magnitude, and closed his remarks by complimenting the electrical fraternity of America on the cordial manner in which they entertain their foreign brethren. He assured his hearers that the fraternity in England were always glad to reciprocate these kind attentions.

Interesting remarks were made by Franklin L. Pope, T. C. Martin and Dr. Louis Duncan, and at 10:45 the exercises were brought to a close.

ELECTRICAL SOCIETIES.

THE CANADIAN ELECTRICAL SOCIETY.

At a meeting of the executive board of the Canadian Electrical Society, held at Hamilton, Ont., May 11, it was decided to hold the annual convention of the association at Hamilton on June 14, 15 and 16. The programme for the three days is as follows :

Tuesday, 14th, at 11 A.M., meeting of the executive board. In the afternoon the election of officers will take place, and a session will be held in the evening for the transaction of regular business. Wednesday, 15th, afternoon session for the reading of papers by different members of the society on diverse subjects ; in the evening an excursion will be made to Burlington Beach by boat. Thursday, 16th, a general discussion of the papers will be held and the business of the meeting concluded. Afterwards a drive around the city and a dinner will close the convention.

The membership in the association is now over 120, and the attendance at this convention promises to be very large.

THE NEW ENGLAND ELECTRIC CLUB.

We are pleased to note the organization of an electric club in the city of Boston. It will be known as the New England Electric Club, and is to be opened on May 25. The club starts out under favorable auspices, over 200 members having been already enrolled. Large donations have been received from all the large electric companies and allied interests. The ELECTRICAL AGE extends to the club its heartiest good wishes for all success and prosperity.

NEW YORK ELECTRIC CLUB.

At a meeting of the board of managers of the Electric Club of New York, held on May 20, twenty-one new members were elected. The club will give a concert on May 27, and an enjoyable entertainment is promised. The affairs of the club are in an excellent condition, and its future prospects very satisfactory.

A LIVE ISSUE.

BY J. M. BATCHELOR.



IN view of the existing tendency among electrical organizations and street railway companies to unite in the shape of enlarged combinations, it is interesting to note some comments on the subject by General E. P. Alexander, who, in a Southern newspaper, dwelt upon the subject of railway consolidation at considerable length, and in a most striking and forcible manner. He said that centuries ago it was discovered that there might possibly be too much of even a good thing, and that too much of some remedies, even of competition, might sometimes constitute another disease. From this conviction arose gradually innumerable forms of what are called protective unions, brotherhoods, alliances and associations in every trade, profession and occupation on earth, until to-day every man sees in his own business, which is the only one he understands fully, that after competition has run to a reasonable extent there must be some form of protection devised against competition gone mad. The correctness of this general view is just now being notoriously emphasized by the calamitous effects of an over-production of cotton.

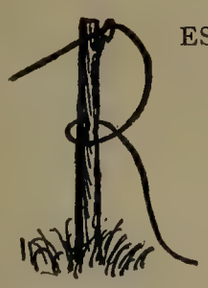
There is sound reason in Gen. Alexander's attitude, particularly as he applies it in the case of railways, be they for local or any purposes, because railways are the objects of more or less legislative discrimination in all the States of the Union, and some form of protection, as he well says, is a positive necessity, not for the purpose of increasing the burdens of the patrons of such roads, but to establish a combination of interests which will enable all concerned to protect themselves from the unjust encroachments of legislatures or any other agencies. Right or wrong, however, the principle, or rather the advantages, of combination are so numerous to the participators that the conclusion is natural in saying we now are on the eve of a much wider movement in the direction of combination than any which has preceded, simply because of the strict economy there is in it, a feature almost lost sight of in the numerous newspaper criticisms against trusts, or whatever name the combination passes under. These critics fail to comprehend

the problem, and devote their energies to crying down everything which a corporation, as such, is permitted to do, merely because the cut-throat policy of competition is removed, or rather, supposed to be removed; for, as a matter of fact, should the combine increase prices in consequence of a supposed monopoly, such advance would be a practical premium for the establishment of rivals. But the true merits of such combinations is a matter entirely apart from the issue of competition, for they permit an economy that is variously estimated all the way from 15 to 30 per cent. of what it is possible to do by any member of such combinations acting alone. While we will not attempt to describe in detail what those economies are, they being almost countless in variety and differ in each case, they can be easily appreciated by explaining that they are the difference between doing business on a wholesale scale and doing it in a retail way. If a new method of doing business is devised which will permit a reduction in the cost of service to the extent described, it is absurd to antagonize it solely from fear that the operator will abuse what is erroneously supposed to be, by the adverse critics referred to, his power. These critics argue that firms should do business at a loss of from 15 and above per cent. rather than take a course which will enable them to prevent it, merely because they, the critics, cannot understand the true advantages derivable to all consumers from combination. Consumers or patrons, as the case may be, are directly benefited in the reduction of prices so long as it is not done at the expense of labor, that is, wages. Consequently such patrons are primarily benefited when the manufacturer or the corporation simplifies his business methods in a manner which will permit a reduction in cost to the consumer; for if no such economy is made no reductions to consumers are possible. For these reasons it becomes a self-evident proposition in saying that combinations, or so-called trusts, are here to stay.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Resistance.



RESISTANCE is the term used in the science of electricity to indicate the property possessed by all substances of offering opposition to the flow of electric currents.

As in the case of electrical potential, which was the subject of consideration in our last article, electrical resistance has an analogue in the water-pipe, and what is true of water passing through a pipe is equally true of an electric current passing through a wire.

When a stream of water passes through a pipe there is a friction between the pipe and the water which retards the flow of the latter, and this friction is greater as the pipe grows smaller in diameter. So it is with conductors of electric currents. The smaller the wire the greater will be the friction or resistance to the passage of the current, and the larger the wire the less will be the resistance. To overcome resistance greater potential or electromotive force is required, as was explained in our last article ; it is advantageous, therefore, always to keep the resistance down as low as possible.

All substances do not possess the same degree of resistance ; some offer exceedingly small and others interpose a very great resistance to an electric current. Those substances which offer the least resistance are called conductors, and those which offer the greatest are known as insulators. All substances are conductors to a greater or less degree. All the metals are conductors and offer the least resistance to the passage of currents, though the resistance varies greatly, some metals offering more than others.

Silver offers the least resistance to a current, and is for this reason adopted as the standard of comparison. Representing a silver wire of given diameter and length as 1, the resistance of a hard-drawn copper wire of the same diameter and length would be 1.086, and an iron wire of similar dimensions would have a resistance of 6.460, more than 6 times that of copper and silver. Copper wire is used for electric lighting because it offers the least resistance and at the same time is within the limit of commercial economy, although it is a very important factor in electric-light calculations on account of its high cost compared with that of iron. Iron is generally used for telegraph wires, although it offers greater resistance to the current. The general use of copper wire for telegraph purposes is to a great extent prohibitive on account of the greater comparative cost, and it is more economical to increase the current strength to overcome the resistance of the iron wire than it would be to use copper. In late years, however, copper wires have come into extensive use for important telegraph circuits.

Resistance is a necessary evil in telegraphy. Consider a telegraph instrument for a moment. The magnets are wound with a very long, fine copper wire, which, on account of its fineness, offers great resistance to the current. Fine wire must be used in order to get a great number of turns around the core of the magnet to produce the necessary electro-magnetism to operate the instrument. It would not do to use large wire, because the magnets would necessarily get beyond all proportions in the matter of size. The currents required to operate telegraph instruments are very feeble as compared with those used in electric lighting, being reckoned in milliampères, (a milliampère meaning one thousandth of an ampère). In electric lighting very large currents are used, consequently wire offering the least resistance possible is required for their transmission.

The resistance in an electric circuit, whether it be telegraph or electric light, has great effect on the resultant current; the current being the quotient of the electromotive force of the generator divided by the total resistance of the circuit.

This law was discovered by Ohm, a German physicist, and is universally known as Ohm's Law. It is usually expressed by this formula :

$$C = \frac{E}{R};$$

C standing for current; E, electromotive force, and R, resistance. Suppose, for example, we have a dynamo or a battery with an electromotive force of 100 volts, and the resistance of the circuit is 50 ohms, the current C, in ampères, would be 2, because, in substituting these values for the symbols of the formula expressing Ohm's law, we would have $\frac{100}{50} = 2$.

The unit of resistance is the ohm, which is named after the discoverer of the law governing electric currents above referred to. It represents the resistance of a column of mercury 106 centimetres in height and 1 square millimetre in cross-section, at the temperature of 0° Centigrade.

In practice very small and very large resistances are met with and measured. In order to facilitate the expression of exceedingly small or large values, which frequently run into the millions, the prefixes *micro* and *meg* are used in conjunction with the word ohm. The prefix *micro* means one-millionth part, and *meg* means one million. Thus if we say five *microhms*, it is equivalent to saying " 5 one-millionth parts of an ohm," or $\frac{5}{1.000.000}$. One *megohm* means one million ohms, and in insulation tests, where the resistance to the passage of the current through the insulating substance is very great, the term

megohm is constantly used. Good insulation runs up into the millions of ohms in its resistance.

Temperature has great influence on the resistance of substances. In the case of metals the resistance increases with the temperature—that is to say, the higher the temperature the greater is the resistance. This is very noticeable on long telegraph lines. On cold days such a line has the least resistance, while on hot days its resistance is greatest; and these variations occur during very short periods of time. Thus, for instance, a wire will have less resistance early in the morning, before sunrise, than it has when the sun is up high in the heavens. These variations in resistance are noticeable in the working of multiplex systems, and have to be compensated for. In electric-light circuits the question of variation of resistance in the lines is not of sufficient importance to require any special consideration in calculations, because the lines are comparatively short, and the variation is not perceptible in practical work.

The longer a conductor is the greater will be its resistance, of course, the resistance being proportional to its length. Thus, if a wire 1 mile long has a resistance of, say, 10 ohms, one hundred miles of similar wire will have one hundred times that resistance, or 100 (miles) × 10 (ohms) = 1,000 (ohms).

The resistance of a wire varies inversely as the square of the diameter. Thus if one wire has a diameter of, say, one-tenth of an inch, and the other two-tenths, the area of the cross-section of the latter will be four times that of the former, because the areas of circles are to one another as the squares of their diameter. Therefore the larger of the two wires will have one-fourth the resistance of the smaller one. The same rule applies in all calculations affecting resistance and diameters of wires.

While the resistance of substances of a metallic nature increases with the temperature, that of non-metallic substances behaves in the opposite manner—that is to say, the resistance of such substances decreases as the temperature increases, and *vice versa*. Hard rubber, for instance, has very great resistance, but if we apply heat to it its resistance decreases as the heat increases; and so it is with all substances that are classed as insulators.

A STUPENDOUS COLUMN OF WATER.

Altogether the most extraordinary water-power installation—so far as head is concerned—ever known has recently been made by the Pelton Water Wheel Co. in one of the famous Comstock Mines at Virginia City, Nevada. The wheel is 36 in. diameter, made of a solid steel disc, with the buckets riveted on to the periphery in a way to afford absolute security, weighing complete 180 lbs.

It is running under a vertical head of 2,100 feet, equal to 911 lbs. pressure. 460 feet of this head is obtained from the pipe line of the Gold Hill Water Co., and the remaining 1,640 feet from the California and Con. Virginia shaft, down which the pipe line is run to the Sutro Tunnel level, where the power station is located and through which the water discharges after passing over the wheel. The wheel runs at 1,150 revolutions, with a peripheral speed of 10,804 feet per minute, or about 120 miles per hour.

The construction of the wheel amply provides for the centrifugal strain the velocity of the water gives it, running without load, when it would attain the enormous speed of 21,608 feet per minute, equal to about 240 miles per hour. A nozzle tip ½ in. diameter gives under above conditions 100 H. P. Every miner's inch of water, equal to a flow of 1.6 cubic feet per minute, gives 5 H. P., while 1 H. P. is given for every 2 lbs. of metal in the wheel. It is only by comparison that an idea can be obtained of the height of a column of water due to such pressure. It is more than four times as high as the Washington Monument, and considerably more than twice the height of the Eiffel Tower. It is safe to say that no water-wheel has ever before been operated under any such head, nor any such demonstration afforded of the velocity and power of water under such an extreme pressure.

The installation made by the Pelton Company some two years ago in the Chollar shaft on the Comstock lode is in some respects no less extraordinary. This consisted of six 40-in. Pelton wheels, which run under a vertical head of 1,680 feet, driving that number of electrical generators, the power from which is conveyed up the shaft to the Nevada Mill, some 2,000 feet distant. These wheels weigh only 220 lbs. each, and with nozzle tips ⅝ of an inch diameter develop 125 H. P. each.

The water is first run over a Pelton wheel on the surface under 460 ft. head, and is then carried down the shaft by a pipe to the Sutro Tunnel level, where the underground station is located, the power from the electrical generators being conveyed to the counter-shaft of the mill with which the surface wheel is connected, the two distinct forces working together in perfect harmony.

A most interesting illustration of the double use of water is here given, some 400 H. P. being produced in this way from what may be termed waste water. This station has now been running more than three years without interruption and practically without expense in the way of repairs, as well as without any appreciable loss in efficiency, affording a most striking example of the advantages of water-power, both by direct application and electric transmission, as well as the reliability of such a plant under such extraordinary conditions.

ANNUAL MEETING OF THE WESTINGHOUSE COMPANY.

The Westinghouse Electric Company held its annual meeting in Pittsburg on May 18.

According to reports submitted, during the fifteen months of reorganization ending March 31, the indebtedness was reduced from $5,298,632 to $1,783,297. The company now owns the Consolidated Electric Company, of New York, and the United States Electric Lighting Company, of Newark, N. J. It has three factories and employs 1,600 men.

The business for March and April of this year amounted to $1,576,323. The cash and available assets are approximately $3,150,000. The company has in its treasury 7,355 shares of preferred stock, 19,242 shares of active stock and $332,751.97 in first mortgage bonds. Now that the company's motor or street-railway system, is perfected, it is no longer entirely dependent upon the electric light business.

The following directors were elected: Charles Francis Adams, of Boston; Lemuel Bannister, of Pittsburg; August Belmont, of New York; A. M. Beyers, of Pittsburg; N. W. Bumsted, of Boston; Marcellus Hartley, of Boston; George W. Hebard, of New York; Henry B. Hyde, of New York; Brayton Ives, of New York, and George Westinghouse, Jr., of Pittsburg.

ANIMAL ELECTRICITY.

Several species of creatures inhabiting the water have the power of producing electric discharges by certain portions of their organism. The best known of these are the *Torpedo*, the *Gymnotus* and the *Silurus*, found in the Nile and the Niger. The *Raia Torpedo*, or electric ray, of which there are three species inhabiting the Mediterranean and Atlantic, is provided with an electric organ on the back of its head. This organ consists of laminæ composed of polygonal cells to the number of 800 to 1,000 or more, supplied with four large bundles of nerve-fibres; the under surface of the fish is —, the upper +. In the *Gymnotus electricus*, or Surinam eel, the

electric organ goes with the whole length of the body along both sides. It is able to give a most terrible shock, and it is a formidable antagonist when it has attained its full length of 5 or 6 feet. Humboldt gives a lively account of the combats between the electric eels and the wild horses, driven by the natives into the swamps inhabited by the *Gymnotus*.

Nobili, Matteucci and others have shown that nerve excitations and muscular contractions of human beings also give rise to feeble discharges of electricity.

ANSWERS TO INQUIRIES.

EDITOR ELECTRICAL AGE: Will you kindly advise me what is the velocity of electricity and light?

FREEDOM, PA. C. J. R.

Answer.—Wheatstone states that the velocity of electricity is 288,000 miles a second, but the fact is there is no definite assignable velocity. The flow of a current through a wire is affected by so many different conditions that it is impossible to state in a general way what the velocity is. Light is said to have about the same velocity as electricity.

Is there any way of preventing the sparking at the contact points of telegraph instruments; if so, will you kindly point to the way out of my troubles? T. A. C.

OLEAN, N. Y.

Answer.—Sparking may be partially prevented by connecting a condenser in shunt around the points. Another good plan is to connect in the same manner a choking magnet of high self-induction. Such a magnet may be made by winding fine wire on an iron core. The coil should be very long compared with its diameter.

Please explain the cause of the production of electric current in a battery cell. J. T. E.

FRANKLIN, PA.

Answer.—It is not known definitely any more than that the electricity is generated by chemical action, which consists in a transferring of the atoms from one compound or element to other elements or compounds. When this change occurs an electric current is the result.

I have a plating dynamo which gives me trouble sometimes by losing its residual magnetism. Can you tell what may be the cause of it? and oblige, P. O.

VICKSBURG, MISS.

Answer.—You give no data on which we can base a reply to your question. The trouble you complain of, however, may be caused by some opposing current circulating in the magnet coils of the dynamo while the machine is idle, such currents coming from the depositing vats.

In the quadruplex apparatus the No. 2 relay as it is called has very short magnets. Why are they made so short? O. C.

PORTLAND, ME.

Answer.—These magnets are made short so that the cores will charge and discharge quicker. The reason that they do charge and discharge quicker is because the magnetic inertia, or lag, is decreased by shortening the core. Magnetic inertia means the inability of the magnet-core to instantly loose or acquire magnetism.

I would like to know what is the value of the legal ohm, and if it is the same as the British Association unit? S. M. M.

ALTOONA, PA.

Answer.—The legal ohm is the resistance of a column of mercury one square millimetre in cross-section and 106 centimetres in length, at the temperature of 32° F. The legal ohm is not the same as the B. A. unit. The legal ohm $=1.00112$ B. A. unit, which value was adopted by the International Electric Congress in 1884, and is now accepted internationally as the true value of the ohm.

Is the passage of an electric current through a conductor of very low resistance accompanied by any heat? Why is it that a small wire heats more than a large one? Please give formulæ for the determination of heat generated in a conductor. H. E.

DUNKIRK, N. Y.

Answer.—Heat is developed in any conductor by the passage of a current, however low the resistance may be. Heat H is equal to the square of the current, C^2, multiplied by the resistance of the wire, or, $H=C^2R$. It will be seen from this that the greater the resistance the greater will be the heat. In a comparatively large conductor the heat is spread over a considerable surface, and is rapidly lost by radiation.

SUBWAY COMMISSIONER.

George R. Gray has been appointed an electrical subway commissioner by Gov. Abbett, of New Jersey, in the place of James Smith, Jr., who resigned.

ELECTRICAL ENERGY.

Whenever a current of electricity flows a certain amount of energy is expended, and it is necessary to be able to measure exactly the amount of energy so expended in any circuit or in any part thereof. The quantity of work performed in raising a mass of one pound through a difference of level of one foot against the force of gravity is generally taken as the unit of mechanical energy, and is known as the foot-pound. The work done in raising any mass through any height is found by simply multiplying together the number of pounds in that mass by the number of feet through which it is lifted. Somewhat similarly we can take, as the practical unit of electrical energy, the amount expended in transferring a unit quantity of electricity (one coulomb) through a difference of potential of one volt. And by multiplying the number of coulombs, which have flowed from one point to another by the difference of potential in volts between those points, we obtain the number of units of electrical energy expended during the passage of the current. The unit of electrical energy, or one coulomb multiplied by one volt, is called the joule. As a simple numerical example, we may suppose a current of 10 ampères to flow for 5 seconds, then the quantity of electricity passing through the circuit would be 50 coulombs, and if this current were maintained by a potential difference of 8 volts, the amount of energy expended in that time would be $8\times 50 = 400$ joules.

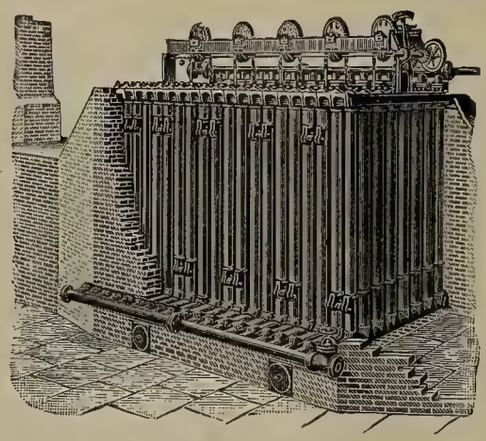
As a rule, we wish to know the *rate* at which work is being done in any circuit rather than the amount which is done in a given time. It is evident that this rate can always be found by dividing the amount of work by the number of seconds taken for its performance; but the same result can be arrived at by multiplying together the potential difference and the rate of transference or flow of electricity instead of the quantity actually transferred in a given time. Now the rate of flow of electricity is what we know as the current strength, which is measured in ampères. Therefore, if the difference of potential in volts between any two given points is multiplied by the resulting current in ampères the product gives the rate at which energy is being expended, or the rate of working between those two points. The unit rate of working or the unit of *power* is called the *watt*—that is to say, 1 ampère $\times$ 1 volt $=$ 1 watt. Therefore, if a difference of potential of 20 volts between the ends of a wire maintains a current of 3 ampères the rate of working is $3\times 20 = 60$ watts.

FUEL ECONOMIZERS.

The use of fuel economizers as an important and very necessary adjunct to a steam-plant is so well known as to call for but little or no comment. Every one having any knowledge of steam boilers knows that they are used for the purpose of utilizing the vast amount of surplus heat which would otherwise be wasted and escape up the chimney in heating the feed-water for the boiler.

An economizer which has met with much success and become very popular is one known as the Green Economizer. The apparatus consists of a set of cast-iron pipes about four inches in diameter and nine feet in length, made in sections (of various widths), and are connected together by "top" and "bottom boxes;" these again being connected by "top" and "bottom branch pipes" running lengthwise, one at the top and the other at the bottom, on opposite sides, both outside the brick flue which encloses the economizer. The waste gases are led to the economizer by the ordinary flue from the boilers to the chimney.

The feed-water is forced into the economizer by the



FUEL ECONOMIZER.

boiler pump or injector at the lower branch-pipe nearest the point of exit of the gases, and emerges from the economizer at the upper branch-pipe nearest the point where the gases enter. Each pipe is provided with a scraper, which is made to travel continuously up and down the pipe at a slow rate of speed, the object being to keep the external surface clean, soot being a non-conductor of heat.

The mechanism for working the scrapers is placed on the top of the economizer, outside the chamber, and the scrapers are moved up and down by rods and chains which pass through small openings in the top of the machine. The motive-power is supplied by a belt or from some convenient shaft; the power required is so small as to be immaterial. The apparatus is fitted with blow-off and safety valves. A space is provided at the bottom of the chamber for the collection of soot which is thrown off by the scrapers.

Great care is exercised and only the best of material employed throughout in the construction of these economizers, a very noticeable feature being their extreme simplicity and freedom from complications.

While, as we have said before, these economizers have become very popular, they will now become more so from the fact that Mr. P. M. McLaren, who has been for the past ten years connected with the Babcock & Wilcox Boiler Company as general agent, and through whose efforts and energy these boilers were so generally introduced into electric light and power stations, mills, etc., has lately become associated with E. Green & Son, the patentees and manufacturers. Large works have been built at Matteawan, N. Y., where the economizers will be manufactured, it having been found cheaper to erect a plant and manufacture them in this country than to import them from abroad, owing to the prohibitive duties imposed by the tariff.

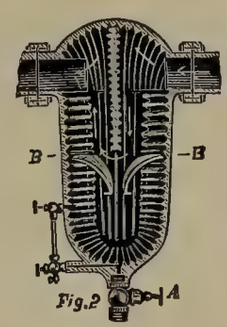
The same old-time zeal will be displayed by Mr. McLaren in his new sphere, and it will add greatly to his credit and the satisfaction of those with whom he is associated. The main offices are at 91 Liberty street, New York.

STEAM SEPARATORS.

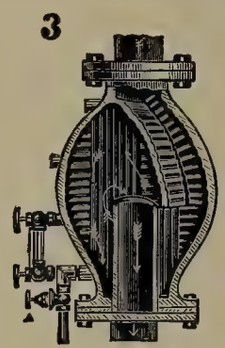
A subject which should receive the careful attention and consideration of every one interested in the use and application of steam power is the separation of water from live steam, and the keeping of exhaust steam in as pure a state as possible by the extraction of oil, grease and dirty water.

The question then becomes the selection and adoption of a device which will best fill the requirements. We take pleasure in presenting to our readers a description of the Hine "Eliminator," which has been eminently successful in this direction, and the fact of its being universally used throughout all sections of the country is a sufficient guarantee of its superiority.

The Eliminator is the only steam separator constructed in such a manner that the steam is thoroughly broken up in its passage through it, and the particles eliminated



HORIZONTAL



VERTICAL.

immediately carried entirely out of and away from the action of the steam current.

The principles of construction and operation which apply to an apparatus for the separation of water from live steam are identical with those required for the extraction of oil, grease and dirty water from exhaust steam.

The Hine Eliminator possesses all these requirements in a marked degree, and is acknowledged to be superior to all other grease extractors.

In connection with this eliminator, it is interesting to note that in a competitive test of steam separators made at Sibley College, Cornell University, in January, 1891, it came out at the head of the list.

The details of the test have been published in a neat little pamphlet by the Hine Eliminator Company, 106 Liberty street, New York, and can be had upon application, as also circulars containing complete information relating to the Eliminator and testimonials from acknowledged authorities all over the country.

HARRISBURG IDE AND IDEAL ENGINES.

The following is a list of a few of the later modern buildings in which the Harrisburg perfected Ide and Ideal engines are now noiselessly running:

Hotel Marlborough, 250 H. P.; Hotel Endicott, 210 H. P.; Hotel St. Lorenze, 110 H. P.; Hotel Del Mont, 110 H. P.; Grand Central Depot, 150 H. P.; H. C. F. Koch & Co., 125 H. P.; Brooklyn Navy Yard, 175 H. P.; Pennsylvania R. R. ferries, 125 H. P.; Browning, King & Co., 100 H. P.; "The Haberman," 100 H. P.; U. S. Naval Observatory, 90 H. P.

The favor with which these engines are regarded may

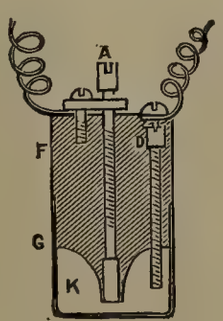
be estimated from the fact that over 600 are now in use in the United States, Chicago alone having 100.

W. R. Fleming & Co., the New York representatives of the Harrisburg Foundry and Machine Works, the makers of these engines, are doing a large trade.

OVERHEATED BEARINGS.*

The overheating of bearings in machinery has very often been the cause of serious troubles, many a conflagration having had its origin from this source, due in more cases than one to the fact of one man having been called upon to do more work than he could properly attend to. This subject, which had been long and carefully studied by Messrs. Pierce, Desisles and Oliver, led to their joint invention of the apparatus called the Electric Heat Alarm, described and illustrated herewith.

The system consists of an automatic device which is situated on the bearing, and which closes a local battery circuit when the bearing reaches a certain temperature. The battery circuit is connected to a drop annunciator with an alarm bell, which may be situated in the engineer's office or in any convenient place, the annunciator having a number on it for every bearing equipped with the device. As soon, therefore, as the alarm bell rings, the engineer has but to look at the annunciator to learn



HEAT ALARM.

at a glance which bearing is running hot, and by quick attention can either cool off the bearing or at least prevent any damage from occurring.

In using the apparatus the centre plug is removed, and the hollow screw *A* is inserted. The screw is then turned down until the bell rings; then it is adjusted for any desired temperature. The screw *D* is always connected with the battery, and the bell or annunciator to *A*. The use of two colored wires is advised.

NEW PUBLICATIONS.

We have received a copy of a handy little classified and descriptive guide to electrical books, edited and published in English, French and German by F. von Szczepanski, St. Petersburg and Leipzig. The book contains 75 pages and can be had from the International News Company, New York. Price 50 cents.

CATALOGUES.

John S. Halls, 40 Cortlandt street, New York, has issued an illustrated catalogue and price-list for 1892, of the engineers' and machinists' specialties manufactured by him. Mr. Halls' many friends will be pleased to hear he is rapidly convalescing from his recent severe illness.

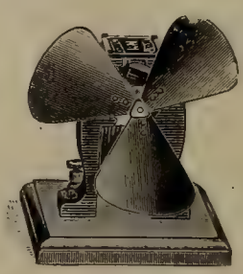
Catalogue No. 23, just issued by the Electrical Supply Company, Chicago, descriptive of the light and power supplies carried by it, contains 496 pages, and is profusely illustrated. It is gotten up in the shape of a pocket edition and is exhaustive in its details.

* Electric Heat Alarm Co., 113 Devonshire street, Boston.

A HANDY MOTOR.*

An exceedingly efficient battery motor for ventilating purposes, operating light or model machinery, turntables, etc., is the one shown in the accompanying cut, and is known as the Premier No. 3. It is made of the best soft iron, enamelled, carefully insulated and wound with best double-covered wire, has oil-cups on bearings, brass driving-pulley, binding-posts, etc., and is mounted on a hard-wood base. Being made exact to gauge, all parts are interchangeable, and the brushes are easily adjusted. The manufacturer claims that for its size it is the strongest motor in the market. It is made to take a current of from 2 to 6 volts, and has a 6-inch fan. Special motors with two fans, for the dining-table, desk, etc., and wound for special voltages, are also made at a slight advance above regular prices.

In addition to the three sizes, the company is at present manufacturing a ½ H. P. motor which will shortly be placed upon the market that will run on any continuous-



FAN MOTOR.

current lamp-circuit. It is designed to meet the demand for a low-priced motor that may be attached to a lamp-circuit to run ventilating fans, sewing-machines, dental drills, etc.

These battery motors are made under letters patent which fully cover the armature of three radial cores, also the connections to make the motor self-starting.

The company reports a good demand for its Premier battery, 5 × 7 in size. This battery will run a motor 18 to 25 hours.

CONTINENTAL DYNAMO IN NEW HANDS.

P. Claus & Co., electrical engineers and contractors, 52 Broad street and 50 New street, this city, have recently completed arrangements for the manufacture of the well-known Continental dynamos, motors and generators. The firm has already on hand several orders for dynamos for lighting and electro-deposition purposes. Among the orders recently secured is one for a complete plant for the New Manhattan Opera-House, on 34th street, New York city. This plant will consist of one 200 H. P. Weston automatic engine, one 1,200-light and and one 600-light Claus & Co. dynamo. There will be in all 3,300 lamps. It said that this will be one of the finest plants in New York city. The firm will also install a 400-light plant complete for Fred. Hollender & Co., 149 West 125th street, New York city. This plant will include one 400-light dynamo and one Ball & Wood engine. Two 600-light dynamos have been sold in Boston and one with a capacity of 1,200 ampères at 10 volts in Philadelphia. The firm will receive bids for estimates on electric-light plants and give estimates for complete electric-light installations, including engines, boilers, dynamos, wiring, feed-water heaters, etc.

Mr. Claus is well known in the trade as a first-class electrician, and his ability to make a first-class electric machine is unquestioned.

* The Premier Electric Company, Brooklyn, N. Y.

THE DETROIT ELECTRICAL WORKS.

At the annual meeting of the stockholders of the Detroit Electrical Works, held at the company's office April 26, the following gentlemen were elected directors to serve for the ensuing year: Hugh McMillan, W. H. Wells, T. H. Newberry, Gilbert N. McMillan, Jas. H. McMillan, Strathearn Hendrie and Louis Warfield, all of Detroit, and Messrs. Albert A. Pope and Geo. B. Strong, of Boston, Mass.

The following officers of the company were elected by the board of directors at the meeting held May 17th: Hugh McMillan, President; Louis Warfield, vice-president and general manager; Joseph E. Lockwood, secretary; Thomas Muir, treasurer and H. C. Van Husa, assistant secretary.

NEW INCORPORATIONS.

Galesburg Electric Motor and Power Co., Galesburg, Ill., incorporated May 13, with a capital stock of $210,000. Incorporators: P. M. Johnson, E. A. Bancroft, William Kellogg, Henry F. Arnold.

The Nicaragua Water, Irrigation and Electric Co., San Francisco, Cal., incorporated May 10, with a capital stock of $250,000. Incorporators: J. I. Jewell, C. C. Jewell, Petaluma, Cal.; W. C. Quinby, A. P. Bacon, San Francisco; W. F. Russell, Santa Rosa.

The Standard Electric Heat, Light and Power Co., Portland, Me., incorporated May 11, with a capital stock of $500,000. Incorporators: Robert J. Edwards, Frank Q. Brown, Boston, Mass.; Charles A. Campbell, Chelsea, Mass.

The West India and Columbia Electric Co., Chicago, Ill., incorporated May 12, with a capital stock of $500,000, to carry on a general telegraph and telephone business and furnish electricity for light, heat and power purposes, street railways, etc. Incorporators: John P. Dieter, William G. Adams, John H. Miller.

The Boulder Electric Power Co., Creighton, Neb., incorporated May 10, with a capital stock of $500,000, to operate mines in Park Co., Mont. Incorporators: A. N. Hawley, L. P. Ash, Charles W. Hamilton.

The Negaunee and Ishpeming Street Railway and Electric Co. (consolidation of the Negaunee and Ishpeming Street Railway Company and the Negaunee and Ishpeming Electric Light Co.), Negaunee, Mich., incorporated May 5, with a capital stock of $120,000. Incorporators: Alexander Maitland, John B. Maas, Peter White.

The Tamaqua and Pottsville Electric Railroad Company, Tamaqua, Pa., incorporated May 5, with a capital stock of $120,000. Incorporators: J. O. Ulrich, John H. Stidfole, William J. Oliver, Tamaqua, Pa.

The Lewistown and Bellefonte Electric Railway Company, Lewistown, Pa., incorporated May 6, with a capital stock of $400,000. Incorporators: Johnson Muthersbaugh, A. P. Martin, W. W. Trout, all of Lewistown, Pa.

The Canton Electric Light, Heat and Power Company, Canton, Pa., incorporated May 2, with a capital stock of $10,000. Incorporators: J. W. Parsons, W. C. Crippen, H. B. Parsons, Canton, Pa.; C. W. Carrier, Troy, Pa.

The Liberty Avenue Street Railway Company, Pittsburg, Pa., incorporated April 23, with a capital stock of $50,000, to operate an electric street railway. Incorporators: S. J. Wainwright, Jr., M. F. Leslie, P. C. Bryne, Pittsburg, Pa.

The Susquehanna Railway Company, Susquehanna, Pa., incorporated May 5, with a capital stock of $75,000, to construct and operate an electric railway. Incorporators: C. Eberle, Girardville, Pa.; M. Walsh, Beaver Falls, Pa.; George R. Graham, Allegheny, Pa.

The Moscow Electric Light and Power Co., Moscow, Idaho, incorporated May 7, with a capital stock of $50,000. Incorporators: M. J. Shield, P. Tillinghast, J. H. Shields.

The Lynden Electric Motor Railway Co., Lynden, Wash., incorporated May 6, with a capital stock of $250,000. Incorporators: W. N. Lawrence, Jr., Dr. Walter Wilbur, H. A. Judson, E. J. Robinson, S. Kildall, E. Edson, P. C. Williams, S. H. Bradley, Alfred Keohan, B. W. Loring, all of Lynden, Wash.

The Enamel Insulator Co., Chicago, Ill., incorporated May 11, with a capital stock of $500,000. Among other things it will manufacture, buy and sell electric heating devices. Incorporators: Thomas E. Morford, Robert W. Vasey, Henry B. Ford.

Neftel & Marsh Co., Jersey City, N. J., incorporated May 9, with a capital stock of $50,000, to purchase, sell, furnish and equip electrical and other machinery, apparatus, etc. Incorporators: K. Neftel, Jersey City, N. J.; C. W. Marsh, H. M. Hawkesworth, New York, N. Y.; F. B. Marsh, Brooklyn, N. Y.

Electric Cutter Co., East Orange, N. J., incorporated May 9, with a capital stock of $25,000, to manufacture, sell and deal in electric cloth cutters, etc. Incorporators: J. Smith, A. K. Thyll, L. A. Smith, New York, N. Y.

The Atlantic and Western Telephone Company, Chicago, Ill., incorporated May 16, with a capital stock of $5,000,000, to manufacture, use and license others to use electric speaking telephones throughout the United States. Incorporators: H. P. Caldwell, H. C. Strong, D. A. Strong, E. B. Springer, G. J. M. Porter, G. M. Brinkerhoff.

PRINTING BY ELECTRIC POWER.

The Sedalia daily and weekly *Democrat*, of Sedalia, Mo., will henceforth run its printing-press by electricity. The Edison Company has installed a 3 H. P. Standard Edison Motor in the Equitable Building, Sedalia, Mo., for this purpose. Current will be taken from the mains of the Electric Railway, Light and Power Company of that town.

ELECTRICITY AND THE PRESS.

The proprietors of the *Daily Palladium*, New Haven, Conn., have, among other improvements made in their plant, discarded their steam-engine and adopted electricity as the motive power for their presses. The Edison General Electric Company has installed one of its 12 H. P. motors in the Palladium Building, and the paper observes: "The motor occupies very small space, is noiseless, easy to manage, and does its work quite as effectively as the cumbersome and more expensive steam-engine, and at far less expense."

WELL-EQUIPPED POLYTECHNIC SCHOOL.

The Rose Polytechnic Institute, an advertisement of which appears in this issue of the ELECTRICAL AGE, is one of the few well-endowed and well-equipped schools of a college grade in the United States devoted exclusively to the professional education of mechanical, electrical and civil engineers and chemists. Very special attention is devoted to electricity.

It is the strongest possible evidence in favor of this school that for several years the number applying for admission has exceeded the limited number that can be admitted.

Those intending to study engineering should address Rose Polytechnic Institute, Terre Haute, Indiana, for catalogue.

MARRIED.

Mr. Louis Warfield, general manager of the Detroit Electrical Works, Detroit, Mich., was on May 2 last, united in marriage to Miss Alice McMillan, of Detroit, Mich. The home of the bride's parents, where the ceremony took place, was brilliantly illuminated and decorated profusely with flowers, and the affair was one of the most elegant seen in Detroit for a long time Mr. Warfield's large circle of friends in the electrical fraternity wish him joy and prosperity in his new venture.

NEW BOOKS.

An advance copy of the second edition of the "Dictionary of Electrical Words, Terms and Phrases," by Prof. Edwin J. Houston, has just been received from the publishers, The W. J. Johnston Company, Limited, Times Building, New York City. The first edition of this book was published in 1889, and was somewhat smaller than the new one. The second edition has been entirely rewritten and revised, and is practically a new book. It is octavo and contains 562 double-column pages. There are 570 illustrations which cover a very wide range of electrical apparatus. Definitions are given under about 5,000 distinct titles, and nearly as many more titles are entered for the sake of giving cross-references to other titles under which their definition may be found. The type is clear and the paper of excellent quantity. Price of book, $5.00.

LIGHTING BY ACCUMULATORS.

The Union Electric Company, of New York, is installing an accumulator plant to be used for lighting at Aldrich court, 45 Broadway. The plant will consist of 150 cells, each having a capacity of 500 watt hours. These cells will be used for supplying the lights in the building after 6 o'clock P.M., the maximum number of lights being 250. The cells will be charged each day while the regular dynamo plant is in operation, and drawn from after 6 o'clock. Heretofore one engine has supplied the lights after 6 P.M., for both Aldrich court and the Columbia Building, but under the new arrangement the two buildings will be operated independently as far as the lights are concerned, the accumulator plant supplying the current for the lights in Aldrich court alone.

The accumulators of the Union Electric Co. are made under the patents of Prof. Wm. Main. The positive plates are made of a number of thin sheets of lead, enclosed between two stout outer sheets. These are all perforated at once in a press and secured together by numerous leaden rivets. During the process of "forming," the inside lead sheets are completely converted into peroxide of lead, leaving the thick ones on the outside, which are but superficially affected. As retaining-walls and supports, the transverse holes afford free access of current and fluid to the interior of the plate. The working surface thus obtained is much greater than the outer flat sides would afford. No peroxide can drop out, and the plate, however thick it may be, is discharged uniformly throughout.

FIRE.

Fire broke out in an extension to the Navy street wing of the Citizens' Electric Light Company, Brooklyn, on the evening of May 17. Damage, about $5,000.

With the breaking out of the fire the electric lights supplied to a large portion of the western district were extinguished. The fire was under control in fifteen minutes, and five minutes later the lights were going all right again.

ELECTRIC LIGHTS EXTINGUISHED.

Owing to the bursting of a steam-pipe connected with the engine in the works of the Detroit Electric Light and Power Company, Detroit, Mich., at 8:30 P.M., May 17, every street light in the city as well as those in private houses and other buildings was extinguished. So far as the streets were concerned Detroit spent a night in darkness.

EASTERN NOTES.

The Economic Electric Manufacturing Company, of Boston, Mass., reports business very good.

H. L. Slade & Co., Boston, Mass., successors to Kendall & Slade, are very busy in their line of electric lighting, etc.

Mr. Geo. F. Talcott, the popular travelling salesman of the Simplex Electric Co., Boston, Mass., is looking after the affairs of the company during the brief absence of Mr. J. R. Mason, who is in Chicago, combining business with pleasure.

H. N. Bates & Co., Boston, Mass., dealers in shafting, pulleys, hangers, gears, friction pulleys and general machinery for the transmission of power, report an excellent business. They keep a large stock constantly on hand, and any one requiring such goods should write for a catalogue.

Mr. Henry S. Kaliske, the popular member of the Beacon Vacuum Pump and Electric Co., Boston, Mass., entertained a representative of the Electrical Age last week. The company is in a flourishing condition, and as is usual, has as many orders as it can fill.

The Samson Cordage Works, Boston, Mass., are six weeks behind in their orders, and in consequence a line of machinery of the most modern design has been placed in their factory, which will aid them in keeping apace with the continual increase of business, and filling orders promptly.

Arthur A. Brigham, manufacturers of textile machinery and mill supplies, of Boston, Mass., is supplying the ropes for transmitting the power from the engine to the ground for the Third avenue and Broadway railway lines of New York city. There will be 32 ropes for each station, 2 inches in diameter. These ropes are made of cotton and very peculiar in construction, being considered the best for the above kind of service. Mr. Brigham is supplying the rope for the cable road in Baltimore, Md. N. D. W.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, May 21, 1892.

Mr. P. C. Burns, manager of the Peru Glass and Carbon Company, Peru, Ind., was in town last week.

J. Jones & Son have moved their establishment to 39 Vesey street, where they will keep a good stock of general electric supplies in addition to carrying on their manufacturing business as heretofore.

Mr. Emil Gabel, of Emil Gabel & Co., 44 Dey street, former representative of the Munson Belting Co., Chicago, now sole Eastern agents for the celebrated Monarch rivetless and Bradford dynamo leather belting, reports great demand and excellent sales for these goods.

In the warerooms of the Apparatus Supply Company,

6 Barclay street, will be found a complete line of the fine chemical and physical apparatus for colleges, schools and laboratories, consisting of balances and weights of precision, assay materials, etc., manufactured by it. Mr. G. H. Davidson is manager.

THE NASSAU ELECTRICAL CO., 112 White street, is manufacturing what they call the Electro-faradic Hair-Brush. The brush is furnished with a faradic battery placed under the cover on the back. Quite a number have been sold, and the latest fad is an electric shampoo at some of the first-class barber shops. The company has just issued a small pamphlet descriptive of its specialties.

THE DETROIT ELECTRICAL WORKS, Detroit, Mich., have opened an Eastern office at No. 18 Cortlandt street, room 311. Mr. T. W. Warfield has been appointed district manager. Another room in the same building has also been secured to display samples of their goods. Mr. Warfield is an energetic man and no doubt will build up a lucrative business for his company in a very short time.

THE BISHOP GUTTA PERCHA COMPANY, of 426–430 East 25th street, is quite busy, just now, finishing a two-inch submarine cable that will be used to illuminate a buoy on Southwest Spit in Lower New York bay, about two miles northwest of Sandy Hook. The cable when completed will be 10,500 feet long. Mr. Henry Reed takes great pleasure in showing visitors this indeed finely constructed cable.

MR. WILLIAM M. FRISBIE, president of the D. Frisbie Company, Mail and Express Building, Broadway and Fulton street, manufacturers of passenger and freight elevators, friction clutches and pulleys, and electric hoisting machinery, is personally looking after the installing of a number of direct electric elevators with C. and C. motors in Detroit, Mich., for several large concerns, among whom are D. M. Ferry & Co., Oliver Goldsmith, and others.

SOME enterprise was shown at the time of the destruction by fire of the electric-light plant at the depot of the Long Island Railroad, Long Island city, a few weeks ago. The same day of the fire the Ball Electric Light Company placed a 100 arc-light machine and a Payne engine on a box car which was side-tracked alongside of a stationary boiler, and with this plant the station was supplied with light the night after the fire. The work was done so quickly that the patrons of the road never suspected that the regular plant had been destroyed.

C. E. CHAPIN, manufacturers' agent and resident buyer, 136 Liberty street, closed orders last week for 300 30, 35 and 40 feet chestnut poles for electric light use and 1,750 Packard lamps. The advantages offered by Mr. Chapin for out-of-town electric people are becoming rapidly appreciated, as is evidenced by the large number of commissions he is constantly receiving. Among the recent orders received was one from Colorado for a marbleized slate-switch board 18x7½ feet; another from Virginia for 36,000 feet of sash cord for arc-lamp use. Other orders received were for a Remington typewriter, sheet copper, spring brass, screws, tool steel, twist drills, Babbitt metal, glue, varnish, 25,000 push button centres, 20,000 pendant bushings, magnolia metal, wire of all kinds, and many orders for the several specialties he handles as manufacturers' agent.

BUSINESS is booming with the A. B. C. Co., 18–20 Cortlandt street. An order was lately received for the equipment of ten miles of electric railway, including wires, hangers, clips, etc. The company has four salesmen out with full lines of electric light, railway, household and office supplies, and the results of their labors are very gratifying, orders having been received which keep the company going at its full capacity. A visit to the salesrooms of the company is the same as visiting an electrical exhibition. The show windows are stocked with all styles of fan motors, gongs and bells, ranging from 12 inches in diameter to the baby call-bell; test instruments of the finest quality for all kinds of electrical testing and laboratory work; electric trumpets for the use of yachts and other purposes. The company exhibits the largest Ajax switches ever made, having a capacity of 1,500 ampères at 500 volts.

THE ELEKTRON MANUFACTURING COMPANY, New York office, 89 Liberty street, Mr. Robert Watson, manager, has lately installed two of its dynamos specially designed for use in connection with gas-engines in the country residence of G. P. Morrisini, the noted banker. These dynamos, which have a capacity of 150 lights each, are provided with three bearings and a fly-wheel for the purpose of steadying the motion of the gas-engines. Mr. D. Rousseau, of the Rousseau Electrical Works, has ordered one of these dynamos for use in his shop. A. C. Manning & Co., 18 Vesey street, agents for the Otto gas engines, have installed a 50-light dynamo to be operated by one of their engines on Ninth street. The Elektron Company is also installing a plant for the Merritt Wrecking Company on one of its wrecking vessels, consisting of one 125-light dynamo, and a Huntington search-light. The dynamo is to be run by one of the new Wells Balance Engines, made by the Wells Engine Company, 91 Liberty street. Arc lamps connected with flexible cables are used for wrecking purposes.

THE ZUCKER-LEAVITT CHEMICAL COMPANY is now settled in its new building 10–14 Grand street. The offices and salesrooms occupy the main floor. The electrical departments, which occupy the upper floors, are busily engaged in turning out a large number of new Hercules dynamos and motors for light and power purposes. The company's improved American "Giant" dynamos for electroplating, electrotyping and deposition are having a big sale. The "Giant" dynamo contains all the latest improvements up to date, and is, without doubt, a very superior machine, and of the highest efficiency. It is said to be absolutely free from sparking, and there is practically no wear on the commutator or brushes, if properly cared for. Possessing these advantages, the "Giant" dynamo should certainly meet with a large sale for electroplating purposes. Owing to the great demand for these machines, it has been found necessary to treble the working force. Mr. M. Mayer, the inventor of these dynamos, has charge of the electrical department, and as every machine is inspected by him before shipment, it may be depended upon that nothing but perfect ones leave the place. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	85 50
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	205 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	115 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101

Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	79 75
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	108 75
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y	50,000	50 00	40 00
Hickory Electric Co., N. C	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	22 00
Laclede Gas pref	2,500,000	100 00	61 50
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	12 75
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	4 00
Short Elec. Ry. Co., Cleveland, O	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*97
The Gamewell Fire Alarm Tel. Co	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Ongley Electric Co., N. Y	250,000	100 00	85 00
The Siemens & Halske Co., Ill	500,000	100 00	par
The Washington Wat. Pow., Wash	1,500 000	100 00	90
The Wells & French Co., Ill	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 50
Thomson-Houston pref	4,000,000	25 00	30 00
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	93 00
Westinghouse Elec. & Manf. Co	7,000,000	50 00	27 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	45 00
Westinghouse Ass. Rects		50 00	17 00
West Point W. Lt. & P. Co., Va	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

On the 17th inst. the New York Stock Exchange had been in existence one hundred years. The many changes which have occurred in that time, afford a subject on which no doubt some financial author will publish a volume; and from the many changes that have taken place, both in men and securities, a lesson may by learned which, if acted upon by the youth of the present institution, will surely lead to honor and wealth. The natural merging of eastern securities will be repeated in the West and South, and on practically the same lines, as the population becomes settled and more dense. While New York and its banks are the centre of American finance, the New York Stock Exchange is the particular point at which it is concentrated, and where will be found the real wealth of the nation represented and the men who in their fiduciary capacity control it. The only new innovation introduced on the occasion is the Clearing-House, which should have been adopted from twenty-five to fifty years ago. The first days clearing includes the leading active securities only, Reading, St. Paul, Northern Pacific (preferred), and Louisville & Nashville. Had the clearing by this method been delayed another month I feel sure one or two of the electrics would have been included. The Clearing-House has come to stay, and before Christmas the brokers will wonder how they managed to get along without it. The next thing wanted is a few leaders in whom the public have confidence and who will work on conservative lines. The business of the Exchange has had quite a rest for the past few years, and there is no doubt but that half a dozen solid houses, represented by known and respected men on the floor, each with his line of securities, ready with explanations of the special conditions, and dealing on the merits, not the rumored speculative qualities, would in a very short time give a tone to and wonderfully increase the business. We wish the Exchange a happy and prosperous new century.

The first grand financial battle between the two electric corporations is now on at Chicago for the lighting of the Exhibition, and the final closing of the contract will practically decide which one is to live. The first bid called for was to furnish 92,000 incandescent lamps. The Edison General Electric Company offered them at $13 per lamp, and the South Side Machine Company, a Chicago corporation, for $5.45; then diplomacy began. The Westinghouse Company came on the field expecting to carry out the contract at the lowest bid, and the result was that all were declared off and new bids asked for. This naturally brought the fight down to the Westinghouse and Edison companies alone, these companies owning or controlling all the other capable competitors. The bid at the present writing is as follows: Westinghouse, $399,000; Edison, for the alternating system, $480,694; direct system, $577,485; combination of both, $525,384. There is a great deal of bluffing going on on both sides, and it is nobody's contract yet. It is asserted that both systems will be absolutely required, and that the Westinghouse Company can only furnish the alternating system, which may lead to a fight over the patents. Every electric-light security holder in the country is interested in this contract, as it may decide the ownership of many patents, and innumerable restrainers and injunctions follow. A division of the contract is hardly possible; the fight is on and a result demanded by both.

ENLARGES ITS PLANT.

It is reported that the Wilmot & Hobbs Manufacturing Company, of Bridgeport, Conn., has purchased the property of the Bridgeport Rolling Mill Company. The original cost of these works is said to have been nearly one hundred thousand dollars, and they have been operated for a year past under lease by the Stanley Works, Alfred N. Stanton having the direct management. The plant is situated on the harbor at Cedar Creek in Bridgeport, and on a branch of the N. Y., N. H. & H. R. R., and within one block of its already extensive Cold Rolled Steel Works, thus giving the best of water and rail transportation facilities.

It is understood that the company has in view the erection of a hot-rolling mill, as the cold-rolled sheet and strip steel which it produces has to be first hot-rolled from their special billets into long strips before the cold rolling takes place, and as heretofore this has had to be done outside, the advantage in having its own rolling-mill is manifest.

It will enable the company to reduce the enormous stock of steel which it was previously compelled to carry, and in future it will keep its stock largely in the shape of billets which can be hot-rolled at a day's notice into any width and thickness which may be desired. This company has a secret and patented process for producing steel which is of such a fine quality that its business is

increasing with wonderful rapidity. It is said to be the largest producer of this kind of steel in the world, and has now an annual capacity of about twenty thousand tons of steel of all kinds.

NEW ANTI-FRICTION BABBITT METAL.

Mr. A. C. Stiles, for six years the superintendent of the brass foundry of the N. Y., N. H. & H. R. R. Co., is the inventor of a formula for the manufacture of an Anti Friction Babbitt Metal, the success of which has been phenomenal. Tried as it was for a long time on the locomotives and cars of the above-mentioned road and in competition with many other metals, it soon proved itself far superior in its ability to withstand the severest tests, and its durability in the long runs of the through Boston express trains, eliminating the long-dreaded hot-boxes which cause so many vexatious and expensive delays; for one of the best features of this metal is its ability to run *long* and *cool* without wearing out.

It has also had many tests on electric motors and rapid-running machinery of all kinds with great success.

Mr. Stiles is also the originator of a formula for bronze for heavy bearings that sustains a record on locomotive driving-wheel bearings now in use of 7,000 miles per month for 27 months, and cannot be equalled for heavy work.

All mixtures of both of these metals are made by the originator of the formula, and insure a uniform quality—always the best

The real merit of these bearings becoming more widely known, a company has been recently formed called the Stiles Smelting Co., with A. C. Stiles, pres.; Newton H. Cox, sec.; James R. Lyon, treas. New York office, 136 Liberty street. F. H. Alling, manager.

The already numerous orders would indicate the large and ever-increasing business in store for it.

P. & B. COMPOUNDS.

The merits of the celebrated P. & B. compounds manufactured by the Standard Paint Company, 2 Liberty street, New York, N. Y., are so well known as to call for but little or no comment. We will content ourselves then with a brief description of the various uses to which these compounds can be applied, particularly as regards telephone, telegraph, electric light and railway companies. The salient features of the compound are that it is a very quick dryer and a good body coating; is a complete preservative for wood, iron, brick or fabrics of all descriptions; makes surfaces thoroughly waterproof and resists the strongest alkalies and strong acids. Above all, it possesses high insulating properties. These qualities bespeak its extreme value as an important aid in all branches of electrical work. Other specialties handled by the Standard Paint Company which also enjoy an enviable reputation are P. & B. armature and field-coil varnish; P. & B. waterproof insulating tape; P. & B. giant insulating paper, and P. & B. little giant insulating paper. To Mr. Frank De Ronde, the company's representative, must be attributed the credit for the phenomenal success of the P. & B. specialties, especially the compounds. A recent order received was for 20,000 pounds of P. & B. compound, the average sale of which is 100,000 pounds per month. As an evidence of the great satisfaction which the specialties of the Standard Paint Company have given to those who have used them, we give a few of the names of several prominent firms out of the great number of testimonials received by the company. Pettingell Andrews Co., Boston, Mass.; Trustees of the New York and Brooklyn Bridge, Brooklyn, N. Y.; American Telephone and Telegraph Company, New York, N. Y.; Standard Underground Cable Company, Pittsburg, Pa.; Westinghouse Electric Manufacturing Company, Pittsburg, Pa.; The Standard Gas Light Company, New York, N. Y., and a host of others.

TRADE NOTES.

Recent shipments made by the Ball Engine Company, Erie, Pa., include the following: Maryland Steel Co., Sparrows Point, Md., one 50 H. P. simple engine; Wilmington Street Railway Co., Wilmington, N. C., two 130 H. P. simple engines and complete steam-plant; J. C. Hubinger Co., Keokuk, Iowa, one 300 H. P. cross-compound engine and condenser; J. W. Parker & Co., Philadelphia, Pa., one 50 H. P. simple engine; Chesapeake Light and Power Co., Hampton, Va., two 150 H. P. tandem-compound engines and transmitting machinery; Moundsville Electrical Co., Moundsville, W. Va., one 130 H. P. simple engine; Niagara Falls Street Railway Co., Niagara Falls, N. Y, two 130 H. P. simple engines and steam-plant complete; Electric Light Co., Elizabeth, N. C., one 100 H. P. simple engine; Philadelphia House of Refuge, Philadelphia, Pa., two 50 H. P. and one 100 H. P. simple engines; Edison General Electric Co., State House, Trenton, N. J., one 35 H. P. simple engine; Schuylkill Electric Railway Co., Pottsville, Pa., one 250 H. P. simple engine; Electric Light Co., Doylestown, Pa., one 130 H. P. simple engine; Somerville Hotel, St. Clair, Mich., one 35 H. P. simple engine and steam-plant; Freeport Gas and Electric Light Co., Freeport, Ill., one 130 H. P. simple engine; Warrenton Electric Light Co., Warrenton, Mo., one 50 H. P. simple engine; Pittsburg Iron and Steel Engr. Co., New Castle, Pa., one 50 H. P. and one 80 H. P. simple engine.

Cicerco Light, Heat and Power Company, Cicero, Ill., was incorporated May 17, with a capital stock of $150,000. Incorporators: E. L. Jeffrey, H. P. Lucas, H. P. Brauns.

The Electrical Age's Illustrated Patent Record.

Issued May 17, 1892.

474,826. Incandescent-Lamp Socket. Harry J. Gutman, Des Moines, Iowa. Filed June 29, 1891.

474,828. Medical Battery. Philip Hathaway, New York, N. Y. Filed April 2, 1891.

474,834. Non-Conducting Material. Henry W. Johns, New York, N. Y. Filed Jan. 29, 1892.

474,835. Time-Call. James Jones and James Jones, Jr., Brooklyn, N. Y. Filed July 31, 1891.

474,847. Standard for Electric Wires. Edmund C. Morgan, Chicago, Ill. Filed Oct. 19, 1891.

474,848. Armature for Electric Motors. Edmund C. Morgan, Chicago, Ill. Filed Dec. 12, 1891.

474,852. Signalling Apparatus. Bernice J. Noyes, Boston, Mass. Filed Sept. 17, 1889.

474,853. Signalling Apparatus. Bernice J. Noyes, Boston, Mass. Filed Sept. 17, 1889.

474,857. Electric-Motor Mechanism. Elbert B. Phillips, Cleveland, Ohio. Filed Dec. 24, 1890.

474,907. Hotel Call System. Grant P. Greene, Chicago, Ill., assignor of one-half to Myron A. Knapp, same place. Filed Oct. 31, 1891.

474,912. Electric Battery. Alphonso S. Keating, Corry, Pa., assignor of one-half to H. W. Thayer, same place. Filed Sept. 29, 1891.

474,913. Insulated Gear-Wheel. George F. Lockwood, Saginaw, Mich., assignor of one-half to John F. Barrows, same place. Filed Dec. 10, 1891.

474,921. Electric Switch. Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed March 1, 1890.

474,945. System of Signalling. Henry A. Chase, Boston, Mass., assignor to Albert Watts, same place. Filed Dec. 18, 1891.

474,953. Automatic Potential Regulator for Electric Currents. Alvinis L. Ellis, Chicago, Ill. Filed March 9, 1891.

474,957. Rheostat. Albert B. Herrick, Bayonne, N. J. Filed Oct. 12, 1891.

474,964. Electrically-Heated Matrix-Press. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Dec. 4, 1891.

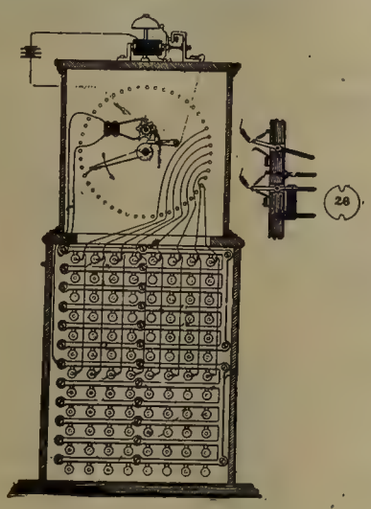
474,977. Cupping-Glass with Electrical Attachment. Francis Thomas, San Francisco, Cal. Filed Sept. 9, 1891.

474,984. Electric Locomotive. Charles Brown, Naples, Italy, and Gustav J. Melms, Chicago, Ill. Filed March 7, 1890.

475,066. Electric Signal for Engines. James C. Ricketson, Milwaukee, Wis. Filed Aug. 31, 1885.

475,107. Electric Railway. John W. Grantland, Philadelphia, Pa., assignor to Gilbert L. Parker, same place. Filed Jan. 14, 1892.

475,137. Electric Lock. Frederick Morgenthaler, Brooklyn, N. Y. Filed Sept. 10, 1891.



474,835.—TIME-CALL.

475,159. Armature for Dynamo-Electric Machines. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 6, 1890.

475,160. Electric-Railway Motor. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Dec. 4, 1890.

475,169. Electrically-Heated Curling-Iron. Arthur H. Watson and Frank E. Antonini, London, Eng. Filed Dec. 1, 1891.

475,178. Electrical Forge. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed May 6, 1891.

475,180. Electric Connector for Converters. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed May 14, 1891.

475,181. Electrical Metal-Heater. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed May 26, 1891.

475,182. Method of Electrical Metal-Working. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed June 29, 1891.

475,183. Method of Electric Metal-Working. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed July 1, 1891.

475,184. Electrical Converter. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed Oct. 21, 1891.

475,185. Electric Metal-Heater. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Feb. 14, 1891.

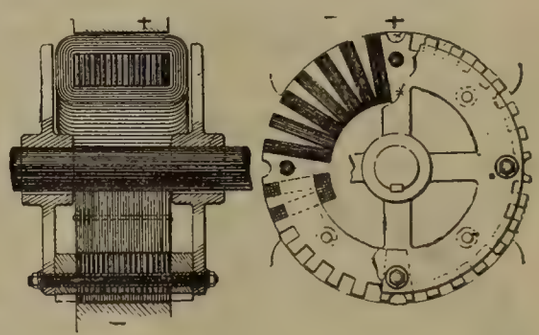
475,186. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed May 25, 1891.

475,187. Apparatus for Cooking by Electricity. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed May 28, 1891.

475,188. Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed May 22, 1891.

475,189. Electric Heater. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed May 29, 1891.

475,190. Electric Cooking Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed May 29, 1891.



475,159.—ARMATURE FOR DYNAMO-ELECTRIC MACHINE.

475,191. Flexible Electrode. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed June 26, 1891.

475,192. Electric Metal-Heater. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 3, 1891.

475,193. Electric Wire-Twister. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 22, 1891.

475,194. Electric Metal-Bending Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 24, 1891.

475,195. Electrical Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 25, 1891.

475,196. Automatic Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Sept. 16, 1891.

475,232. Converting System for Electric Metal-Heating. George D. Burton, Boston, Mass., and Arthur H. Eddy, Hartford, and George T. Briggs, Windsor, Conn., assignors to the Electrical Forging Company, of Maine. Filed Sept. 15, 1891. Patented in France, in Italy, in Spain and in Belgium.

475,255. Rheostat. Walter A. Sterling, Denver, Col., assignor of one-half to George H. Campbell, same place. Filed Nov. 6, 1891.

475,261. Device for Bending Electric Trolley-Wires. Henry D. Winton, Wellesley, Mass., assignor to the Hersey Manufacturing Company, Portland, Me. Filed Oct. 26, 1891.

475,264. Electric Metal-Heater. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed Aug. 3, 1891.

475,286. Electric-Lamp Holder. Joseph B. Moore Minneapolis, Minn. Filed Jan. 19, 1891.

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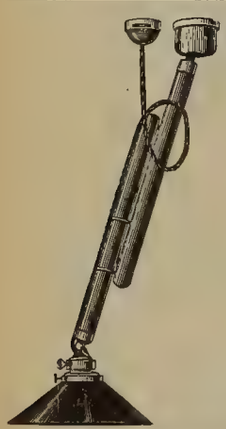
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ELECTRIC POWER IN FARM WORK.

Enterprising proprietors of large farms would do well to look into the subject of electric power to perform their farm work. Some interesting experiments have been made in this direction by the State Agricultural and Mechanical College of Alabama, at Auburn, Ala., and the electric plant is now running successfully. The power is put to various uses, such as ginning, pressing cotton, cutting up feed-stuff, thrashing grain, etc. An account of this plant, which is the first of its kind ever established, will be found on another page.

Who dares to say that even the horse on the farm will not be displaced by its more powerful and efficient rival, the electric motor?

THOUGHT-WAVES.

In a lecture delivered by Prof. E. J. Houston on March 1 last before the electrical section of the Franklin Institute, Philadelphia, that gentleman in an extremely interesting manner attempted to correlate to some extent the phenomena of thought with grosser physical phenomena. On the assumption that thought is accompanied by molecular or atomic vibrations of that part of the brain called the cerebrum, he proposes a hypothesis to account for mesmerism, hypnotism and other cognate phenomena.

In support of this hypothesis he cites his own experience, which can be corroborated by many others, that in taking charge of a class as a teacher where a number of bright students are undergoing examination, he experiences great mental exhaustion. He suggests that it is possibly caused by the rapid dissipation of energy by the cerebral radiations being absorbed by the receptive brains of the students, in a manner analogous to the well-known fact that when sympathetic vibrations are being excited by a sounding tuning-fork in a body near it there is greater rapidity of expenditure of energy of the fork's motion than when it was not exciting such waves.

For the benefit of those of our readers who are interested in such matters we publish Prof. Houston's lecture in full elsewhere in this issue.

HEROIC TREATMENT NEEDED.

The success of the electrical execution on May 16 last had the effect of causing a very noticeable change in sentiment among the daily papers regarding that mode of executing criminals. Those papers which had previously violently attacked the system were remarkably mild in their comments this last time, which fact can have but one significance, and that is that electrical executions having been rendered successful of accomplishment, may now as well be regarded as having come to stay.

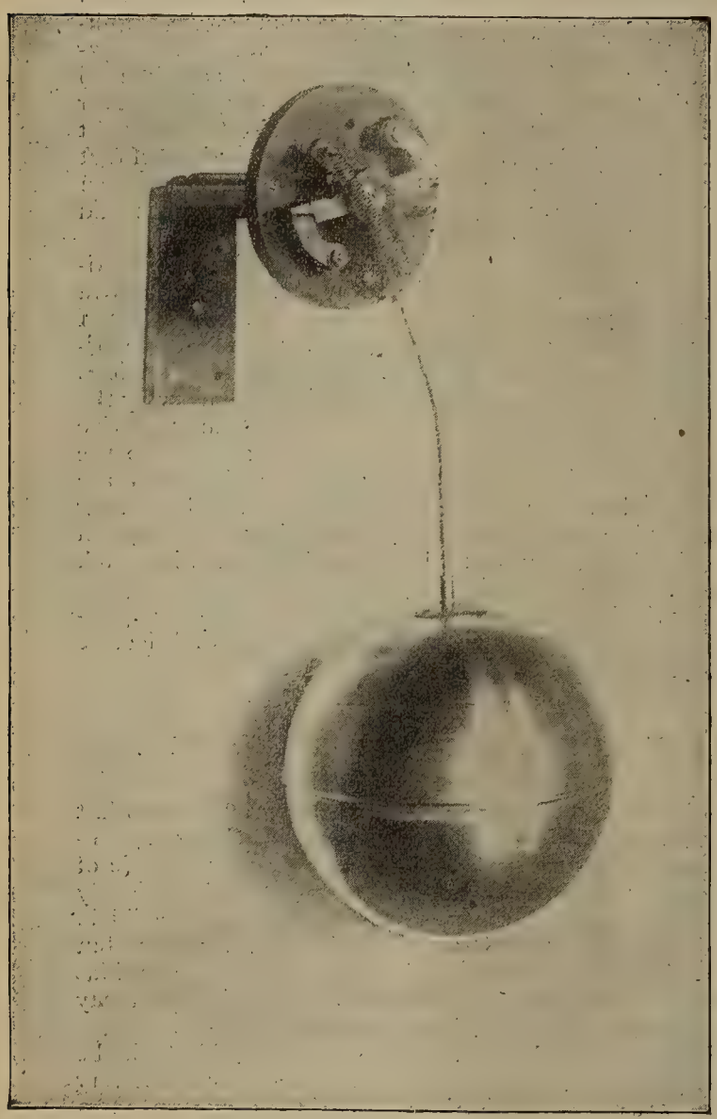
In an article by Mr. J. M. Batchelor, which will be found on another page, that gentleman gives some very good reasons why electricians should unite in an effort to discourage such use of electricity. Everything connected with executions, he argues, is repugnant, and "can electricians afford to encourage such a state of mind with reference to electricity?" he asks. Millions of dollars have been invested in electrical enterprises of various sorts, and in order to protect these vast interests, electricians, he thinks, should combine and discourage the use of electricity for the purposes of executing criminals. They should foster a public appreciation of the great benefits derived from the use of this wonderful force instead of remaining indifferent to the fact that the public is learning by these electrical executions to look upon electricity as some horrible thing, to be shunned.

The suggestions Mr. Batchelor makes should receive the careful attention of all electrical people. Now is the time to act, if any action is to be taken in the matter.

ELECTRIC PUMP SWITCH.

The Edison General Electric Company has just designed and put on the market an automatic switch for use with electrically operated pumps employed in filling water tanks.

This is a simple single-pole switch with ebonite base, mounted upon an angle piece and operated by a ball-float. As the water rises in the tank, the ball-float rises with it until it reaches a point where the switch is opened by the operation of a spring. The motor consequently stops and no more water is pumped into the tank. As the water is drawn off, the ball falls with the water level, the switch is closed, the pump starts and continues



AUTOMATIC PUMP SWITCH.

working until the tank is again filled to the desired point. The ball and all parts coming in contact with the water are insulated from the switch connections and line terminals, so that no part of the circuit can be grounded through the tank. The switch may be screwed to a wall or partition by the side of the tank, or, if convenient, may be placed within and screwed directly to one side of the tank.

The particular switch shown in the illustration is fitted with an arm 7 in. long and a ball 7½ in. in diameter, and will operate with a variation of 6 in. in the water level. It requires a cubic space of 11½ x 18½ x 20 in., and can be used in any ordinary tank capable of holding more than thirty gallons.

Switches of this type can be used in connection with motors up to 2 K. W. capacity, and can be changed to operate upon any reasonable change in water level.

A GRAVE SUBJECT FOR SERIOUS CONSIDERATION.

BY JOHN M. BATCHELOR.

PUBLIC hangmen are shunned by the community; the profession they are engaged in is not generally deemed sufficiently respectable to permit intimate social relations with them. The scaffold and the guillotine are likewise objects of horror and repugnance to all well-balanced people; as is the case with the public executioner's axe and block and all other similar paraphernalia exclusively devoted to carrying out the mandates of the law in the shape of public executions. Now, in consequence of this universal feeling, the question seriously arises: can electricians as a body afford to encourage or in any way abet the use of electricity which this State has made lawful for the execution of criminals? If such encouragement is given, and other States imitate New York, would not the natural tendency be to create a popular feeling of horror or, at best, disgust at a means which is associated with one of the most painful so-called necessities of the times?

This issue is now in its infancy, and the number of electrical executions are comparatively few, therefore any possible prejudice has not yet had an opportunity for serious development; at the same time let any one to-day ask a lady what she thinks of electricity being used for executing criminals, and she will undoubtedly reply that it gives her a nervous horror to thinkof it, and she strongly desires to avoid the subject. Now, as it affects these ladies, it will in all likelihood sooner or later affect gentlemen and all honestly-disposed people, whether they endorse capital punishment or not. Now again we ask, can electricians afford to encourage any such state of mind? Is the electrical business not dependent upon the pleasure one receives from the use of the incandescent light, the arc light, or the manifold uses to which electricity is being put in the household? Likewise, is not the success and prosperity of electrical development for power purposes—such as its use to propel street cars and obtain passengers therefor, as well as for the thousand and one purposes to which the street supply is devoted in the public's behalf—solely, or at least largely, dependent upon its popularity, as well as its money-saving attributes?

These questions might have had less point previous to the execution on May 16; becau e, before that execution took place the press was all but universal in the condemnation of the use of electricity for such a purpose, in consequence of a supposed torture associated with it; and the indications were that sooner or later the law would be repealed and electrical executions be abolished. But now a change in the sentiment of the daily press is noticeable; they all, if they make any comments on the subject, class this last execution in the light of a physiological success, using such an expression from the physician's standpoint. Herein, in this new attitude, is the danger threatening future electrical development. Let this notion of "success" become prevalent in other States, and the law of this State may receive general imitation. The effect of so united an action may be easily conceived; for ladies would be likely, in looking at the incandescent lights put into their homes, to consider them as being objects suggesting fearful suffering; as objects to be shunned, like the executioner's apparatus; and in time the remainder of the community would more or less be affected in a like manner.

It must not be forgotten that the popular use of electricity is yet in its infancy, and that the struggle to intro-

duce its manifold uses is hard enough at best, in consequence of the newness of the idea. That particular remembered, and the enormous amount of money already invested in allied industries, as well as the sums in contemplation which capitalists will be called upon to meet, should be a sufficient incentive to all electricians to "sit down" upon and in every way discourage the use of electricity in any such injurious manner. The feeling induced by rare accidents is already sufficient to cause insurmountable obstacles against the general use of electricity; as is well known in the case of legislative consent to the extension of business in needed departments. Then shall this legislative obstruction be made worse through any additional incitation on the part of the public, because in the minds of those unable to make proper distinctions it is looked upon as an object of public torture? It is not to the point that experts concede that there can be no torture; for, so long as the class referred to think there is, that thought is what will, in all likelihood, modify future legislation in conformity with it.

It is to be taken for granted that many electrical mechanicians may look upon this argument as too sentimental for their consideration; as their attention is so wrapped up in the details of their work, the state of mind customers may get into over public executions becomes to them a matter of indifference. But all electrical workers must remember that the consumer of electrical products reasons from another standpoint. He is more interested in the utility of electricity in its application to the circumstances where it is to be used; and he well knows that in numerous instances any existing prejudice, whether ill or well founded, is calculated to injure or lessen consumption. Few householders would put electricity in their houses if the women part of the family were afraid of it, or manifested repugnance to its use. Therefore, conceding the necessity of stopping any further executions of the described kind, the next point is, how to remedy the matter. A good answer to this query at this moment is not at hand, except that it might be advisable to unite on the subject and determine to bring about the desired end. That determination will sooner or later develop its own fruit; as the saying is, "where there is a will there is a way."

AUTOMATIC CUT-OFF ENGINES.

The Ball Engine Company, of Erie, Pa., was fortunate in recently securing the services of Mr. Frank R. Chinnock, well known in the electrical trade as a wide-awake and successful young business man, as its selling agent for Long Island, New York and New Jersey, and for the export trade; and it is reasonable to assume that the company will experience a boom in business in consequence of having its interests confided to the hands of so qualified a person as Mr. Chinnock.

Mr. Chinnock is quite a young man, being born in Harlem, N. Y., September 21, 1860. His first business venture was as a telegraph operator on the Intercolonial Railway, Canada. This was in 1881–83, and in the latter year Mr. Chinnock became chief inspector for the Metropolitan Telegraph and Telephone Company of New York. He remained in the telephone service in various capacities until 1887, when he was appointed state agent for the United Edison Manufacturing Company, with which concern (known afterwards as the Edison General Electric Company) he remained until his appointment to his present position.

Mr. Chinnock has taken hold of his new duties in a manner that indicates success both for himself and the company he represents.

He has engaged Mr. J. S. Du Vall, formerly with the Edison Electric Illuminating Co., as assistant, to have charge of his office, etc.

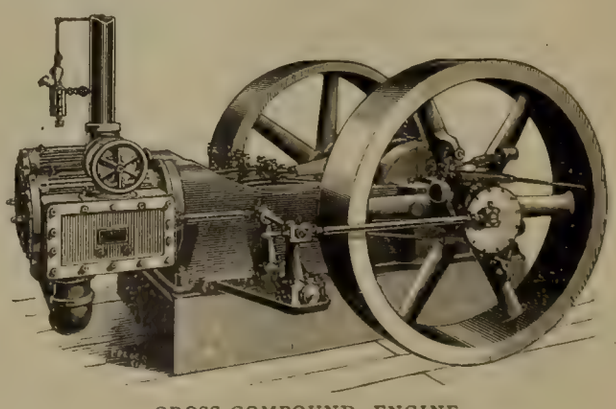
The engines handled by Mr. Chinnock are well known in the electric light and railway service for their high efficiency. While they meet the exacting duties required of them in these services the company is not content, but is anxious to make them still more perfect, and is constantly making important improvements with this end in view.

The Ball Engine Company, of Erie, Pa., makes four classes of engines, namely: simple, tandem-compound, cross-compound and triple-expansion. Some of the feat-



FRANK R. CHINNOCK.

ures of great importance possessed by these celebrated engines are simplicity of construction and compactness. They are very solid and strong, and their bearings and wearing surfaces are unusually large. For smooth and quiet running they are unsurpassed; and they are economical in operation, durable, and have good regulation. Every engine is thoroughly inspected before it leaves the works, and no expense or efforts are spared to improve the engines wherever it is seen that improvements can be made. Such is the record of the Ball engine, of Erie, Pa. The simple engine is designed for heavy duty and long, continuous runs. One of the wheels contains the automatic cut-off regulator or governor, the sensitiveness of



CROSS-COMPOUND ENGINE.

which insures great regularity in speed. The frame is rigid, and the varying strains and direct thrust of the moving parts are so balanced that there is no vibration or deflection when the engine is in operation. On long runs it shows no signs of distress when subjected to heavy, continuous loading, and has staying qualities that few engines possess.

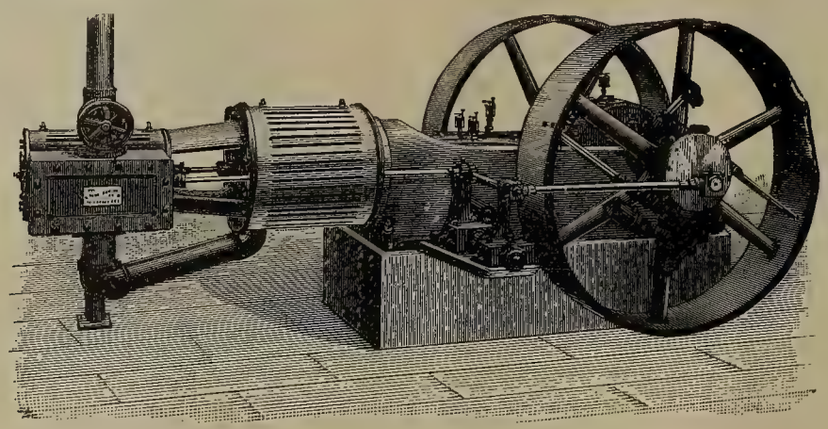
The advantages of the compound condensing engine are well known to all engineers. It saves fuel and soon pays for its additional cost in this manner; even if condensing water is not available, the saving is very consider-

able and well worth the consideration of steam users who desire high efficiency.

In the tandem-compound engine the valve operating the mechanism allows each valve to be driven in the most simple and direct manner, and the many parts are readily accessible. Among recent improvements in the engine is the placing of a hand-hole in one side of the low-pressure cylinder, rendering it an easy matter to examine the interior of the cylinder, the condition of the packing-rings, and to fasten the piston-head to its rod. This improvement meets the objection sometimes raised against this class of engines, that the examination of the low-pressure cylinder cannot be easily made.

Three years' experience with these engines has proved that they excel in these points: economy of fuel, close regulation of speed under all changes of load and boiler pressure, ample strength, superior quality of material and workmanship, extreme simplicity, and reliability under all conditions. All the engines of this type built and put into operation by this company are giving excellent service.

Two years ago this company brought out its first cross-compound engine, which was designed for and put into the new station of the Edison Electric Illuminating Co., Brooklyn, N. Y. It was designed for heavy work, and all the parts were made unusually large and massive.



TANDEM COMPOUND ENGINE.

The crank-shafts of these engines, which are made of the best open-hearth steel forgings, are set opposite each other, one counteracting the effect of the other, and in this way obtaining a perfectly balanced engine, capable of being run at a rapid speed with quietness and ease and without heating. The valves provide for quick admission of steam and insure against all possible leakages.

The engine as a whole is a most perfect machine, and is claimed to excel all other engines of this type in the matter of simplicity, durability, strength and economy. The company builds a special cross-compound engine for electric railway work, and has a number of them in successful operation in this service. Among the large electric railroad companies using this class of engine are the Rochester Street Railway Company, Rochester, N. Y., and the Buffalo Street Railway Company, Buffalo, N. Y. The results attained both in economy and the performance of these engines under very trying conditions have, it is said, been entirely satisfactory.

It is claimed for this cross-compound engine that it will give more satisfactory results and produce power at less cost under the conditions of variable load generally encountered in service than any other type of slow-speed engine. The engine can be operated at its most economical point of cut-off and the governor gives closer regulation under changes of speed and boiler pressure than is possible with a slow-speed engine.

In addition to these engines the company makes a double-condensing, triple-expansion, high-speed engine, which is believed to be the first engine of this class ever built and adapted to street-railway work. The performance of these engines has been highly satisfactory, and they give the greatest economy. Their construction is strong and massive, and at the present time are made of 300, 400 and 500 H. P.

The favor with which Ball engines, of Erie, Pa., are regarded may be judged from the fact that at the present time over 850 electric plants are equipped with these engines, besides those used in street-railway work. Some of the largest stations in the country use them, and the utmost satisfaction is given in every instance.

We give below a list of the cities where Ball engines of Erie, Pa., are used for the generation of street-railway currents:

Buffalo, Rochester, Amsterdam (two roads) and Binghamton, N. Y.; Pottsville, Reading, Allentown, Lebanon, Erie, Johnstown, Pittsburg (two roads), Du Bois, Braddock, Pa.; Cincinnati (two roads), Cleveland (two roads), Akron, Canal Dover, Ohio; Detroit, Mich.; Lynchburg, Richmond, Va.; Salem, Milford, Brockton, Mass.; Newark, N. J.; Portland, Oregon (two roads); Port Townsend, Seattle and Corvallis, Wash.; Rockford, Elgin, Ill.; St. Louis, Kansas City, Mo.; Beatrice, Norfolk, Neb.; Louisville, Paducah, Ky.; Baltimore, Md.; Great Falls, Mont.; Melbourne, Aus.; Denver, Col.; Washington, D. C. (two roads); Austin, New Birmingham, Texas; Athens, Macon, Ga.; Vancouver, B. C.; Windsor, Ont.

CONTRACT FOR THE WESTINGHOUSE COMPANY.

A despatch from Chicago, Ill., states that the contract for the incandescent lighting of the World's Fair has been awarded to the Westinghouse Electric Manufacturing Company, Pittsburg, Pa., by the committee on grounds and buildings; but that, however, a bond of $1,000,000 was required as an evidence that the Westinghouse Company would fulfil its contract. The company has until June 10 to accept the terms. President Westinghouse will consider the matter before accepting, as he thinks the demand for a $1,000,000 guarantee very unjust and entirely uncalled for.

SUBWAY COMMISSIONERS APPOINTED.

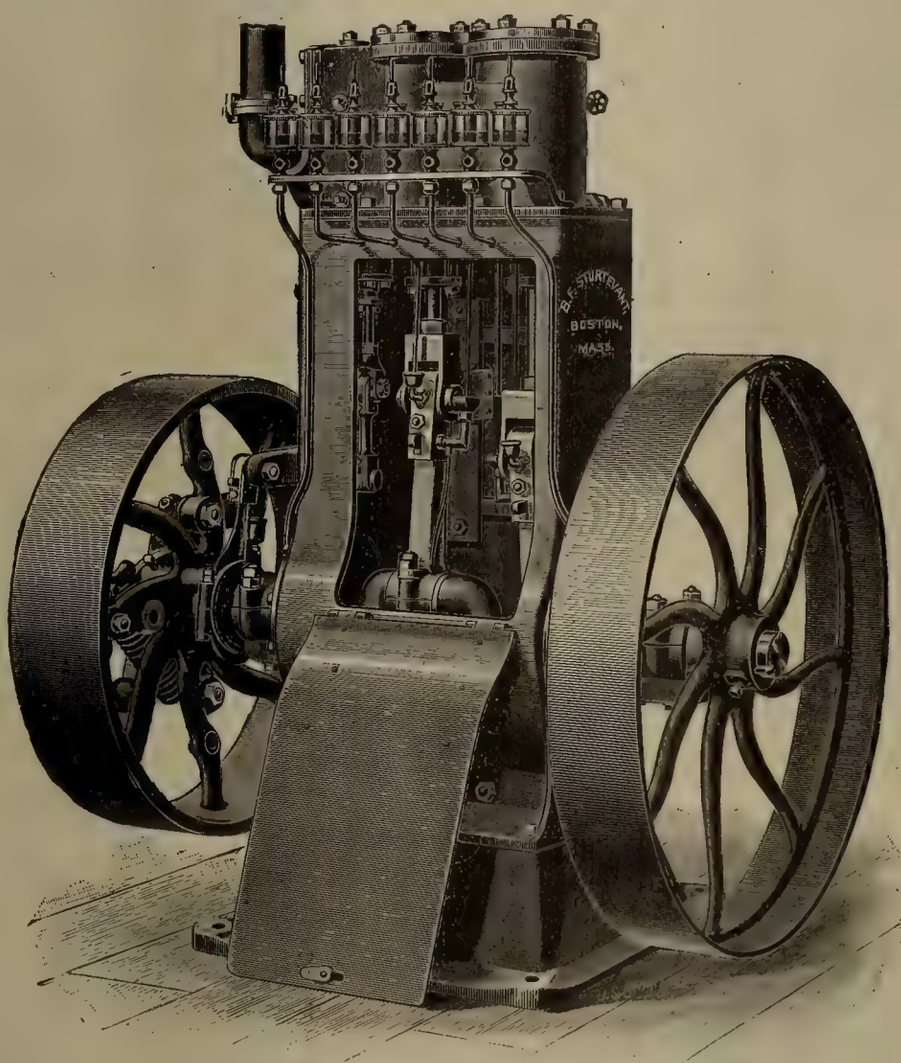
Mr. Frederick R. Lee and George W. Plympton were appointed subway commissioners by Mayor Boody, of Brooklyn, at an annual salary of $3,000. Their terms will expire on Nov. 1, 1896. The custody of the subways will devolve upon the mayor and city works commissioner.

THE STURTEVANT AUTOMATIC DOUBLE ENCLOSED ENGINE.*

We present in the accompanying illustration a unique design in the way of upright engines suitable for general work, but specially designed for fan propulsion and electric-light work. The bed upon which the engine rests is well spread, very heavy, and is so designed as to give the engine a substantial foundation. The body of the engine is built in two parts, the upper part consisting of the cylinder alone, which may be readily removed for re-oiling. It will be seen that this makes a very convenient arrangement in case it is necessary to repair either cylinders or valve-seat.

The valve is of the piston type and supplies both cylinders by a special arrangement of ports. The design assures continuous running in dusty atmospheres, where any other engine would rapidly become worn by the dust which would unavoidably enter all bearings.

As the cylinders are placed side by side in the same casting, the cranks set opposite at an angle of 180 degrees, and steam admitted simultaneously at the top of one cylinder and the bottom of the other, the reciprocating parts are balanced in their movements, and high speed is made possible. The cylinders are of large diameter as compared with the stroke, so that a large amount of power may be developed at high rotative, but moderate piston speed. By the omission of the band-wheel and the bed beneath the engine, it may readily be placed upon entire engine can be easily and tightly closed, preventing a frame casting and connected direct to the shaft of a moderate-speed dynamo. In fact, although it has been



STURTEVANT ENCLOSED AUTOMATIC ENGINE.

of the cross-head is readily seen, it being of the slipper-guide type, running upon a steel slide-bar attached to the back of the frame. The connecting-rod is very substantial, being of the marine type with large crank-pin bearings. The crank itself is carefully counterbalanced and all moving parts are made as light as is consistent with the heavy duty which is placed upon the engine.

The regulation of the engine is secured by means of a shaft governor acting through a single eccentric to change cut-off from zero to ⅞ stroke.

The oiling has had special attention, and the oilers are all collected together and connected with the various bearings by tubes. By means of the doors shown, the the admission of dust, or the objectionable throwing of oil upon the running parts.

This is a very prominent feature of the engine, as it but recently introduced, it is being very generally employed for this particular purpose, and its record as a continuous running, high-speed engine is warranting its introduction.

* B. F. Sturtevant, 34 Oliver st., Boston.

IMMENSE CAR-SHOPS.

The Brooklyn City Railroad Co., Brooklyn, N. Y., is now at work on plans for a new car-shop, which will be a gigantic one. It will occupy one entire square, and will be bounded by 58th and 59th streets and Second and Third avenues. The size of the shop will be 200 by 700 feet, three stories high and built of brick. It will accommodate nearly 1,000 cars each 24 feet long. It is expected that the shop will be ready for occupancy about October 1 next. Its cost will be $250,000, exclusive of the land, which cost $80,000.

MAGNETO-ELECTRIC MANUFACTURING COMPANY.

Mr. C. J. Francis was born in Owen Sound, Ontario, Canada, on January 12, 1860, where he attended the common and high schools until 18 years of age, at the same time taking a special course in mathematics and physics under Prof. De La Matter. While still attending the high school in 1877, he constructed and put in operation between the post-office and the Dominion Telegraph office the first pair of telephones in that section of Canada.



C. J. FRANCIS.

Mr. Francis received his first practical experience in mechanics with Farrar & Trefts, engine builders, in Buffalo, N.Y., in whose shops he served about two years, after which he had a varied experience, working in different electrical factories and experimental shops in Philadelphia and New York until 1884, when, in connection with Mr. Geo. B. Wilkes, he started the firm of Wilkes & Francis, for the purpose of manufacturing electro-surgical and dental apparatus. In 1887 Mr. Francis sold out his interest in the firm to Mr. Wilkes, and then engaged in experiments in fac-simile telegraphy for the Auto-Telegraph Company, a subject in which he has been greatly interested for 13 or 14 years, and on which he is still working. Mr. Francis says that he already has it in a very advanced state, but will not put it out until it has been brought to such a degree of perfection that it can be operated by an office boy, or person without any special training. In September, 1888, Mr. Francis entered the employ of the Echo Telephone Company as electrician, and perfected the telephones, magnetos and most of the apparatus now controlled by that company. About a year after the company had

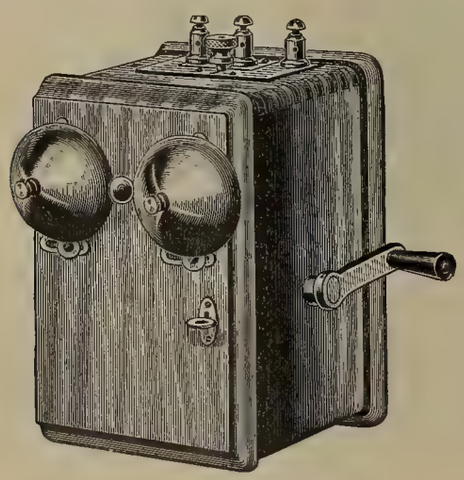


FIG. 1.

started in the manufacturing business Mr. Francis was made superintendent, and when the Magneto-Electric Manufacturing Company succeeded to the manufacturing business of the Echo Company he was retained in the same position by the new company. The company is now doing a general manufacturing business, electrical and otherwise. Its factory is equipped with the latest improved machinery and tools, including automatic gear-cutters, boring-machines, screw-machines, heating and tempering furnaces, etc., etc. The company has contracts on hand embracing quite a variety of work, including ampèremeters, combination locks, fire-alarm boxes and apparatus, and all descriptions of magneto-bells, the manufacture of which is the company's principal business.

Figs. 1 and 2 represent the ordinary magneto-bell closed and open. It will be noticed that the permanent magnets in the generator are made of circular form, the poles being set in steps on the pole-pieces, thus concentrating the lines of force almost entirely through the

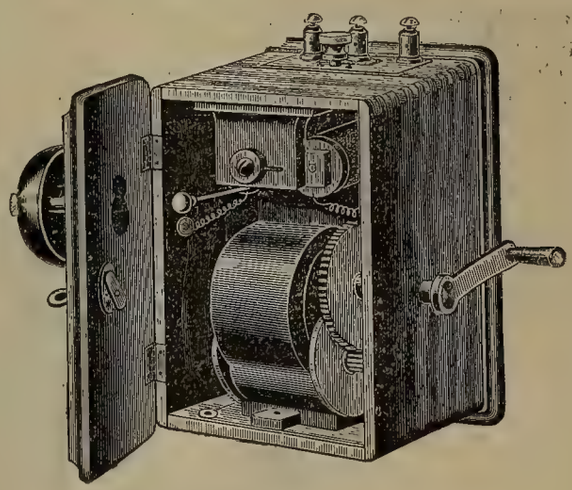


FIG. 2.

armature, and making a very neat and compact arrangement. There is a shunt around the generator which is operated automatically by the action of turning the crank. All parts of the machine are made from accurate tools and jigs, and are interchangeable; they are made in six grades, to ring through from 1,000 to 35,000 ohms.

Figs. 3 and 4 show the testing-bell closed and open. It is practically the same as the ordinary bell, with the exception that the gongs are inside of the box, which is provided with a strap for carrying, and has two large binding-posts which take from the smallest wire up to

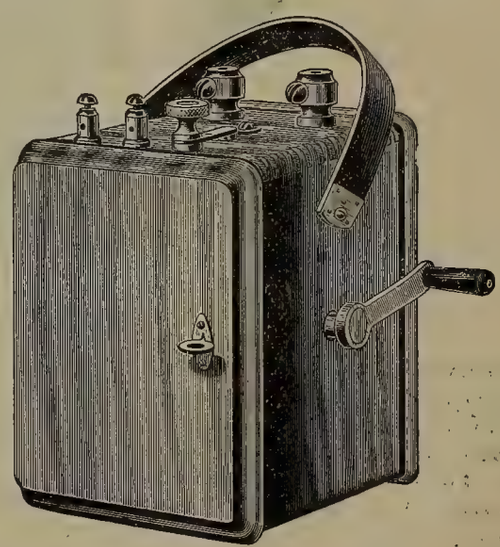


FIG. 3

quarter-of-an-inch, also two smaller ones for looping in a telephone when required, so that a lineman or inspector may talk with the central station; they are made to ring through from 15,000 to 50,000 ohms or more on special order.

Fig. 5 shows the extension bell which is suitable to use

in connection with a 1,000 or 3,000 ohm bell, and "standard" for use with the high grades of magnets.

One or more of these bells can be connected with a telephone and placed in different parts of a building so as to ring simultaneously with the telephone, or they may

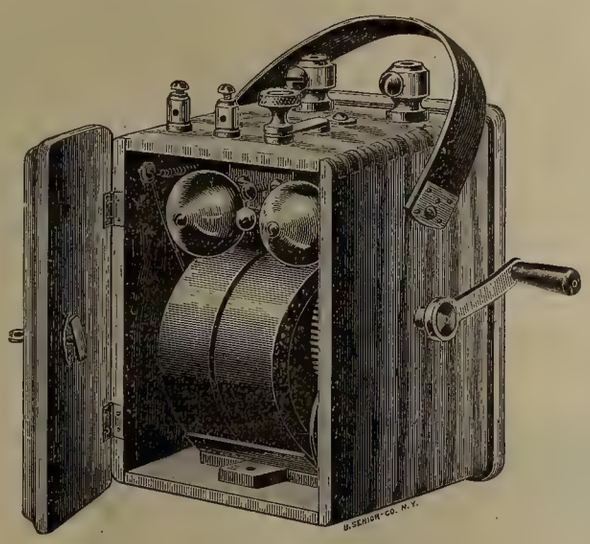


FIG. 4.

be placed in different parts of a factory and connected with a magneto-bell in the office.

The office and factory of the company are located at No. 520 W. 35th street, New York City; downtown office 15 Cortlandt street.

THE "INSULATING SADDLE STAPLE."

Since the introduction of electric lighting the wire staple has become an object of great consideration and solicitude. Prior to this time it was an insignificant but quite indispensable article, and probably would never have played an important part in the electrical field had electric lighting not appeared upon the scene.

The ordinary metal staple has been the cause of so much trouble on wires that inventors have given their attention to the matter, with a view to devising some way to overcome these difficulties.

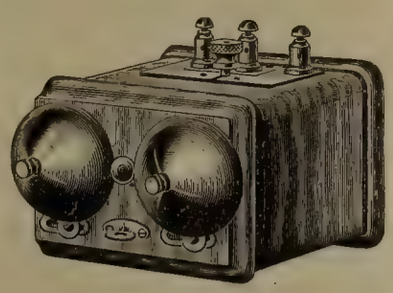


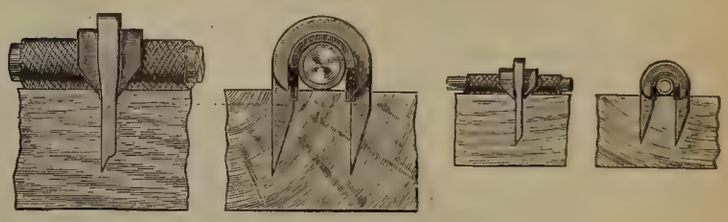
FIG. 5.

Metal staples are objectionable because they cut the insulation of wires in the operation of driving them; this, of course, results in leakage of current, either from one wire to the other or to the ground. Besides this leakage a weak spot is developed on the wires where the insulation is damaged. Moisture is enabled to penetrate, and eventually causes a corrosion of the copper wire. Frequently the conductor itself is broken by the pressure of the staple upon it, in the operation of driving the staple, and trouble of this sort causes considerable annoyance and delay because it frequently escapes detection at the time.

The board of underwriters does not permit the use of metal staples for electric lighting and power work on account of the objections named.

The "Insulating Saddle Staple," a description and illustration of which are given herewith, was designed to overcome the objections met with in the use of the ordinary metal staple, and from the fact that the board of underwriters approves of it and requires its use in wiring buildings for electric light and power, is evidence that it meets all of the requirements of a perfect, safe and reliable staple.

By reference to the illustration it will be seen that the staple has a "saddle," which is made of vulcanized fibre and firmly attached to the staple. The "saddle" is treated with a moisture-repelling compound which also coats the metal in such a way as to prevent corrosion and the leakage which would ordinarily take place where the old form of metal staple is used. These staples do not abrade the insulation on the wires, drive equally well in hard and soft woods, and they are neater and stronger than cleats. They are valuable for electric light and power conductors, telephone, district messenger, burglar-alarm, annunciator or telegraph wires, especially where wires run in moist places.



INSULATING SADDLE STAPLE.

The Vulcanized Fibre Company, 14 Dey street, New York City, has the exclusive agency for the sale of "Insulating Saddle Staples" throughout the world, and has perfected machinery whereby large quantities of these staples can be produced at greatly reduced cost. The company is now prepared to supply the trade with these goods in any quantities to suit.

POWERFUL TURBINES FOR NIAGARA.

The immense new pulp and paper plant of the Cliff Paper Co., at Niagara Falls, is to be supplied with late new designs of the horizontal shaft Double Discharge James Leffel Wheels, built by James Leffel & Co., Springfield, O. The contract for this work was signed by the Cliff Paper Co. and James Leffel & Co. on May 13, after the Cliff Co. had made a full and careful investigation of the merits of various wheels presented during the past year for its consideration. Each of these turbines is to be eleven hundred horse-power capacity, and built essentially upon the plan of style No. 23, illustrated in the pamphlet of James Leffel & Co. These wheels will connect directly to the pulp-grinder shafts at each end of the wheel shafts, without belts or gearing.

This water-wheel company has celebrated its thirtieth year of continuous business in this line of work. It has added many improvements to its James Leffel Wheel in the past two years, and has designed a large number of new styles, incorporating in them the best ideas of its large experience. The manufacturing plant of this company has also been recently greatly extended, and various pieces of new, improved and heavy machinery added; all adapted to the heavy water-wheel work it is now manufacturing. The company shipped some time since one James Leffel wheel and casing weighing forty-five tons; also filled one order for nineteen large wheels for one pulp and paper company.

THE COMPLETE COMBUSTION BOILER.

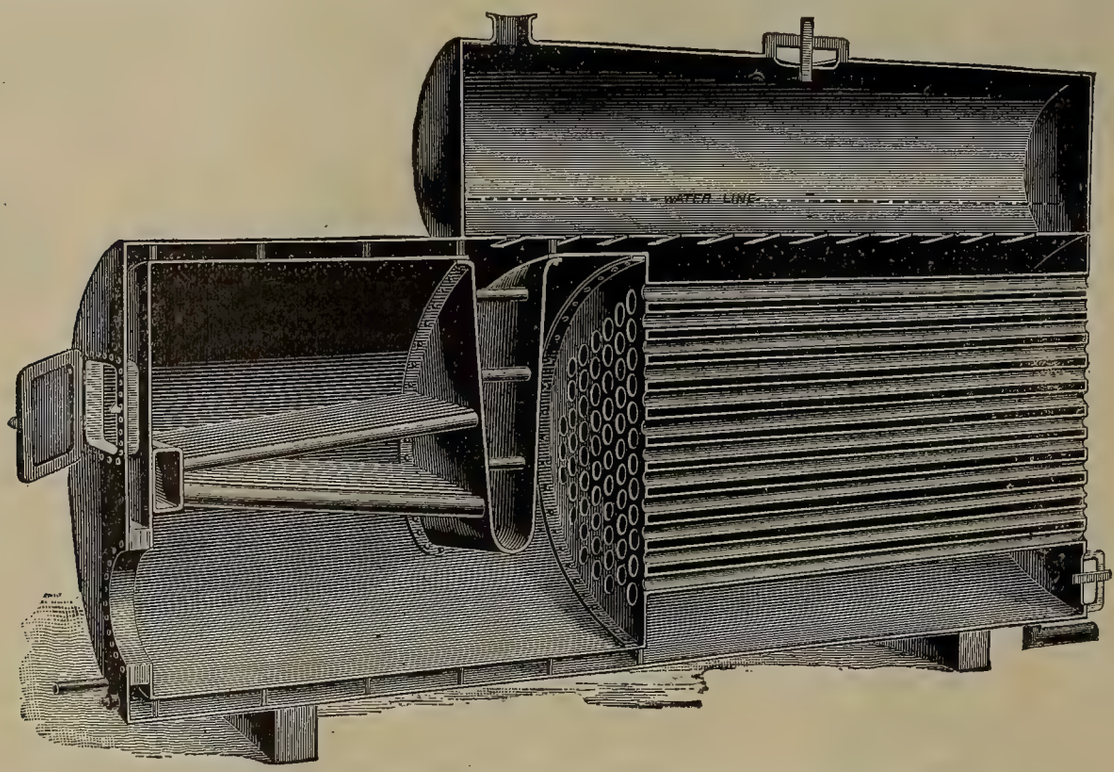
The Central Complete Combustion Manufacturing Company—Calab R. Ayer, president; Melville Eggleston, vice-president; and H. Durant Cheever, secretary and treasurer—with headquarters at 13 Park row, New York city, has put upon the market a new style steam-boiler, which, from its radical departure from old and accepted forms and methods of constructing and operating steam generators, will be studied with interest by steam users generally.

It is known as the complete combustion boiler, and is of the down-draught pattern, and everything points to a brilliant success for it.

This boiler is of the horizontal cylinder, multitubular type, differing principally in the furnace. At the back of the grate is a hanging water-leg of steel plates, riveted to the crown sheet and side wall of the fire-box. The grate is formed of water-tubes entering the front side of this water-leg at a moderate inclination from the horizontal, tan, shavings or any other kind of fuel which may be burned in any steam-boiler, and is absolutely smokeless, thus insuring a great saving in fuel by its use.

At a test of a twenty-five H. P. complete combustion boiler at Bishop Bros., East Somerville, Mass., the evaporation from and at 212 degrees was found to be equivalent to 11.53 lbs. of water for one pound of combustible. Another test of a seventy-five H. P. boiler at Smith & Carleton's Iron Works, South Boston, showed equivalent evaporation of 12.21 lbs. to one pound of combustible, the water evaporated from and at 212 degrees per square foot of heating surface per hour, 2.85 lbs. Other tests showed like results, and in all the horse-power developed was considerably in excess of that at which the boiler was rated.

A recent test of this boiler under ordinary working conditions, made by Peter Backus & Sons, engineers, at the factory of Messrs. McGuire & Clark, 68 Madison street, New York, gave even better results than those we have already mentioned.



LONGITUDINAL SECTIONAL VIEW, COMPLETE COMBUSTION BOILER.

and at the front of the furnace entering a gun-metal box just below the furnace doors. Return tubes, also inclined, extend from this box back to the water-leg and insure circulation of water through the shell and water-leg through the grate tubes. The grate is one of the most important features of the boiler. It is constructed of the best lap-welded, seamless tubing, made to order. The tubes are arranged in zigzag or alternating form, the wide spaces between the upper series of pipes being divided by a lower series, so that a fine mesh is secured without loss of air-space or impediment to draught. Ample and practical provision is made for expansion, and this grate has never been known to leak. As an auxiliary in generating steam the grate takes first rank. The space below the grate, ordinarily the ash-pit, is the combustion chamber; the air for combustion being admitted through the fire-box above the grate and drawn down through the grate-bars by the chimney draught, where it becomes highly heated during its combination with the hot gases of the coal. As the combustion chamber is completely surrounded by the water-heating surfaces of the boiler, and as the heat after leaving the combustion chamber passes through the tubes, which form a large absorbing area, directly to the uptake chimney, it will be seen that the boiler should have a high efficiency. No brickwork is required in setting, which is another good feature.

This boiler can burn either hard or soft coal, wood, dry

NEW BOOKS.

ELECTRIC RAILWAY ENGINEERING. By Edward Trevert. 186 pages, profusely illustrated. Bubier Publishing Company, Lynn, Mass. Price, $2.

In this work it has been the author's aim to describe in as simple a manner as possible the application of electricity to street-railway service as a means of motive-power, and the mechanism employed in connection therewith. He has admirably succeeded in his endeavor, and the book will be found of great value not only by the electrical student, but also by the public generally. It contains fifteen chapters in the following order: The power-house and its apparatus; Railway generators; Line construction; Electric railway motors; Rheostats; Electric heaters; Trolleys; Locomotives for heavy traction; Trucks; Car wiring; The storage-battery system; Some illustrative roads; Some general remarks for motormen; Some general remarks for stationmen, and Conclusion. There are five appendices, which treat of: The chronological history of the electric railway; Fenders; Methods of controlling street-car motors; Rapid transit, and Electric street railways as investments.

CEREBRAL RADIATION.*

BY PROF. EDWIN J. HOUSTON.

I HAVE thought it possible that it might interest you to consider some rather wild speculations in which I have indulged for a number of years past, but which I have heretofore refrained from publishing. In these speculations, to which I was first led by a suggestion from a friend, I have endeavored to correlate, to some extent, the phenomena of thought with grosser physical phenomena. Although the suggestions I have to offer as a basis for a hypothesis of the mechanism of cerebration are confessedly incomplete, and perhaps improbable, yet I have concluded to place them on record as of possible interest to the scientific world.

I am, of course, aware of the fact that the psychical operations of the brain are by no means understood. It is generally believed, however, that the seat of psychical activity is the cerebrum. The manner in which the brain acts to produce, record and reproduce thought is unknown, and will probably remain unknown.

On the single assumption, however, that cerebration or thought, whatever may be its exact mechanism, is accompanied by molecular or atomic vibrations of the gray or other matter of that part of the brain called the cerebrum, I would propose the following hypothesis to account for telepathy, mesmerism, thought transference, hypnotism and other cognate phenomena.

Postulating the existence of the universal or luminiferous ether, which is now generally accepted in scientific circles, and bearing in mind the fact that this ether passes through even the densest matter as easily as water through a sieve, it follows that the brain atoms or molecules that are here assumed as the cause of cerebration are completely surrounded by the ether. Now since the ether is a highly elastic, easily movable medium, it would follow that thought or cerebration, if attended by vibrations, must necessarily develop in the ether wave-motions, which have the brain atoms or molecules for their centres. In other words, the act of thought or cerebration necessitates an expenditure of energy, because it necessitates the setting in motion of these assumed atomic or molecular brain particles.

The exact nature of the motions that are assumed to attend an active condition of the brain must necessarily remain unknown as long as we are ignorant of the exact nature of the mechanism that is moved. But if an active brain evolves thought because something is set in motion, it of course follows that a brain absolutely free from producing thought must be at rest so far as that kind of motion is concerned. An absolute freedom from thought in a healthy brain is most probably a condition that seldom exists; relative rest, however, must be quite common.

That the brain cells of the gray or other matter involved in the production of thought can be caused to assume certain groupings or relations towards one another would appear to follow from the ease with which that curious function of the brain called memory permits it to readily recall past peculiarities in the to-and-fro motions. By continually repeating certain trains of thought, as in study or repeated observations, the peculiar motions required to produce such thought are probably given a set or tendency to form more or less permanent groupings. When, therefore, the brain is moved or played upon, so to speak, these motions recur and certain memories are awakened.

How may these motions be produced? The answer would certainly appear to be both from within and without. It is, perhaps, possible that the flow of blood to an active brain, which as is well known attends all active cerebration, is not only for the purpose of nourishing and rebuilding the organ, but also for affording the purely mechanical force, that needs but to touch this marvellously attuned organ to awaken the thoughts already impressed thereon, or to sit in judgment on new combinations never before presented to it.

I will suggest an explanation later on as to how these impressions may possibly be excited from without.

Whatever be the origin of these vibrations, or however excited, energy is required to be expended in producing them, and, as the brain-worker will readily acknowledge, the expenditure of such energy often calls for an enormous expenditure of nervous force.

Cerebral energy, or energy thus expended in producing thought, is dissipated by imparting wave-motions to the surrounding ether, and such waves are sent out in all directions from the brain, possibly in greater amount or of greater amplitude from some of the brain openings, as, for example, those of the eyes.

Although there are no absolute proofs of the existence of the molecular or atomic vibrations of the brain particles which I have assumed, such a movement, however, is far from being improbable, and, indeed, some facts known to the medical profession are far from being at variance with such an assumption. A certain amount of pressure on the brain arising from the pressure of the blood is necessary for its proper action. If this pressure increases beyond a certain value, as, for example, in cases of fractures of the skull, where a portion of the bone is depressed by the fracture, thereby producing a compression of the brain material, all thought or cerebration instantly ceases; but when this pressure is relieved by the act of trephining, cerebration not only begins but, curiously enough, generally goes on from the point where the patient left off when the injury occurred.

Let us assume, then, that cerebral radiations or waves are given off from every sentient or active brain, and that these waves pass into the space around the brain something like the waves that are imparted to the air around a sounding tuning-fork.

The cerebral radiations are not so gross as those of sound. Their wave-lengths are almost certainly much shorter. They are imparted to the universal ether.

If such waves, which I would call thought-waves or cerebral-waves, be present in ether that fills all space, it will be interesting to inquire what phenomena they might be expected to produce.

It being assumed that these vibrations take place in the ether itself, there need be no doubt or speculation as to the general nature of the waves themselves. They would presumably partake either of the nature of transverse or torsional vibrations.

The commonest character of the vibrations which occur in the universal ether are the vibrations which are now generally recognized as transmitting the phenomena of heat, light, electric or magnetic radiations, viz., of transverse or torsional vibrations.

An active brain may therefore be regarded as moulding the ether around it into thought-waves that are spreading outwards from it in all directions. In this respect it is not unlike a conductor through which an oscillatory discharge is passing, producing those waves which Hertz has so beautifully demonstrated as resembling the vibrations that produce light.

Assume, then, that the cerebral radiations partake of the nature of thermal, luminous, electric or magnetic radiations, and the following explanation of telepathy, or thought transference, is, to say the least, not improbable.

I would explain the possibility of the transference of specific cerebral vibrations from an active brain to a

* Read before the Electrical Section, Franklin Institute, Philadelphia, March 1, 1892.

passive or receptive brain by the simple action of what is known in science as sympathetic vibrations.

Take the case, for example, of a vibrating tuning-fork that is sending off its waves across the space which separates it from a second tuning-fork, not as yet in motion, but tuned so as to be able to vibrate in exact unison with it. As is well known, the exact correspondence between the period of the active, or the transmitting-fork, and the passive- or the receptive-fork, is such that the vibrations of one fork are gradually taken up by the other fork, so that the energy of the motion of the one is transferred or carried across the space existing between them, by means of pulses or waves set up in the air which surround them.

As is well known, such sympathetically excited vibrations can be produced in a fork situated at a considerable distance from the exciting-fork.

Or, similarly, take the case of the sympathetic vibrations excited by waves of light. Solar energy is radiated or transferred across the space existing between the sun and the earth by waves or oscillations in the luminiferous ether. These waves, falling on the delicate structure of a leaf, suffer a species of selective absorption, certain wave-lengths being absorbed and others thrown off. The absorbed waves excite or produce sympathetic vibrations in the molecules of carbon dioxide present in the leaf, and cause the atoms of carbon and oxygen in such molecules to move towards and from one another in interatomic vibrations, which increase in amplitude or violence until their chemical affinity or atomic attraction is overcome and dissociation occurs. The oxygen is then thrown from the leaf into the air, and the carbon is retained in the structure of the plant.

Or, take the still more interesting case of what Hertz calls electric resonance. As already mentioned, it is now generally recognized by electricians that a conductor which is the seat of an oscillatory electric discharge is sending into the space around it electric-waves or oscillations which travel with the velocity of light, and which are in fact of exactly the same nature as light itself. If these electric-waves meet a circuit so tuned as regards the period of oscillation of the circuit in which they originally occurred as to be in consonance with them, electric oscillations will be set up in this circuit of exactly the same nature as those exciting it.

In view of these facts it does not seem improbable to me that a brain engaged in intense thought should act as a centre of cerebral radiations, nor that these radiations proceeding outwards in all directions from such brain should affect other brains on which they fall, provided, of course, that such brains are tuned to vibrate in unison with them. In such cases the absorption of energy by the recipient brain may be either a species of selective absorption in which its train of thought is only modified, or it may be absolute; in which case the recipient brain has excited in it an exact reproduction of the thoughts of the exciting brain.

Such a hypothesis is far from improbable; on the contrary, it would appear to be carried out by a variety of curious circumstances, which have only wanted some general hypothesis to properly correlate them.

If such a hypothesis be true, then these cerebral vibrations or radiations must travel through space with exactly the velocity of light. This is of course on the assumption that the vibrating or oscillating brain molecules or atoms set up vibrations similar to those of light. Of course, this equality between the velocity of cerebral wave propagation and that of light is true only for free ether. In the ether which fills the interatomic or intermolecular spaces of gross matter, or, as it is technically called, combined ether, the velocity of wave propagation varies according to the particular character of the matter with which it is associated. A retardation or decrease in the velocity of the assumed cerebral waves would doubtless be experienced while passing through the materials of the skull and head.

If thought travels along waves in the ether similar to waves of light, it would be able to travel along any path by which rays of lights can pass. It can therefore travel along rays of light, *i.e.*, along paths in the ether through which rays of light are moving.

There is a well-known experiment in hypnotism, in which the patient, placed in a state of semi- or complete unconsciousness, has his brain called into a more or less active condition by the suggestions of the hypnotizer, which might seem to somewhat favor the hypothesis of cerebral radiation.

It might be interesting, in view of the above suggestions, to see whether a hypnotizer, placed in such a position as regards the hypnotized that flashes of light falling on his eyes shall afterwards fall on the eyes of the patient, to observe whether or not acts of suggestion are more readily perceived by the brain of the hypnotized along such rays of light than without the aid of such rays.

If the preceding speculations be regarded as wild, and that this is true I have already granted, what may not be said as to the following?

If thought radiations partake of the nature of ether-waves, then there should presumably exist in the thought radiations or waves phenomena corresponding to the various phenomena of thermal, luminous, electric or magnetic radiation; even the phenomena of reflection, refraction and possibly even of dispersion of such waves would appear to be a possibility. In this connection it is of interest to imagine the analysis or separation of a complex wave of thought into its component or elementary waves, corresponding to the separation of a beam of light by means of a prism.

In this connection there would be a new significance in the phrases, "radiant with thought," or, "to concentrate one's thoughts on a subject."

If thought radiations or waves partake of the nature of light, then it would seem among the remote possibilities of science to obtain—say by means of a lens—a photographic impression of such thought-waves on a suitably sensitized plate, somewhat after the manner of the ordinary photographic picture. Such a thought-record, suitably employed, might be able to awaken at any subsequent time in the brain of a person submitting himself to its influences thoughts identical to those recorded.

Of course I am aware of the improbability of such a record being obtained in the near future, and of the exceeding difficulties that would seem to stand in the way of ever obtaining it.

Until we know something more definite concerning the nature of these assumed cerebral vibrations and of their lengths, we must necessarily be seriously handicapped as how best to permanently fix them on a suitable record-surface, and how afterwards to cause such record-surface to interpret its peculiarities to the brain. I merely throw it out as a possibility of what science may have in store for those who come after us. I would suggest, in this connection, that 100 years ago it would probably have been regarded as quite impossible that the telephone or the phonograph could have been produced.

Such a thought-record, however, if obtained, would not be an image of the thought itself, or of the particular groupings of the particles, whose to-and-fro movements attend or produce thought, any more than the tracings of the phonograph record form an image of the spoken words. They would merely represent the to-and-fro motions of the ether set in motion by the thought or cerebrations.

An eye looking at such an image would not be influenced thereby. If, however, ether-waves similar to those recorded could be reproduced by causing light to pass through such photographic images of the to-and-fro

motions of thought-waves, such waves might be caused to influence the brain and thereby awaken thoughts similar or identical to those recorded.

I have often amused myself with picturing a possible thought-recording machine, whereby the thoughts of an active brain might be continuously and permanently recorded on a moving sensitized film, the exposed surface of which was placed at the focus of a large lens placed in front of any one engaged in intense thought.

If, like the cylinder or plate of a phonograph or gramophone, such a record were afterward rotated at the same speed as that at which it received its impressions, under circumstances in which light passing through it is moulded into waves similar to those recorded on it, such waves when caused to act on a receptive brain should, it would certainly seem, excite therein thoughts identical to those recorded as its record-surface.

Of course, it is needless for me to say that such a machine has never been actually constructed, and is still as unsubstantial as are the speculations which I have offered you. Indeed, the probabilities against its being produced are so great that I have hesitated even to mention it.

Some experiments might be tried in a similar manner in thought transference, by holding large lenses in front of the eyes of a hypnotizer at such a distance as to converge the assumed cerebral radiations on the eyes of the hypnotized. These experiments might be tried either along with light, or independent of it.

I know that many points of the hypothesis which I have suggested are quite improbable, and that I may and probably will be misunderstood by some as putting forward facts rather than a bare hypothesis.

Probably one of the most serious objections to the hypothesis is to be found in the fact that the phenomena of telepathy and thought transference are not of more frequent occurrence. This I must frankly acknowledge to be a most serious objection. I would suggest, however, that the comparative infrequency of the phenomena may possibly be explained by the presence in the human body of a shield which protects the brain or the nerve centres from the effects of cerebral radiations. It is not impossible the sheaths of the nerves act as screens to prevent the reception by the brain of these thought radiations.

Prof. Tyndall, in his work on sound, alludes to the well-known fact that when sympathetic vibrations are being excited by a sounding tuning-fork in any body near it, that there is a greater rapidity of expenditure of energy of the fork's motion than when it was not exciting such waves. The analogue of this phenomena exists, perhaps, in the case of the assumed thought transference. Mental energy is presumably expended at a greater rate when it is exciting thought-waves in this manner than when such are not being excited.

There has often been experienced by me as a teacher a feeling of great exhaustion in taking charge of or watching a room in which a number of bright students were undergoing an examination. It is possible that the cause of this exhaustion is the rapid dissipation of energy by the cerebral radiations being absorbed by the receptive brains of the examinees. I am informed by certain physicians that a feeling of great exhaustion is experienced by them in the treatment of some cases.

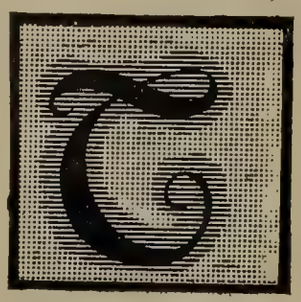
If there be any truth in the hypothesis I have briefly outlined, there should be what I would term a kind of vital radiation going on and passing outwards from the body of a healthy person, which may not improbably excite by sympathetic vibrations in the bodies of weaker persons around them, vibrations of a normal or more healthy type than those present in the sick person.

If this be true, the old belief of the efficacy of the laying on of hands, or of magnetic healing, may find some foundation, in fact, apart from what is most probably the general explanation of such causes, viz., hysteria.

I have thrown out the above hypothesis of cerebral radiations with considerable doubt and hesitation as a suggestion only to those working in the field of telepathy or thought transference, in the hope that I may thereby call the attention of such investigators to some phenomena in this very obscure field of research.

ELECTRICITY ON THE FARM.

BY A. F. McKISSICK.



THE recent application of the electric motor to ginning and pressing cotton, cutting up feed stuff, thrashing grain and other farming operations where mechanical power is called into play is another of the many instances where power transmitted by electricity furnished from a central station has proven more convenient, more economical and safer than power furnished by a steam-engine.

The location of the first plant of this kind is on the farm of the experiment station of the State Agricultural and Mechanical College of Alabama at Auburn, Ala. The station is situated about three-quarters of a mile from the college, and is in every respect a typical Southern farm. One of the necessities on a large farm like this is some source of mechanical power for performing the various operations such as ginning and pressing cotton, cutting up feed-stuff, thrashing grain, etc. This power has heretofore been supplied by a 15 horse-power engine and boiler, but it was decided some weeks ago to supplant this by the electric motor, which is furnished with current from a generator in the dynamo-room of the college. This generator is a 12 kilo-watt compound-wound Edison, 125 volts, and is run by a 35 horse-power Westinghouse Junior engine, furnished with steam from the steam plant which supplies the mechanical and electrical laboratories. The motor is a Thomson-Houston shunt-wound 110-volt 10 horse-power and contains the device for variation of speed. Owing to circumstances, the dynamo that furnishes the college buildings with lights had to be used as a generator, and the low voltage necessitated a greater loss than would otherwise have occurred. This defect it is proposed to remedy this summer by the installation of a 500-volt system. The generator and motor plants were installed, the poles put up and the wires strung by the students in electrical engineering. A number 0000 B. & S. wire is used for the outgoing; a number 6 grounded at each end and at intervals completes the return.

The motor is belted to a counter-shaft, and from this belts run to the feed-cutter, gin, screw press, cotton-seed crusher and thresher. A Brush arc dynamo is used for lighting up the campus. The feed-cutter is used for grinding up oats, ears of corn, shelled corn, peas and all kinds of grain.

In the same room is located the cotton-seed crusher. The gin and thresher are run also from the same counter-shaft. The silo-cutter is used for preparing silo, and there is a corn sheller and separator.

The steam plant is in operation the greater part of the day, so there is no delay in starting the motor at any time.

The advantages of this plant over the superseded one are its safety from danger to life and property, its safety from damage by fires, its convenience, its economy, its neatness, and the advantages necessarily accompanying the centralization of small units into one large plant.

The plant is running successfully and has proven its claims.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Current.



N ELECTRIC current, whether it be for telegraphic, telephonic or electric lighting purposes, may be said to have two natures—visible and invisible—the visible consisting of the batteries or dynamos, poles, wires, etc.; the invisible, which comprises electromotive force, resistance and current. The visible part is simply a medium for the application of the invisible part to useful purposes.

If an electric current flows through a wire, a fountain head of electric power or electromotive force somewhere is implied; and the quantity of current (current being measurable) depends upon the resistance the current has to overcome.

In our last two articles we considered "Electromotive Force" and "Resistance," and in this "Current" will be given our attention, the amount of current being determined by dividing the electromotive force by the resistance.

As has already been stated, if we have a source of electromotive force and a wire connecting the two poles (positive and negative) of that source, the result will be a current of electricity in the wire. If the electromotive force of a dynamo, for instance, be 100 volts, the electromotive force at any point along the wire would not be 100 volts, but less, because in passing through the wire the current strength is exhausted by being required to do work in overcoming the resistance of the wire. The less resistance the wire has the greater will be the power of the current to do work at any point along the wire, as was explained in the article on "Resistance," in last issue. If the current is required to pass through a wire of great resistance, its strength might all be frittered away uselessly before it reached the point where we want it to perform work. It is evident from what has already been said that the less resistance we have in the conductor the greater will be the current. This is proved by Ohm's well-known law, that the current is equal to the electromotive force divided by the resistance. $\left\{ C = \frac{E}{R} \right\}$

To make this clear we will give a couple of examples to show the practical application of this law, which is one that every electrician is constantly required to deal with in his calculations.

Suppose we have a dynamo with an electromotive force of 100 volts at its terminals, and a wire with a resistance of 50 ohms is connected to the terminals; then, according to Ohm's law, the current in that wire will be 2 ampères, because the electromotive force (100 volts) divided by the resistance (50 ohms) gives the current, which is equal to 2 ampères.

Take another case, the dynamo having an electromotive force of 50 volts and the resistance in the circuit being 100 ohms. By the application of Ohm's law we would get a current of .5 of an ampère.

We can increase the current in a circuit by decreasing the resistance. By decreasing the resistance we do not affect the electromotive force at all, because that remains constant in a given machine; the increase of current is due solely to the decrease of resistance in the circuit. Decreasing the resistance of a wire can only be accomplished by increasing its thickness; therefore, by increasing its thickness we increase its current carrying capacity.

Electric currents behave very much as currents of water do. If we have a pipe of a certain diameter connected with a water-tank of a given capacity, the pipe will deliver the water at a certain rate; but if we put in a larger pipe we increase its carrying capacity, and get, in consequence, a larger stream of water. As in the case of an electric wire, friction or resistance to the flow is what limits the quantity discharged in a given time. If the water-tank is of a certain capacity, and no provision is made to supply the loss caused by the discharge through the pipe, the current would soon cease, and the water would be discharged the quicker if the diameter of the discharge pipe were increased. This is exactly what occurs when the source of electric current is limited in its ability to produce current; a battery for instance, or an accumulator. In a battery by adding fresh chemicals and liquids we extend its ability to generate a current, and by making such renewals at proper intervals we practically make the battery a constant source of current. In a dynamo the current is maintained so long as we maintain the proper motion of the armature.

Currents are measured in ampères. To the lay mind an ampère is a meaningless term; it has no understandable value; some conception of its value, however, may be formed by comparing it with a quart measure, which is the unit measure of liquids.

The current can always be determined by the application of Ohm's law if we know what the electromotive force and the resistance are. In the generation of currents for electric lighting and electric railways an instrument called the ampèremeter is used, which shows by direct readings what the current value is at any moment. These instruments do away with the necessity of calculations.

The quality of *intensity* is inherent to a more or less degree in every electric current, but must not be confounded with the quantity of current. The intensity represents the power a current has of overcoming resistance, while the quantity of current depends altogether upon the resistance, and is variable inversely as the resistance.

ELECTRICAL SOCIETIES.

THE NEW ENGLAND ELECTRIC CLUB.

The New England Electric Club was launched into existence very successfully on the evening of May 25, in the presence of a large number of members and invited guests.

The club-house is at No. 14 Bosworth street, Boston, and since the organization of a club was first mentioned it has received generous support. It is the outgrowth of an idea formulated some months ago by a few prominent electricians and others engaged in the electrical trade in Boston, that such a club would be beneficial to the trade in that city as well as visiting members of the fraternity from all parts of the country.

There were over one hundred gentlemen present at the opening ceremonies.

Hon. Ferdinand K. Wyman, on account of ill-health, resigned the office of president of the club two months ago, and Mr. C. S. Knowles was unanimously elected to fill the position. Mr. Knowles has exerted a great deal of influence for the good of the club, having brought no less than fifty new members into the organization.

The ground floor of the club-house is taken up by a reception and dining room, the reception-room being handsomely furnished with plush and leather furniture. The second floor contains a billiard-room, kitchen and wine-room. The entire third floor is devoted to sleeping-rooms, and the fourth floor is used by employés.

Every floor in the house is fitted up with electric lights and bells and every modern convenience. It is the object of the club to provide a place for social gatherings and discuss topics of general interest to the electrical fraternity.

During the winter months a course of lectures will be established, and discussions will be had among the members at least once a month.

Among those present were Mr. Morris W. Mead, of Pittsburg, Pa.; Charles T. Luther, of Pawtucket, R. I.; George M. Phelps, of New York; Frank Ridlon, J. K. Robinson, D. A. Andrews, C. C. Pierce and others.

Refreshments were served and music was furnished for the entertainment of the members and guests. Mr. Morris W. Mead made a few impromtu remarks, wishing the club great prosperity, and many congratulations were received by wire from different electric clubs throughout the country conveying the best wishes for the club's success.

The officers of the club are: President, C. S. Knowles; vice-president, E. A. Record; treasurer, A. O. Smith; secretary, Lynn M. Hays. Directors: Maybin W. Brown, Elmer P. Morris, Charles C. Pierce, E. R. Tilton, Edward W. Sawyer.

The present membership comprises over one hundred names.

THE NEW YORK ELECTRIC CLUB.

The board of managers of the Electric Club of New York has issued a circular letter to the members of which the following is a copy:

"The efforts of the board of managers to raise funds to pay the floating debt of the club have been so far successful that the sum of $4,460 has been contributed to date. This has enabled the club to pay off about three-fourths of its obligations (excluding bonds).

"It has been determined to continue the occupancy of the present commodious club-house.

"Many members have contributed largely in excess of the assessment asked for March 21, and it is the desire of the managers to resume the restaurant on a self-sustaining basis as early as possible.

"It is earnestly hoped that all members who have not yet responded to the request of the managers for contributions will do so at once, whether the amounts donated be less or greater than the assessment of March 21."

AT THE WORLD'S FAIR.

Prof. John P. Barrett, chief of the Department of Electricity of the World's Fair; has sent us a copy of a circular he is sending out to intending and possible electrical exhibitors concerning electrical installations, space, etc. The following is the circular in full:

"It is the purpose of the Exposition management to allow exhibitors to completely equip the electrical building for lighting and power. With a view to determine just what may be done in this direction, the Department of Electricity chooses to place its plans before those who are interested in its success, and advise with them as nearly as may be, with a view to give them an opportunity to participate in this equipment.

"Under the rules of the Exposition it will be necessary as to plant all operating machinery in what is to be known the general power plant. All generators will be established at that point immediately adjacent to steam power of competent capacity. Between this power plant and the electrical building there is a subway six feet deep and six feet wide for the accommodation of conductors Fireproof vaults will be built at the point of entrance to the electrical building, in which to install transformers, to comply with the National Underwriters' requirements. Headway averaging seven feet under the flooring, and foundation posts at intervals of twelve feet will give ample wiring facilities.

"It is the purpose to divide the building into equitable sections, and to assign these sections to the various exhibiting interests. Those to whom assignments are made will be expected to install their own generators, furnish cables between the plant and the building, and do all wiring—including the furnishing of wire. Those who are given arc lighting to do will be expected to furnish carbons and attend to renewing same. Those undertaking to operate incandescent lamps will be expected to furnish all renewals and attendance. In addition to these items of expenditure, all exhibitors whose generators are operated from steam in the power-station will be asked to pay, *pro rata*, the costs incident to the erection of the machinery. Belting from shafting to generators must also be furnished by exhibitors, and exhibitors of alternating systems will be asked to contribute to the expense of constructing the transformer vault.

"The building will be equipped for 500 horse power for the operation of motors; 500 horse power for arc lights; 500 horse power for incandescents, and a reserve of 500 horse power for extra incandescents, applications for most of which are already in.

"In order that the plant for this building may not be a source of expense to the Exposition management a charge will be made for any special arc lighting desired by exhibitors who *do not* participate in the equipment and electrical supply of the building, also against the same class of exhibitors who desire power for motors or who require incandescent lamps. These charges do not concern any who contribute to the expenses cited above.

"In order that the above proposed system may be reduced to a definable quantity, I beg leave to submit the enclosed blank, which please fill out *completely* and return to me at once:

"TO EXHIBITORS IN THE ELECTRICAL DEPARTMENT OF THE WORLD'S COLUMBIAN EXPOSITION.

"Do you desire to participate in the electrical equipment of the electrical building on terms in accord with the accompanying circular?

"Is your exhibit designed to include generators operated under load?

"If so, how many, what capacity, what minimum steam power required, nature of current and character of work intended to be done (motor, incandescent or arc lighting)?

"What floor space will generators and adjuncts occupy? (Send scale drawing and confine as much as possible.)

"How many arc lamps will you exhibit?

"How many incandescent lamps will you exhibit?

"How many motors will you operate, of what sizes, and how much *power* for motors?

"Do you desire to equip your own space for arc lighting? space for incandescent lighting? space for motor power?

"Do you desire to equip additional space in the general scheme, and if so, how much, and for what purposes?

"NOTE.—Those exhibitors of special electrical apparatus which may enter into the equipment of the building, lamps, carbons, ornamental or other posts, brackets, wires, etc., and who desire to exhibit same in operation, will state kind and quantity of apparatus and specify as to its use. The department will endeavor to place such apparatus in service, and exhibitors will realize full credit conspicuously announced.

"Exhibitors will, of course, remove all their apparatus at the close of the Exposition.

"Those exhibitors who do not contemplate participation in this lighting and power scheme, but who will require electric current for motors or who will require arc lights as a part of their exhibit, in addition to the general illumination, or who will require incandescent lamps, will please state as directly and explicitly as possible the details of their requirement."

ELECTRIC RAILWAY EQUIPMENT.

Data furnished by the Field Engineering Company, 143 Liberty street, engineers and contractors for electric railways and power stations, show that the cost of equipment of electric street railways per mile of double track for cities, assuming four-minute service and 25 H. P. per car in capacity of power, is $55,000, or $27,500 per mile of road in single track length, based on road being all double tracked, and may be briefly summarized as follows:

Power station, $1,500; steam plant, $5,000; electrical plant, $3,000; car equipment, $13,000; track construction, $22,000; line construction, $7,500; general sundries, $3,000.

DIE-SLOTTER.*

To manufacturers and others making numbers of punches and dies, the machine shown will be of special interest, for there is an undoubted advantage in using a slotter.

This machine, Fig. 1, appears to combine in an eminent degree the special features desired in a tool of this kind. The two cross-motions and the rotary table provide for

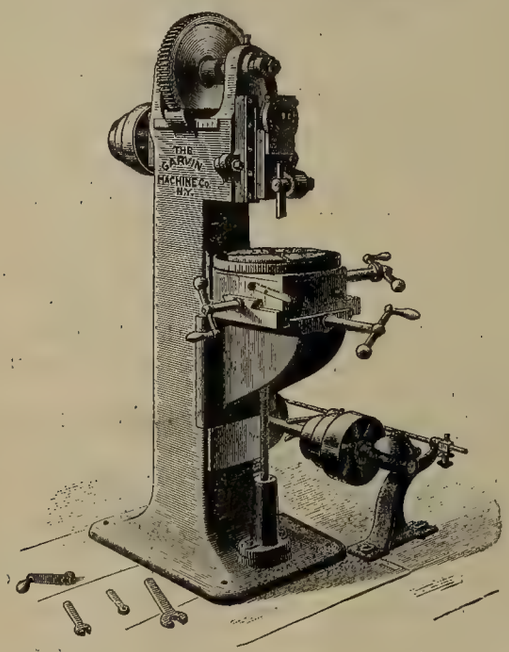


FIG. 1.

following any outline, and the arrangement of handles is convenient and avoids mistaking one for the other. The handle for the rotary table has provision for using dials for dividing purposes, which is convenient for such work as that shown in Fig. 4. For small numbers of divisions and for rapid work the worm shaft can be pulled right out and a lock-pin arrangement used for indexing the table, the handle for which is shown at the left-hand side. The handle for raising and lowering the knee is con-

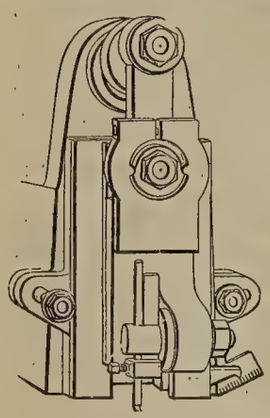


FIG. 2.

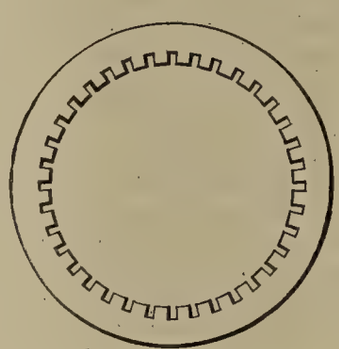


FIG. 4.

veniently placed on the side of the knee (not shown in the cut). The stroke of the machine, after due consideration, has been fixed at 2½, which is more than sufficient for the class of work intended, and affords a more solid arrangement than the usual adjustable pin. The work can be brought into proper relation to the stroke by raising the knee; and for thin work, since the cutting is done at the last or slowest part of the stroke, the number of strokes can be increased by means of the cone pulley, which thus fully compensates for any surplus stroke. To give the required draught to the die, the slides for the cam can be swivelled either way and set by the graduated index shown. With this arrangement the draught is the same in every part of the die. The tool-block is well adapted to hold special tools, such as the one shown in Fig. 2, made of Stubb's steel, clamped in a holder. The tool is cleared on the return stroke by an ingenious cam arrangement, shown more clearly in Fig. 2. The tool-block swivels on a centre near the lower edge; and at the upper end, carried in a yoke, are two hardened plugs which bear on a cam, which is bushed in to the lower end of the connecting rod, and derives a partial rotary movement from the action of the rod, and by this motion locks the tool-block. As an instance of what can be done on the machine, a typewriter key of form shown in Fig. 3, 10″ long and $\frac{3}{16}$″ wide at narrowest part, was machine finished in six hours. A die for armature rings 5″ diameter, with 36 notches $\frac{1}{8}$″ wide, $\frac{1}{4}$″ deep, such as shown in Fig. 4, was done in two hours.

* Garvin Machine Company, New York.

NEW INCORPORATIONS.

The Hoke Electric Belt Company, Camden, N. J., incorporated May 13, with a capital stock of $100,000, to manufacture, sell and dispose of Prof. C. U. Hoke's electric appliances, etc. Incorporators: C. U. Hoke, M. C. J. Stupp, Reading, Pa.; H. Becker, Philadelphia; E. S. Warren, Pensaukin, N. J.

Thomas Day & Company, San Francisco, Cal., incorporated May 12, with a capital stock of $300,000, to manufacture and deal in gas and electric fixtures, etc. Incorporators: Frank J. Symmes, Vanderlyn Stow, Samuel C. Bigelow, H. T. Clay, E. J. Duffey, all of San Francisco, Cal.

The Delaware County and Philadelphia Electric Railway, Chester, Pa., incorporated May 11, with a capital stock of $120,000. Incorporators: William H. Sayer, Wayne, Pa.; James S. Austin, Lansdowne, Pa.; Edward V. Kane, Lansdowne, Pa.

The Brookwood Traction Company, Harrisburg, Pa., incorporated May 13, with a capital stock of $10,000, to construct and operate motors and cables and other machinery for supplying motive power to passenger railways. Incorporators: N. Hamilton, Christian W. Lynch, John E. Fox, Harrisburg, Pa.

The Bloomfield Street-Railway Company, Pittsburg, Pa., incorporated May 9, with a capital stock of $12,000. Incorporators: Joshua Rhodes, John W. Fraggardh, George M. Von Bonnhorst, Pittsburg, Pa.

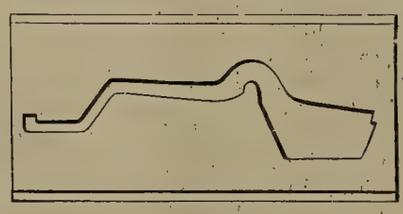


FIG. 3.

Physicians' Electrical Supply Company, Lafayette, Ind., incorporated May 13, with a capital stock of $50,000. Incorporators: Charles G. Longyear, William D. Hyslop, William G. Churcher.

Gate City Electric Street-Railway Company, Keokuk, Ia., incorporated May 12, with a capital stock of $130,000. Incorporators: William Logan, S. P. Townsend, G. S. Dana, William J. Roberts, H. H. Richardson, H. C. Reimer, all of Keokuk, Ia.

The North Manufacturing Company, Denver, Col., incorporated May 21, with a capital stock of $100,000, to

manufacture, buy and sell batteries and motors of all kinds and descriptions operated by electricity, etc. Incorporators: John D. North, W. L. Beardsley, B. A. Ambler, of Denver, Col.

The Glendale Electrical Company, Glendale, W. Va., incorporated May 23, with a capital stock of $50,000, to furnish light, heat and power by means of electricity. Incorporators: William Erskine, D. L. Hukill, Wheeling, W. Va.; J. M. Booth, Moundsville, W. Va.

The Falls City Electric Company, Louisville, Ky., has been incorporated, with a capital stock of $10,000, to manufacture and sell Hanson primary batteries, etc. Incorporators: Nicholas Finger, George A. Foree, E. D. Foree, J. B. Quinn, W. J. Wilson, H. F. Smithers, Louisville, Ky.

The Union Electric Company, Louisville, Ky., has been incorporated, with a capital stock of $50,000, to manufacture and deal in electrical instruments and supplies. Incorporators: James Marret, J. M. Biggs, John Welch, J. M. Williams, Louisville, Ky.

Home Electric Light and Power Company, Muscatine, Ia., incorporated May 23, with a capital stock of $150,000. Incorporators: S. G. Stein, F. P. Sawyer, Muscatine, Ia.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, May 28, 1892.

MR. A. B. LAURENCE, New York manager of the Shultz Belting Co. of St. Louis, has just taken an order for three 8″ dynamo belts for the Citizens' Electric Lighting Co., of Far Rockaway, L. I.

MR. ABEL HUOT, electrical engineer of Quebec, is in New York. Mr. Huot holds a number of options on waterfalls in the vicinity of Quebec, and is trying to form a company to utilize them for the generation of electric power.

MESSRS. B. W. PAYNE & SON are nicely situated in their new office and salesrooms, 41 Dey street. They recently installed a 30 H. P. automatic engine in the Seabury building, Maiden lane, to operate a 250 incandescent light plant on the Loomis system.

THE SAFETY INSULATED WIRE AND CABLE COMPANY, 234 West Twenty-ninth street, of which Mr. L. F. Requa is general manager, has secured the order for the insulated wires to be used in installing the arc-light system at the World's Fair, Chicago.

E. J. VON SAUN, formerly with Schneider, Campbell & Co., is carrying on a practical sanitary plumbing, gas-fitting and electrical business at 86 Fifth avenue. Mr. Von Saun has had a thorough experience in these branches, and is qualified in every respect to handle the finest kind of work. He makes a specialty of jobbing and repair work.

MR. J. W. GODFREY, general manager of the New York Insulated Wire Company, 15 Cortlandt street, has secured an order from the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., for insulated wire for 100,000 16 c. p. lamps, which will be used in lighting the World's Fair. The order calls for the celebrated Grimshaw wire.

MR. ISSERTEL, of the A. B. C. Company, 20 Cortlandt street, has just returned from a successful trip west. The A. B. C. Company's incandescent railway lamp with carbon support is meeting with excellent success. While on his trip Mr. Issertel secured a large order for railway lamps from the Pittsburg Traction Company. He also received a number of orders in Ohio for railway and electric light supplies.

MR. A. G. GREENBURG, formerly in the office of the Fort Wayne Electric Company, New York, is now with the New York office of the Washburn & Moen Manufacturing Company. This company has secured the contract for the trolley, feeder and supplementary wires to be used on the electric system of the Brooklyn City Railroad Company, Brooklyn, N. Y.

MESSRS. BAKER, SEELY & PORTER, 12 Cortlandt street, are rapidly completing the construction of the Newtown electric light plant. The Fort Wayne arc and incandescent systems are employed; 60 arc and 8,000 incandescent lamps. The dynamos as now arranged will be worked to their full capacity, and it is more than likely that others will have to be added. Buckeye engines are used in this station.

MR. W. R. BRIXEY, having undertaken the general management of the long established business of S. A. Day (successor to A. G. Day), manufacturer of the celebrated Kerite insulated wires and cables, with offices in the new Mail and Express building, 166 Fulton street, is prepared, after an experience of thirteeen years in superintending and improving their manufacture, to supply materials of the highest standard attainable. His personal close study and contact with the practical part of the business will enable him to meet the wants of customers in every detail.

A. T. SMITH, 6 West 15th street, is selling agent for Holtzer-Cabot motors and fans. He makes a specialty of fan motors and carries all sizes up to 1 H. P. for power purposes. Mr. Smith is getting a number of storage batteries ready that will be used to operate a small search-light on the steam yacht *Mamie*. He lately installed a 1 H. P. motor to run five grindstones and four diamond drills for Mundorff, the optician on Broadway, between 26th and 27th streets; also a dynamo for gold, silver and nickel plating. Mr. Smith contracts for and installs all kinds of household electrical goods, particularly gas-lighting appliances. All those who are in need of anything in his line should write him for figures.

A SALESMAN of the Manhattan Electric Supply Company, 38 Cortlandt street, travelling in the interest of the Mesco dry batteries, manufactured by the company, while on his rounds met a competitor, and in a comparative test of the merits of their respective batteries the Mesco battery came out on top of the heap. The Mesco showed 38 and the other only 25 points after a half-hour's test. The result was that the Manhattan Electric Supply Company secured an order for nearly 1,000 of its batteries. This company is gradually getting its salesrooms into ship-shape, and from the great number of packing-cases which can be constantly seen being filled up with supplies, it is easy to guess that business is booming.

MR. C. A. BENTON has disposed of all of his interests in the Detroit Electrical Works, and will hereafter devote his entire time and attention to the management of the Sprague Electric Elevator Company, 15 Wall street. Mr. Benton is thoroughly at home in New York, having before his connection with the Detroit company been associated with the Edison Company in this city. He was one of the most successful of the many representatives that this company ever had, it being conceded that the degree of perfection of the company's system existing under his efficient management has never since been surpassed. The Sprague Company may well be congratulated in having secured his valuable services. The Sprague system of propelling elevators is very ingenious, and under Mr. Benton's vigorous management we have no doubt but that a great demand will be created for it.

MESSRS. DOUBLEDAY, MITCHELL & COMPANY, 136 Liberty street, report large orders for their flexible conduits and canvas-jacket insulated wires. A big quan-

tity of the conduit is being installed in several large buildings in this city. As the conduit can be bought in any length desired, the cost of installation is reduced to a minimum. It is composed of a spiral tube of fibre, covered with tape and canvas jacket, and then saturated with a weatherproof and waterproof compound. The manufacturers claim that it cannot become abraded through contact with rough surfaces, as the spiral tube is so flexible that any amount of hard usage will not damage it. In the language of Mr. Doubleday, a cart can run over and not injure it. Messrs. Doubleday, Mitchell & Company are agents for the motors of the Holtzer-Cabot Company, Boston, Mass. They are doing a big business with Columbia lamps, and handle a full line of the Consolidated Electric Company's specialties ; in fact, anything in the electrical line can be obtained from this firm.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	85 50
Am. Visnal Telegarph Co	†500,000	100 00	75 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	208 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	115 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	79 75
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	111 75
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	45 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	21 50
Laclede Gas pref.	2,500,000	100 00	61 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	53 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 50
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	4 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 50
Thomson-Houston pref.	4,000,000	25 00	29 50
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	94 50
Westinghouse Elec. & Manf. Co	7,000,000	50 00	28 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	45 50
Westinghouse Ass. Rects.		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

PERSONAL.

Mr. M. D. Law, of the Edison General Electric Company, Schenectady, New York, has resigned to engage in other business.

EASTERN NOTES.

MR. ALFRED CLARK, vice-president of the Eastern Electric Light and Storage Battery Company, Lowell, Mass., reports business improving.

THE COLBURN ELECTRIC MANUFACTURING COMPANY, Fitchburg, Mass., has found it necessary to increase its facilities in order to supply the demand for its motors.

THE ELECTRIC GAS LIGHTING COMPANY, Boston, reports business very good. Col. Burnham, the senior member of the company, is visiting friends in California.

MR. HENRY HINE, general manager of the Stanley Electric Manufacturing Company, Pittsfield, Mass., has been confined to his home for the past two months with a severe attack of rheumatism.

MR. GEO. H. POOR, manager of the Hill Electric Company, Boston, is very popular, as is also the incandescent motor manufactured by his company. These motors are sold as fast as they can be manufactured. N. D. W.

The Electrical Age's Illustrated Patent Record.

Issued May 24, 1892.

475,289. Electric-Arc Lamp. Lucien Brianne, Paris, France. Filed July 28, 1891. Patented in France, in Germany, in Austria-Hungary, in Belgium, in England, in Italy and in Spain.

475,300. Extension-Transmitter for Telephones. Victor A. Cook, New York, N. Y. Filed Jan. 8, 1892.

475,334. Electric Signalling Apparatus. William C. Moore, Kansas City, Mo., assignor to the Electric Secret Service Company, New York, N. Y. Filed June 19, 1891.

475,335. Manufacture of Electrodes for Secondary Batteries. James F. McLaughlin, Philadelphia, Pa. Filed Jan. 31, 1890.

475,340. Automatic Electric Heat Alarm. Fred S. Palmer, Boston, Mass., and Leonard H. Desisle, Lamoine, Me., assignors to the Electric Heat Alarm Company, Bangor, Me. Filed Jan. 9, 1892.

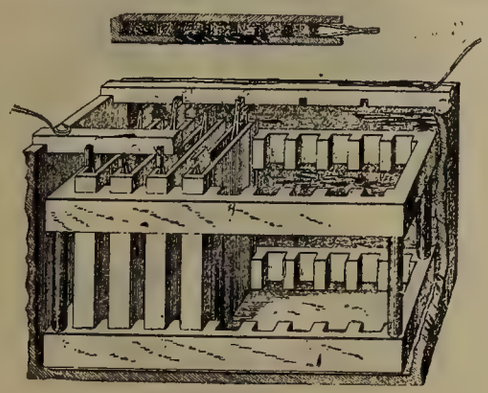
475,345. Incandescent-Lamp Socket. Frederick C. Rockwell, Hartford, Conn. Filed Feb. 24, 1892.

475,394. Incandescent Electric Lamp. Henry Green,

Hartford, Conn., assignor of one-half to Geo. S. Miller, same place. Filed Aug. 22, 1891.

475,399. Electric Actuator for Registering Mechanisms. Charles F. Holt, New London, Conn., assignor of one-half to William S. Starr, same place. Filed June 22, 1891.

475,410. Electric Mechanism for Reciprocating Motion. Henry S. McKay, Boston, Mass. Filed Aug. 20, 1891.



475,335.—MANUFACTURE OF ELECTRODES FOR SECONDARY BATTERIES.

475,411. Electric Meter. Alexander G. McKenna, Allegheny, Pa., and Henry T. Weed, Brooklyn, N. Y., Filed July 14, 1891.

475,441. Telegraphic Relay. Charles Cuttriss, New York, N. Y. Filed Dec. 1, 1891.

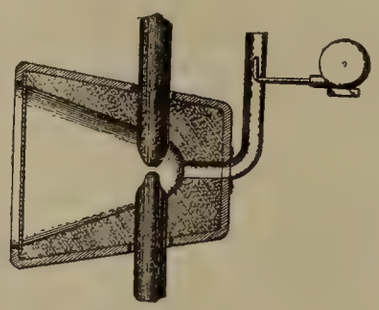
475,467. Trolley for Electric Railways. John W. Newhouse, Indianapolis, Ind. Filed Nov. 14, 1891.

475,468. Electrical Transmitting System. Frederick E. Now, Cleveland, Ohio. Filed Dec. 4. 1891.

475,482. Lightning-Arrester. James E. Browne and Frederick H. Tidnam, Elizabeth, N. J., assignors to James E. Browne, same place. Filed July 10, 1889.

475,491. Electric Locomotive. Thomas A. Edison, Llewellyn Park. N. J., assignor to the Edison Electric Light Company, New York, N. Y. Original application filed June 3, 1880. Divided and application, filed May 20, 1882. Again divided and this application filed June 9, 1891. Patented in England, in Canada, in Victoria, in France, in New South Wales, in Queensland and in New Zealand.

475,492. Electric Locomotive. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Original application filed June 3, 1880. Divided and application filed May 20, 1882. Again divided and this application filed June 9, 1891. Patented in England, in Canada, in India, in Victoria, in France, in New South Wales, in Queensland and in New Zealand.



475,544.—ELECTRIC-ARC LAMP.

475,493. Electric Locomotive. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Original application filed June 3, 1880. Divided and application filed May 20, 1882. Again divided and this application filed June 9, 1891. Patented in England, in Canada, in India, in Victoria, in France, in New South Wales, in Queensland and in New Zealand.

475,494. Electric Railway. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Original application filed June 3, 1880. Divided and application filed May 20, 1882. Again divided and this application filed June 9, 1891. Patented in England, in Canada, in India, in Victoria, in France, in New South Wales, in Queensland and in New Zealand.

475,514. Electric Car-Lighting System. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Dec. 19, 1891.

475,527. Coin-Controlled Electrical Apparatus. Horace Wickham, Milwaukee, Wis., assignor to Hugh Ryan and Henry D. Goodwin, same place. Filed Dec. 11, 1891.

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HENRY A. CLARK, Treasurer and General Manager.
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475,528. Rheostat. Charles Willms, Baltimore, Md. Filed Jan. 14, 1892.

475,529. Rheostat. Charles Willms, Baltimore, Md. Filed Jan. 14, 1892.

475,544. Electric-Arc Lamp. RobertS. Dobbie, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed June 11, 1891.

475,555. Incandescent-Lamp Socket. Cromwell A. B. Halvorson, Saugus, Mass. Filed Aug. 5, 1891.

475,566. Automatic Electric Time-Check. Charles K. Jardine, Georgetown, British Guiana. Filed Dec. 10, 1891.

475,587. Diffusion-Battery. George A. Messick, Wilmington, Del. Filed March 22, 1889.

475,600. Cable-Hanger. John J. Nate, Chicago, Ill. Filed March 24, 1892.

475,645. Lightning-Arrester. Addison G. Waterhouse, Hartford, Conn. Filed Dec. 17, 1891.

475,648. Anti-Inductive Conductor. Bror H. Wesslau, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed Jan. 21, 1892.

475,668. Commutator-Brush. Charles L. Coffin, Detroit, Mich. Filed Sept. 5, 1891.

475,727. Electric-Arc Lamp. James E. Gaston, Sparta, Ill., assignor to the Gaston Electric Head Light Company, same place. Filed Sept. 4, 1891.

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ELECTRICAL AGE

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ELECTRIC LAUNCHES AT THE WORLD'S FAIR.

Last Friday a trip was made on the Passaic river at Newark, N. J., of an electric launch which may be one of the many that will transport visitors at the World's Fair about the lagoons next year. The trip was a complete success as far as appearances would indicate. The boat is a sample to be sent to Chicago, so the Fair authorities can see for themselves what an electric launch is, and capable of doing, and if they are satisfied they will probably give the contract to the company which makes these boats, and travelling around the lagoons in these handy little craft will be one of the pleasant features of the World's Fair. There will be no offensive odors, nor any of the disagreeable features of steam or naphtha launches, and it will be a pleasure to ride about the waters in a clean and elegantly appointed boat.

A REMARKABLE STORM IN TEXAS.

A story comes from Texas that an "electrical storm" killed several acres of grass and cotton near Greenville. "The cotton is dead," says the despatch, "and has the appearance of being burned." It is further stated that the grass was burned dry by the action of the electricity. This is an unusual occurrence, and so extensive damage by an "electrical storm" has no parallel in history. The lightning, if "electrical storm" means lightning, must have been extremely active to get around several acres and kill vegetation.

ELECTRICITY ON THE ELEVATED ROADS.

There is a report that the Third avenue elevated road in this city will soon be operated by electricity. The residents along this line no doubt would welcome such a change; the electric motor would not keep them awake at night by puffing and blowing off steam, and filling their rooms with coal gas, and in every way the change would be a desirable one. It does not seem reasonable to doubt that all the elevated roads will some day be operated by electricity. "It's got to come," as an enthusiast said the other day.

ELECTRIC LIGHT STATION CONSTRUCTION.

Among the papers read at the general meeting of the American Institute of Electrical Engineers at Chicago this week was one by Mr. H. A. Foster, which should interest electric-light people. The title of the paper is "Some Points for the Electrical Engineer," and in it Mr. Foster calls attention to the careless manner in which electric-light stations are, in many cases, erected. He suggests that the Institute might, through a committee which should examine into proper station design, and report on some few general plans and suggestions as to lines to be followed, do a great deal of good by establishing a better backing for those of the members who are engaged in the electric-light business.

It is a wonder that some electric-light stations can be practically operated at all when the disadvantages to be offset are considered. Poor locations, poor construction and poor apparatus are the weak points in many stations, and there probably cannot be found any other mechanical industry where so little expert knowledge has been applied in laying the foundations for the business than in electric lighting.

Mr. Foster calls attention to the disregard of common-sense principles in many instances where electric-light stations have been established, and there can be no doubt that if the Institute should lay down some general lines to be followed in the construction of stations it would be of great benefit to the operating companies.

Some stations are models of engineering skill. This is true of large cities, but in smaller places the idea seems to prevail that any place is good enough for an electric-light station. It is gratifying to note, however, that station managers are gradually being made to realise the fact that the best is not too good for an electric-light station, which is a paying investment if run on business and scientific principles.

THE EDISON-LALANDE BATTERY AT THE CRYSTAL PALACE.

Among the numerous exhibits at the electrical exhibition now running at the Crystal Palace, near London, Eng., perhaps none has excited more general interest than that of the Edison Manufacturing Company, of New York, which shows a full line of the various types of Edison-Lalande cells, of which it is the sole manufacturer. The accompanying illustration is taken from a photograph of the company's stall, and gives an excellent idea of its general appearance. The stall occupies a corner space 10 ft. by 14 ft. in the south nave of the Crystal Palace, and thus stands in a very prominent position. The arches and balustrading are of ebonized wood, relieved with gold, and the panelled roof is covered with semi-transparent duraline, which gives a very soft light in the interior. The walls are draped with art serge and finished with an ebonized moulding round the top and sides, being also divided vertically into long panels by flat gilt strips. The upper shelf attached to the wall of stall seen on the left and supported by turned pillars contains a complete sample outfit of all the various types of cells that the



EXHIBIT OF THE EDISON MANUFACTURING CO., CRYSTAL PALACE, LONDON.

Edison Manufacturing Co. makes, while upon the shelf underneath it exhibits its Family and Physician's Faradic Batteries, and further back its Combination Cabinet outfit, which is a most complete equipment for physicians, combining both Faradic and galvanic currents, and provided with pole-changer, slow and rapid vibrators, and a circular selecting switch for throwing into circuit any particular number of cells required. In the corner another single set of cells is arranged in pyramidal form. On the shelf seen on the right the company's various cautery outfit and accessories are displayed.

The batteries are exhibited in actual operation, doing the special work for which they are severally designed. The sewing-machine in the front part of stall is driven by 6 M-type Edison-Lalande cells (motor model), while the fan-motor on the right-hand shelf at back is driven by 4 cells of the same type.

The Cautery batteries are shown heating the various cautery electrodes (all of which are manufactured by this enterprising company), and also lighting miniature incandescent lamps. The Edison-Lalande cells are also exhibited in another part of the Crystal Palace running electrical steam pressure-indicators attached to the boilers of the central power station, it having been found that this cell was best adapted to this class of work on account of its great constancy and minimum of attention required.

The stall is crowded with visitors every day, and judging from the very considerable attention that these cells are receiving from the foremost scientists in the electrical profession in England, we may safely conclude that they are destined to achieve as signal a success in that country as they have already gained in the United States. In other words, that they have come to stay.

Mr. J. W. Gladstone, superintendent, had full charge of this exhibit, and was its designer.

MOTORS AND BATTERIES.

The demand for a cheap and efficient battery-current motor to operate sewing-machines, electric fans, etc., has led to the production of numberless machines of this class, but none seems to have met all the requirements so well and completely as the one described below.

These motors are series wound and of high efficiency. They are wound for a 30-volt current and will do good work with a current as low as 4 volts. The field-magnet and pole-pieces are composed of only three castings, and are more massive than usual. The armature is of the three-coil type, with the cores of the coils arranged radially on the shaft at angles of 120 degrees. The armature core casting is all in one piece and is of the best soft iron. The base of the motor shown in Fig. 1 is

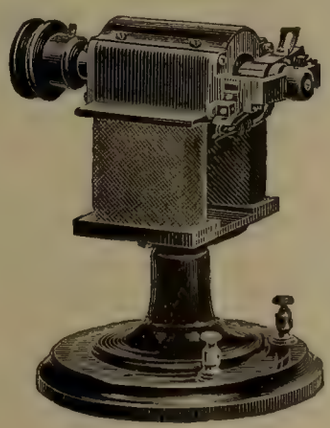


FIG. 1.

solid iron, which, on account of its weight, acts as an anchor to the motor when in operation. This avoids the necessity of screwing the motor base down to keep the machine from "walking off" or "blowing itself away," as it is liable to do when the fan is running at its full speed.

The sewing-machine motor (Fig. 2) is provided with a clamp for the purpose of attaching it to the machine stand.

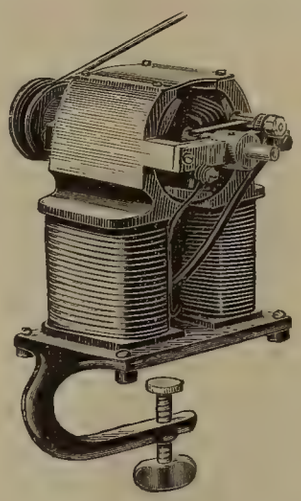


FIG. 2.—SEWING-MACHINE MOTOR.

These motors are well finished in black enamel with polished brass trimmings, and develop $\frac{1}{16}$ H. P. at 16 volts.

The "Conqueror" battery, which is designed to operate this motor, has some meritorious features, the main one and most important of which is long life. It is guaranteed to run a motor for 90 consecutive hours. It



FIG. 3.—CONQUEROR BATTERY.

is of the two-solution type, the porous cup containing the "Conqueror" solution, and the outer jar the acidulated water. The zinc is amalgamated by a special process, and it tapers so as to present the greatest quantity at the water-line, where the consumption is greatest. The carbons are especially made and are the largest on the market. They are cylindrical in shape, with two slots in the sides for the free motion of the liquids. The battery has a glass cover which is a desirable feature. (See Fig. 3).

The company has also brought out an open circuit battery which is a new departure. It is named the "Hero."

The outer cell contains the granulated carbon and the porous cup the sal-ammoniac solution. On top of the granulated carbon a hard carbon ring is set and forced

down on the grains of carbon by a screw cap, thus insuring a reliable contact. (See Fig. 4).

The granulated substance is always accessible in this battery, which is a valuable feature. The zinc is amalgamated by the same special process above referred to, which adds longer life to it, equal to a gain of about half the life of an ordinary Leclanche zinc. The E. M. F. of



FIG. 4.—"HERO" BATTERY.

this battery is said to be about $\frac{1}{5}$ volt greater than that of any other open-circuit battery in the market.

The disagreeable features of the creeping of salts are practically overcome in this battery.

These motors and batteries are manufactured by the Hero Electric Company, 80 Cortlandt street, New York city.

ELECTRICAL SOCIETIES.

CANADIAN ELECTRICAL ASSOCIATION.

During the first annual convention of the Canadian Electrical Association, which will be held in the Board of Trade Rooms, Hamilton, Ont., on Tuesday, Wednesday and Thursday, June 14, 15 and 16, 1892, the following papers will be read: "Long-Distance Telephoning," with illustrations, by Mr. Hugh Neilson; "Central Stations," by Mr. D. Thomson; "Carbons," by Mr. H. O. Fisk; "Financial Aspects of Electric Lighting," by Mr. S. J. Parker; "Steam and Electric Power," by Mr. J. J. Wright; "Multiple Switchboards," by Mr. Baylis; "Possibilities of Electric Railroading," by Mr. W. A. Johnston; "Line Construction," by Mr. T. H. Wadland, and "Safe Wiring," by Mr. A. B. Smith.

ELECTRICITY ONE HUNDRED YEARS AGO AND TO-DAY.

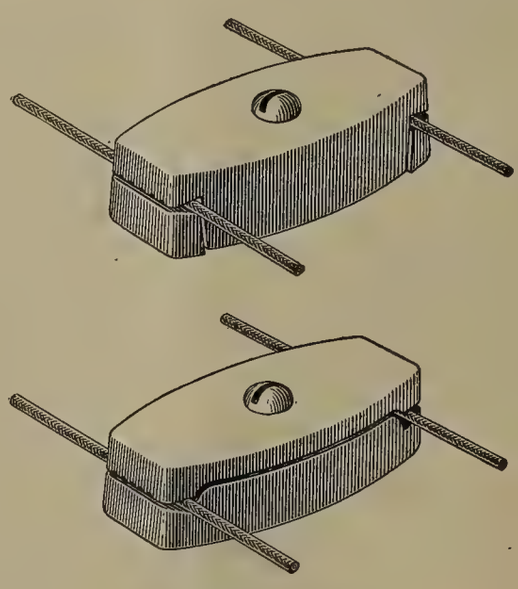
A highly interesting, entertaining and instructive lecture on "Electricity One Hundred Years Ago and To-day" was delivered by Professor Edwin J. Houston, of Philadelphia, at the Brooklyn Institute of Arts and Sciences, 502 Fulton street, Brooklyn, on the evening of June 1. There was a large attendance, and every word of the lecturer was listened to with profound attention. The professor commenced his discourse with a quotation from King Solomon, "that there was nothing new under the sun," and then in a masterly manner proceeded to demonstrate that, wise as Solomon was, yet still there was something new under the sun, and that it was to be found in the discovery and development of the electrical science. The professor divided his subject into three classifications, viz.: The immature or incomplete; the mature, but unripe, and the ripe, each one of which was specially dilated upon. He briefly reviewed the first practical discovery of electricity, which was made about 2,000 years B.C., and then running rapidly over successive periods, confined himself to the development of the science from about one hundred years or so ago up to the present time. For two hours he held his audience in rapt attention.

In concluding his remarks, the professor made some forecasts into the future, and wound up by telling the story of Alladin and his lamp, and asking if in the possession of the arc and incandescent electric lighting the world might not be considered as being in possession of a veritable Alladin's lamp.

The professor finished his remarks amid great applause, and a unanimous vote of thanks was tendered him, accompanied by expressions of regret that he had not time to continue longer. It was sincerely hoped that at some future date he would be again able to address the Institute.

THE SECURITY CLEAT.

This new departure in the way of a two-wire porcelain cleat is one of the specialties of the Security Insulator Co., of 136 Liberty street, New York. The accompanying cuts (which are about one-half actual size), showing both front and back views of the cleat, give a very fair idea of the way it is used. It is intended for incandescent wiring, and will hold securely wires of any of the usual diameters. The principal features of this cleat are its strength, neat appearance, absolute freedom from injury to the wire, and low cost in comparison to other porcelain cleats. The cleats can be had either glazed or unglazed.



SECURITY CLEAT.

EASY LESSONS FOR STUDENTS.

Owing to the press of other matter we have been compelled to omit from this issue the regular weekly contribution under this general heading.

SOME POINTS FOR THE ELECTRICAL ENGINEER.*

BY HORATIO A. FOSTER.

Although it is the province of this Institute to consider largely the more theoretical side of electrical engineering, and rightly so, it is perhaps well that it should occasionally have brought to its attention that outside practical part, only for which theory would have no backing and therefore could not reach its proper development.

It has been the fortune of the writer during the last ten months to visit and inspect, both technically and financially, considerably more than a hundred central lighting stations.

Taken as a whole, it really seems as if much of the ordinary commercial common sense and the usual keen judgment of self-interest had been on a vacation when these plants were erected. In many cases this traces back—first, to the wiles of that sleekest of all individuals the agent, who is always willing to assure the buyers that his system of lighting will virtually run itself, and then to the fact that people were formerly so doubtful of the prospective profits that on going into the business they invested the smallest amount that would start the work. The consequence was, bad construction, bad machinery, bad lines, and, of course, an entirely unreliable service. Oftentimes the man put in charge was a novice, and that worst of all novices for the business, the local amateur electrician; and is it any wonder that the business was a failure for the first few years ?

In some localities this condition still obtains, nothing having been done but to patch up the bad work of the past.

In a few cases the administration has been changed by putting at the head some substantial and tried business man, very much to the benefit of the concern. While, in many instances, even the large city plants suffer from the above causes, they also suffer from other conditions inherent in the size of their field.

The pioneers were so timid about the outcome, that the city station was invariably very much too small, and inside of two years had become so patched up and crowded, that rebuilding became necessary, and this in many cases was repeated two or three times.

There is probably no business extant which has been built over so many times and that has had the same quality and quantity of brains applied to it that is in such chaos as to the proper design of building and arrangement of machinery. In cotton or any other weaving industry, machine shops, foundries and similar establishments, it has long been determined which is the best form of building to erect, and those put up in the last ten years or so of a similar industry are planned in the same lines, differing only in size to suit the special case. Now, this not only fails to be the case in electric lighting, but outside of the two prominent systems of connecting the dynamo to its power—that is, by direct belting to fast-running engines, or by counter shaft to larger slow-running engines, there are scarcely a half dozen stations in the State built on the same or similar lines.

So much diversity of opinion is shown in designing these stations, and oftentimes by those whose opinion should have no weight, but unfortunately does, that it has the effect to convince some of the investing public that the electrical engineer does not know his business and they might as well go it alone.

If some action could be taken by this Institute through a committee which should examine into proper station design and report on some few general plans and suggestions as to lines to be followed, it might go far toward establishing a better backing for our members who are in that branch. As it is I think it will be acknowledged that far more electrical engineering skill is applied to the larger isolated plants, and that the central stations are enlarged or rebuilt under the management of the local superintendent or board of directors, who frequently lack technical knowledge or even familiarity with recent improvements elsewhere. Quite often this is owing to the fact that the only experience they have had with an electrician has been the generally young inexperienced expert who was sent out to install the first plant, and they think they can make better use of their money by controlling it themselves.

The method of distribution should also have consideration, especially in reference to the amount and style of underground work which certain sizes of city will be able to stand.

This may seem a large question, but you can be assured it is one of the most vital to the future welfare of the industry. It may be said that it is not well to interfere in private business, and that electrical engineers can be trusted to remedy the evil. I assure you the electrical engineer "is not in it," to use a vulgar phrase, and sad to say, has never been in it to any extent. Quite often officials of the electric lighting companies take a jaunt through the country visiting different stations for models for a new one for themselves. This often results in a worse muddle than ever, as they seldom find two stations at all similar, and they return resolved to use their own judgment.

This leaves the real electrical engineer out in the cold, at a point where if known he could by consultation do much good; but many of these company officials never heard of the American Institute of Electrical Engineers and need to have it brought to their notice in some way.

Some may think that in time the electrical engineer will be called in and consulted, as are engineers of other works, but at the present rate I am afraid many will be angels or worse before the majority of electrical central station companies come to that point.

Perhaps if instances be mentioned under the following heads a better understanding can be arrived at, viz.: Location; foundations; construction of station; motive-power; arrangement of machinery, and location and construction of lines.

LOCATION.

The location of plants is not now so generally bad as in the past, although we occasionally find a station in a location for which no excuse is apparent, as, for instance, one located in the basement of a carpenter shop at a long distance from fuel supplies, and only plenty of condensing water to recommend it; insurance rate, three per cent. or more. Another located nine miles away from a village of two thousand people to take advantage of water-power never surely available all the year, and since destroyed entirely for the greater part of the year. Another placed so low down in reference to its water power as to be flooded in freshets. Another located more than a mile from fuel supplies, and the centre of distribution at the top of a long, steep hill, with not even free water to recommend it. Another so located in relation to a very intermittent water-power as to be unable to take advantage of the water for condensing purposes and now running the poorest kind of a side-valve engine. Another located in a rickety, old, uncared-for part of a gas-house, where coke is scarce, and apparently plenty of water-power available within a half mile.

Another located a long distance from centre of distribution and coal supplies, to take advantage of cheap land and cheap fuel, the last of which has since proved very unreliable, when seemingly land could have been

* A paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

had much more central, with a much surer supply of cheap fuel, and to cap all, the value of that land has since increased enough to have paid the entire cost of the station at any moment it be desirable to sell.

One advantage of some of the older centrally located stations has since been learned in the increase in value of such real estate. One such station visited will enlarge and rebuild soon, and will sell its present real estate for enough advance to go far toward paying for the new station, and there are others which can, I think, tell the same story. In fact, in the present problematical growth of the future, a well-selected piece of ground may prove a very valuable part of the investment.

FOUNDATIONS.

Foundations are now much better than in the past, and some of those now placed under dynamos would sustain almost anything that could be put on them. Poor foundations are occasionally seen though, as for instance those under a large bank of boilers in a station which was erected and started in six weeks. The boilers have since lurched forward until the fronts are some two or three inches out of plumb. In fact too little attention seems to have been paid to boiler foundations as a general thing.

Engines have fared better, and when the ground has been good the foundations are to be little criticised.

One station has very large Corliss engines, and owing to water-soaked ground and limited time in which to build the brick foundations, they were placed wholly above the floor level of the dynamo-room, and belts run both ways from the fly-wheels to the shafting on either side of the room.

Very few bad dynamo foundations are now met, but many unbalanced armatures are found which no amount of foundation would hold steady.

STATION CONSTRUCTION.

In station construction there has been no settled design, therefore the promoters have generally built as they saw fit, occasionally following suggestions of the agent. Of course many plants are located in buildings already up, in which case the machinery had to be made to fit.

In many of those built especially for the work, no attention has been paid to designing for a low insurance rate, and brick stations are found sheathed all over the inside with pine, the one thing that insurance inspectors always criticise. A couple of coatings of whitewash or paint would have been much cheaper, safer, and looked quite as well.

When stations have been remodelled, very little improvement has been made in the smaller ones, but those in large cities have generally taken advantage of all the improvements to date, if not too strongly attached to some one parent company.

MOTIVE-POWER.

The selection of motive-power has of course been governed by local conditions; in the northern and northwestern part of New York State water-power is abundant and is largely used as motive-power for stations, but almost invaribly with steam reserve.

Water-power alone has been found very difficult to govern for uniform speed, and some of the devices used for that purpose are to say the least ingenious.

When the load is large enough to use part steam there is no trouble whatever, as the wheel takes a steady load and the engine does the governing.

Plants are sometimes placed a long way from the work in order to take advantage of water-power, and in some cases it seems as if all else had been sacrificed to that one point.

Of engines there is no end to the different designs, style and size used. Some use high speed, belted direct to dynamos, others slow speed belted to counter, some simple non-condensing where compound-condensing would be decidedly best.

I know of at least three plants located in waterworks pumping stations, using high-speed simple non-condensing engines on a practically steady load, all of which have been erected during the past three or four years.

Two stations I remember having an all-night and every-night load of arc lights, and situated on a lake shore, which run high-speed simple non-condensing engines.

To offset this there is one station that deserves mention, as it embodies many points of value. The building is substantial, of brick, two stories high and on a river-bank. The boilers are very efficient and well set, the engine is a moderate speed compound-condensing, with shaft extended for three dynamo pulleys and one for the power condenser. There is a heater between the exhaust and condenser and a power-pump attached to one side of the condenser. The flow to the boilers is governed by a bye-pass valve, as the pump is of course in motion all the time the engine is running. This station has only an arc load and runs all night. It was built entirely under the supervision of a local mechanical engineer, with the exception of connecting the lines and dynamo terminals to the switchboard, and would, I think, be hard to beat for results.

ARRANGEMENT OF MACHINERY.

The arrangement of machinery is as diverse as the style of motive-power; when direct belting is used the arrangement is generally simple and plain, but oftentimes so crowded as to be very inconvenient.

There seems no end to the arrangement of shafting; some have a line shaft through the middle of the dynamo-room and belt both ways to dynamos; others a shaft on either side of the room belting to dynamos in the centre; others the shaft under the floor belting up to dynamos and occasionally to engines also; others have the shafting overhead—in fact, there is no end to the styles, some good and some bad. In most cases friction-clutches are used with shafting for stopping individual dynamos, and some few may use loose pulleys on independent sleeve for the same purpose.

The length of belt centres varies greatly, some apparently thinking if long belts are better than short, very long ones must be much the best.

The improvement in switchboards seems to me more marked than in any other one department, which is probably owing to the pressure of insurance men who look at the switchboard as the most dangerous risk of all.

LINE CONSTRUCTION.

In line construction I cannot see that any very marked improvement has been made excepting, in some cases, the substitution of larger and better poles for the older ones.

The use of black covered wire in place of white has perhaps made the lines a trifle less conspicuous, but that is about all. The lines still have the apparent aimlessness of direction mentioned by Prof. Thomson at Buffalo.

People in the larger interior cities are already agitating the question of underground wires, and it seems probable that unless something is done soon by the companies themselves to rid the streets of the more conspicuous of these wires, there will be very costly trouble for them to contend with.

It can no longer be denied that wires are working well every day in subways, and the only valid argument against them is extreme cost. Nevertheless when the general public learns this fact, cost will have little to do with the argument.

In many places wires can be removed from the main

streets to alleys back of the shops, and the extra cost will be decidedly cheaper than underground work. In such few places as have already done this, wires are inconspicuous and the underground question is never raised.

In street lighting the favorite method is the cable suspension across the street. Where the work is neatly done this serves very well, but it would be difficult to find a more unsightly thing than some of the lamps so suspended.

Considerable trouble is occasioned in the above method by breakage of the wires at the joint with the line and at the cross-bar over the hood. There is no apparent reason why twin or duplex wire should not be more used for this purpose instead of the kinked and straggly single wires.

There are many other methods, some of them good in principle but bad in the application, and so it goes.

It seems to me that if some action was taken by a non-partisan association like this Institute an advance toward better engineering might be made, if a few general laws could be suggested to be followed in laying out the different parts of a lighting station. Perhaps it may be said that much of the above work should more properly come before the National Electric Light Association, but as many of that society are members of this Institute, I feel sure they would individually appreciate its backing in the future when the time comes for enlargement, and they have need of combined expert opinion.

RAILWAY TRAIN LIGHTING.*

BY A. H. BAUER.

The first successful system of railway train lighting is that invented by Houghton, and adopted by the London, Brighton and South Coast Railway of England, in 1881–82. Since then the many improvements suggested by other inventors have made it almost automatic. . . .

Numerous propositions have been made to use primary batteries for car lighting, but I am not informed of a successful installation of that character.

Secondary or storage batteries have been more or less employed for that purpose, with varying success. The first attempt in this direction was made in 1887–8 on two Pullman limited trains, of six cars each.

Each car was equipped with thirty cells of battery, having a capacity of 150 ampére hours, and weighing 50 lbs. per cell, or 1,500 lbs. per car. Duplicate sets were kept charged at each end of the line, and on arrival of the train exchanged for those that had been exhausted while on the road. The average number of lamps per car was 26, of 16 candle-power, at 60 volts, or a total of 156 in the train. After sixty days' trial, it was clearly demonstrated that, under existing conditions, the system could not be made successful, and it was abandoned. . . .

This was five years ago. Since then improved methods of manufacture as well as more intelligent care in handling has to a great extent overcome their objections and thereby increased the life of the battery. It may be asked—why not increase the size and therefore the capacity of the cell? The reply is—that to properly light a train of six Pullman cars, for instance, between Chicago and Jersey City, with the number and kind of lamps above stated, would require 30 cells, each weighing not less than 100 pounds—a total of 3,000 pounds per car, or 18,000 pounds for a six car train. The expense of handling and changing such a weight would make its use almost prohibitory, for each cell would have to be handled singly. The weight on the car would also be objectionable. Since these experiments were made, car lighting for short distance only, from storage batteries, has been made successful. For the past two years four cars, each equipped with 32 cells of 150 ampère-hours capacity and 26 16 c.p. 60-volt lamps have been running between Chicago and Cincinnati, and Chicago and Indianapolis. Two of these cars are charged every day at Chicago for about nine hours with sufficient current for a round trip. The batteries, however, are not changed; the cars are always placed on the same side track to which wires from the dynamo are led, and the charging is done without removing them. The average length of time the light is required during a round trip is six hours; the cars leave each end of the line at 8 and 9 P.M. respectively. Repairs are made by removing the defective cell and substituting another if necessary.

The cost of repairs and renewals of all kinds since September, 1891, to January, 1892, inclusive, per month, was as follows:

September, 1891	$ 36 44
October, "	108 82
November, "	51 24
December, "	79 21
January, 1892,	38 31
Total	$314 02

which, divided by four, is $78.50 per car per month, or $2.61 per car per day, and this divided by 26 gives 10 cents as the cost per lamp per day. As the engine and boiler are used for furnishing power for other purposes while running the charging dynamo, it is difficult to get the cost of the power for charging these batteries, that factor, therefore, is not included in the above statement.

In January, 1888, a solution of the problem of lighting six car trains for long distances was sought for in another direction. Two trains running between Jersey City and Jacksonville, Florida, a distance of 1,100 miles, were selected for the experiment. At first an attempt was made to utilize the power of the axle, but for reasons already stated did not prove successful.

The next step was the substitution of a vertical single-stroke engine, located in the baggage car, for the axle connection. This engine was belted to the dynamo, and was supplied with steam from the locomotive boiler.

While this plan seemed to be a step in the right direction, it still had its objections, due to the fact that the upward and downward movement of the driving-rod acted in the same manner as would a heavy blow on the car body, so that the latter would vibrate in unison with the stroke of the engine.

After a few trials, the vertical engine was removed and a three-cylinder reciprocating engine, with three-inch cylinders and four-inch stroke, was substituted. It was connected direct by a flexible coupling to a 75 volt 60 ampère dynamo of the ordinary open-frame type, and both run at 1,000 revolutions per minute.

The working of this combination clearly demonstrated that a solution of the problem was attainable, and it was now possible to guarantee a fairly successful lighting of the two trains. A fault soon developed which could not be anticipated. It is well known that all railway trains while running gather more or less dust and dirt, but it was not known until train lighting was attempted that this dust and dirt contains certain quantities of carbon and metal which adhere to armature and field wires, and being conductive form short-circuits. So frequently did this occur, that it became necessary to carry an extra armature with each plant, and make changes while the train was in motion. Later in the year these dynamos were removed, and the Eickemeyer installed. The Eickemeyer dynamo seems to be perfectly adapted for train lighting. As both the armature and field coils are protected by the iron of the machine, the dust and dirt does not reach the wire, except in small quantities, and by removing it every six months, when the car is shopped

*Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

for repairs, short-circuits have been prevented. Its strong construction is such that it will successfully withstand the general rough usage to which machinery of this character is subjected to on railway trains.

The system which has been used for the past five years on all Pullman trains consists of a Brotherhood three-cylinder engine and Eickemeyer dynamo, bolted to a cast-iron bed-plate, and located in the forward end of the baggage car, occupying an enclosed space of 6 feet 6 inches by 3 feet 3 inches. The engine and dynamo are connected by a flexible coupling which allows for the irregularity should they not be in perfect line. A two-gallon sight-feed pressure lubricator bolted to the end of the car furnishes oil to all wearing parts of the engine. The average consumption of oil is about one gallon every 20 hours of actual running of the engine.

Steam is taken from the locomotive boiler, a tap being made at the dome, the pipe passing under the tender and car, between which a flexible rubber hose makes connection. It has been found that with 1½-inch pipe between the boiler-head and car, there is a loss of 15 pounds pressure due to friction and condensation; therefore, to run the engine with 50 pounds requires 65 pounds at the supply-pipe on the locomotive. With 50 pounds pressure, the dynamo will, at 900 revolutions, generate 80 ampères, at 72 volts, when all the lamps and batteries in a six car train are in circuit, and 50 to 75 ampères, at 80 to 85 volts, at the same speed when the batteries alone are connected, depending on the counter E. M. F. of the batteries.

On the side of the car is placed an automatic switch, which will break the circuit when the E. M. F. of the dynamo equals that of the batteries. A voltmeter and ammeter are kept constantly in circuit while the plant is in operation. A tachometer, belted to the armature shaft, is also provided for noting the speed of the engine and dynamo. This plant is enclosed by a tongue-and-groove partition surmounted by a wire screen.

The system of wiring adopted is the equi-potential, in which the pressure is practically equal at each lamp and battery. One wire leads from the positive pole of the dynamo to the rear end of the rear car, where it is coupled to a second that returns to the baggage car—but not to the dynamo—being tapped, however, by the positive pole of each battery and one side of each lamp. A third wire leans from the negative pole of the dynamo to the rear end of the rear car. where it ends. This third wire is tapped to the negative pole of each battery and the remaining side of each lamp.

All the batteries and lamps are therefore in multiple arc. Double-pole, fusible cut-outs are placed in each circuit, and with the switches are located in the closets of each car. The wires are always placed on the roof of a car. For this purpose white-wood moulding, thickly coated with asphalt paint, is nailed from end to end as near the centre as possible, usually one and three-quarter inches from the edge of the smoke-jack if the car is equipped with centre oil lamps, and from 6 to 24 inches when gas lamps are applied. Branch mouldings extend to all points on the roof through which it is desired to run wires to the lamps, switches, etc., inside the car. . . .

When the batteries alone are in circuit, the E. M. F. of the dynamo will be from 67 to 83 volts, which, minus the loss, will overcome the counter E. M. F. of the batteries, viz., 57.6 to 73.6 volts. When both lamps and batteries are in circuit the external resistance is of course reduced, and the E. M. F. of the dynamo falls in proportion, and that at the lamps will be from 60 to 66 volts.

It is unnecessary to use a resistance in the lamp circuit, as when the lamps are first turned on, the E. M. F. being, say, 66, a greater candle-power is had just at the time when most needed, which, however, gradually falls and ordinarily reaches 60 to 61 volts in from two to four hours, depending upon the amount of charge in the batteries. It is true that this is at the expense of the life of the lamp, but as the handling of the switches is done by the porters and conductors, the use of rheostats or regulators, no matter how simple, would complicate the system and probably cause the total extinction of the light. Each car is provided with 32 cells of storage batteries, placed 16 in each of two boxes, securely fastened under the centre, and directly over the truss-rod. The weight of batteries and boxes complete is about 2,000 pounds. As already stated, with the system of wiring adopted the batteries and lamps are permanently connected in multiple arc, so that shouldthe train be parted and connection with the dynamo become broken the batteries will supply current necessary to maintain the light; or should the batteries under one car become disconnected, its lamps will be supplied from batteries under other cars in the train.

SELECTIVE OR INDIVIDUAL SIGNALS.*

BY THOMAS D. LOCKWOOD.

The business of the average user of the telephone keeps a line employed but for a very small part of the entire business day, and for the remainder of the time the line wire is idle and earning absolutely nothing. If by any means it could be made possible to place several sub-stations in connection with the same circuit, without materially affecting the efficiency of the service rendered, it is obvious that the earning power of the circuit would be largely increased. But a call-bell or other signal is clearly necessary in order that the attention of the station may be attracted when some other station desires to communicate, and as we add stations to a circuit we also necessarily add call-bells; thus introducing two practical objections, viz.:

1. A most incessant and annoying ringing, because a call sent to any station is heard at all stations.

2. The necessity of distinctive signals, whereby when the bell at any station is rung the attendant may know whether the call is for his or for some other station.

At this juncture the selective signal steps in, and its special work or function may be thus stated: That two or more stations being electrically connected with the same circuit, the call-bell at any predetermined or desired one of such stations may be operated, and the call given there, to the exclusion of the call-bells at the other stations, which at the same time remain quiescent, or are silent. We therefore see that the thing to be done is not merely to ring a bell over an electrical circuit; but to select and ring from a distant point a *given* bell on a circuit with which more than one are connected; and at the same time to insure that the bells at the other stations which are not intended to be rung shall not be rung.

This statement of function justifies the term "*selective signal*," which I have adopted, and which I conceive to be more appropriate than the old term "individual signal," because more descriptive.

The idea of producing a practical selective signal is not (as might from the introductory remarks of this paper have been supposed) one which made its first appearance subsequent to the advent of the telephone.

Appliances possessing the same characteristics appeared in England many years ago, and several forms have from time to time been patented in that country for use in connection with telegraphy, which closely resemble some of the forms which within the last ten or twelve years have been reinvented and patented here.

* Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

One of these[1] is based upon combinations of a plurality of line wires, two or more of which extend from a terminal to each two substations.

A second[2] involves two wires, together with the use of both directions and varying strengths of currents; and states itself to be "for sounding any particular alarm in a set of telegraph stations."

The third,[3] quoting from the published abstract, is for "transmitting secret intelligence to any one or more stations without the use of extra wires. At each station a metallic disc, suitably inlaid with non-conducting portions, is brought to the required position in order to complete the circuit or not, by any electro-magnetic step-by-step movement, thus excluding or including the telegraph instrument at any particular station or set of stations as required."

Three other British patents prior to 1876 are of this class, one of which[4] speaks of "an apparatus comprising a main line, a series of independent branch or station lines at each end, and clocks at both ends working synchronously, which, by means of revolving cams, place the main wire in consecutive connection with corresponding branches at the two ends for definite times."

Another[5] speaks of "apparatus placed in a continuous circuit; the bell at any particular station being caused to ring by the simultaneous advance in all the line-wire apparatus of a cam disposed in a way peculiar to each station, which is instrumental in closing a local circuit by which the bell is sounded."

The final instance[6] of this series is a mechanism in which a disc slotted or perforated at but one point, the location of such point differing for each station, opposes itself to the forward motion of an armature lever, at all times, except when the slot or hole is immediately opposite a pin on the end of the lever. This occurs at no two stations at the same moment, but when it does occur at any station the pin passes into the slot and the armature is thereby permitted to complete its advance and to close a local circuit and ring a bell.

Several of these suggestions will no doubt be recognized as being found also in some of the more modern selective signal appliances.

In France, too, in connection with railway telegraphy, this class of invention was formerly very popular; and as might be expected, is not neglected by that indefatigable chronicler, the late Count du Moncel, who devotes considerable space to the subject in the "Exposé des Applications de L'Electricité."[7]

It is unnecessary to recapitulate much of what he states, and it is perhaps sufficient to say that the plans of no less than thirteen different inventors are described in which the achievement of selective signalling is at least aimed at, and that some of them evince as thorough an appreciation of the merits of the question as do many of the appliances patented for the same purpose in America since 1876; while one or two actually are based upon ideas which are found in comparatively recent patents also.

In the plan of Lamothe, for example, which is discussed by M. Du Moncel, the gong which is to be struck is by one electro-magnet brought within range of a bell hammer, which then by a second electro-magnet is caused to strike the bell.

Another inventor, Bizot, has a plan for selectively ringing bells by means of pendulum hammers placed at the different stations, and adjusted at each station to a different length.

An electro-magnet at each station in the main circuit controls the swing of the pendulums by its alternate magnetizations and demagnetizations brought about by the makes and breaks of the main line current; these being effected by a vibratory circuit breaker at the transmitting station, operated by a similar electro-magnetic pendulum there, which can be adjusted when desired to the same length as the pendulum at any one of the other stations which it is desired to operate. Only that one to which it is adjusted will be operated, the others remaining inert. By so arranging *all* of the station pendulums that they can be adjusted, any station is enabled to selectively signal any other.

This apparatus I have described at considerable length, because it is founded on the harmonic principle which later was introduced into telegraphy, and because it contemplates the use in selective signalling of that principle, subsequently more elaborately worked out by German and American inventors and described in their several patents.[1]

Martorey's system, which likewise is described by M. du Moncel, also contains the elements of many subsequent forms. In it, by an electro-magnetic step-by-step motion, an escapement wheel having a number of teeth at least equal to the number of stations on the circuit, to give the signal is brought to a given position by a given number of pulsations, differing for each station. All the teeth are metallic, and all except one are insulated. That one connects with the axis and mechanism, and is part of the alarm circuit. When brought into position, the ringing circuit, which it appears is open normally at two points, is closed at one of these points, and at this juncture a single impulse sent over a second wire closes the second break in the local circuit, causing the bell to ring.

In addition to the foregoing examples of the condition of the art, it is not, I conceive, out of order to point out that the principles which govern printing telegraphy are closely related also to selective signalling. Consider for example, the House, Hughes and Phelps telegraphs, and the form of stock quotation recorders now so universally employed; in all of these a given letter or figure is brought to a suitable point and is then pressed by a final operation against the paper to make the impression.

Now a little careful thought will show that the two problems:

A. To bring a number of typewheels at different stations all to the same predetermined point, and then press the paper against them so that the same letter will be printed at all stations, and

B. To bring a number of wheels at different stations carrying local circuit-closing devices (placed at a different point for each wheel) all to the same predetermined point, where any particular one of them will be in position to close its local and ring its bell when the press movement is made; are not in principle by any means far distant from each other.

They are further related, in that both must have a unison, zero, or starting-point, to which they can be brought periodically for a fresh start, to forestall a lack of harmony between the different stations, or to provide means for bringing back an errant wheel which has strayed away from the path of electro-mechanical rectitude.

A good stock of knowledge thus was at the disposal of those interested, even at as early a date as 1876, when the career of the telephone was only beginning. We had the electro-magnetic ratchet and pawl, step-by-step, movement. We had electrically controlled clocktrains.

It was old to trip clockwork electrically, and also to use wheel circuit changers. The unison device in connection with step-by-step devices was old, and its use well known; the relay and its function of closing local alarm circuits was already a classic; wire combinations of various sorts were customarily employed, and the har-

1. Br. Patent 12039, January 25, 1848, H. and E. Highton.
2. Br. Patent 12959, February 7, 1850, E. Highton.
3. Br. Patent 13427, December 27, 1850, Dering.
4. Br. Patent No. 3006, December 1, 1863, Wilde.
5. Br. Patent No. 910, March 31, 1865, De Bonneville.
6. Br. Patent No. 1801, June 11, 1869, Lyttle.
7. Exposé des Applications de L'Electricité, Vol. iii, 1874, pp. 510–528.

1. German Patent, No. 1944, Maron, December 5, 1877.
   Br. Patent, No. 5078, Blake, December 11, 1877).
   U. S. Patent, No. 251,097, Currier, Dec. 20, 1881, and others.

monic field had already been well threshed by Helmholtz, Bizot, La Cour, Varley, Gray, Bell and others.

Why then was it not easy to make at once a thoroughly satisfactory and efficient selective call?

One reason is, that the average inventor or would-be inventor generally refuses, tacitly it is true, to recognize that there is any material of which he may make use. He does not know the state of the art; does not want to know the prior art; does not care anything about the prior art, and often feels affronted when he is necessarily brought face to face with it; and then he gives utterance to the pathetic plaint that "the people of former times were a dishonest race, they have stolen all my new inventions."

It is, however, clear from what has been stated, that the principles which underlie the problem in its many phases had to a great extent been elucidated, and that much had been done in working out scores of electro-mechanical contrivances, capable of being utilized in apparatus embodying such principles; and for these reasons there has in this branch of electro-mechanics been little scope for the exercise of original broad invention, and consequently little reasonable expectation of substantial pecuniary reward, even for him who might produce a thorough practical success in selective signalling.

These considerations have without doubt had effect in preventing many inventors and mechanicians of the first rank, or of great experience, from vigorously grappling with what was left of the problem. Yet from January 1879 to December 1891, 161 U. S. patents were granted for forms of telephonic selective signalling appliances, all of which I have examined.

A careful analysis shows that quite a large number of general plans have been proposed, and that each of these has been developed in several ways, with greater or less care, and to many degrees of perfection. Several sub-methods can be utilized in many of the general plans, and in a number of cases attempt has been made to provide for several additional functions.

Though at one or two points selective signals embodying a few of these different plans are even yet employed, every telephone man knows that it cannot truly be asserted that success has attended such appliances.

To reach practical success, by which is meant to devise a really trustworthy selective signal, economical, simple and easily kept in order, invention is not so much needed—keeping the prior art in mind—as is electro-mechanical skill to mould a homogeneous and perfect apparatus from the immense amount of material we have to choose from; an apparatus in fact which will operate perfectly, not only when the several circuit signals are ranged up alongside each other on the testing-room wall, where a screw may be adjusted here, a spring tightened there, and a bell-hammer rod bent in another place; but equally well when they are distributed over the circuit, and all at a distance from the operator.

HIGH-SPEED ELECTRIC RAILROAD.

The announcement that Dr. Wellington Adams was to lecture before the New York Electric Club on June 2, on the subject of the proposed high-speed electric railroad between Chicago and St. Louis, brought out a large attendance, and although the weather was extremely warm, all those present were deeply interested in the details of the unparalleled project as given by Dr. Adams.

The speaker introduced his subject by referring to the difficulties and obstacles met with in the introduction of the early railroads, and how these projects were ridiculed. So it was with his.

It was while he was in Europe last summer that he first got the idea of building a long high-speed electric road. At first he thought of laying the road out between New York and Philadelphia, or New York and Boston—where the traffic is great—but after further consideration he came to the conclusion that the hilliness of the country intervening between these cities, and the many streams which would have to be crossed would form great obstacles, so he finally selected St. Louis and Chicago as the termini of his proposed road. Between these two cities —a distance of 248 miles in a straight line—the country is for 200 miles as level as a floor, and on the other 48 miles the maximum grade is but 2 per cent.

It is proposed to erect two generating stations along the line of the road, one at Wilmington or Fairbury, 60 miles from Chicago, and the other at Edinburg, 18 miles southeast of Springfield. At Wilmington there is an abundance of water-power which can be had free, and at Edinburg the company owns a coal-mine, the coal from which can be sold, and the coal dust which is ordinarily waste will be used in the production of steam for the generation of the electric power; in this way it will cost the company nothing for fuel, which is the most important item of expense in a power-generating plant.

It is proposed to divide the road into four sections, as far as the electrical distribution is concerned, and each power plant will supply current to two of the quarter sections—one on each side of the station.

On a screen was projected a cross-sectional view of the road-bed, which showed that great care would be given to this important particular.

The company proposes to build at first two tracks, and each will be put upon an independent bed with a drain between the two beds and a ditch at either outside. The road-bed will be of unusually solid construction and the rails will be California rails, which overlap and are practically continuous, without fish-plates or any devices of that sort. The road will thus be secure against many of the accidents which ordinary road-beds cause. Between the two roadbeds will rise a series of poles supporting cross-arms, to either end of which will be strung the wire along which the trolley will work. The trolley will be of different design to that ordinarily used on street lines. It will be a combination of the sliding contact and wheel, and constructed with a view to meeting the conditions of high speed. The trolley wire itself will be suspended in such a way that it will be a perfectly straight line. This will be accomplished by the use of suspension supporting wires, on the principle of the suspension bridge. It is necessary to have a straight trolley wire to prevent the trolley jumping off, as it would if there were any inequalities of level, in going at such high speeds

The cars will be low, heavily weighted, and the front end of each car will be a sort of inclined plane, so that the least atmospheric resistance will be got. There will be two trucks, with a pair of six-foot wheels and a pair of 31-inch wheels to each truck. The part of the car in which the passengers will be put will be partly down between the two trucks. The top of the cars will be only 9 feet from the rail. This low car permits of the cheap construction of bridges over highways. All the highways crossed by the road will be carried over the tracks by bridges, which will be built in a substantial and proper manner, at a cost of $10,000 each.

The electrical generating and translating apparatus was meagrely described, Dr. Adams, stating afterwards that there were some details that he was compelled to withhold at present. In general, however, a three-phase 500-volt current is to be generated at the power-house, and this is to be transformed into one of 25,000 volts, which will be again transformed by step-down apparatus to 3,000 volts at transforming stations located 10 miles apart, and fed to the trolley wire at this pressure at these stations.

As to the motors to be used on the cars, Dr. Adams said practically nothing.

In the practical operation of the road all cars will go through without stop. It is intended to build spurs from the main tracks to the larger towns that have been cut off because of taking the air-line route. The car from each town will run straight from that town to Chicago or St. Louis, as the case may be, without stop or let-up. In the course of time the company expects to build two more tracks and run accommodation trains on them, stopping at stations erected a mile apart.

Mr. O. T. Crosby and Prof. George Forbes, of London, both made a few remarks at the conclusion of Dr. Adams' address.

Mr. Crosby hoped that the Doctor's enthusiasm was well founded, but he feared there were still many difficulties in the way.

Prof. Forbes said he regretted that Dr. Adams had not been more explicit as to the way the electricity was to be applied, as without knowing that no one could discuss the scheme. He has listened to the Doctor with enthusiasm but not without some misgivings.

NEW COMPANY.

The Pierce & Miller Engineering Company, 42 Cortlandt street, which succeeds the firm of Pierce & Thomas in the general engineering and contracting business carried on by that firm, was organized under the laws of the State of New York, on June 2, 1892, with a paid-up capital of $100,000. The officers are: President, F. M. Pierce; vice-president, J. D. Miller; secretary and treasurer, W. H. Stalnaker. Mr. F. Schmerber continues as chief-engineer and Mr. W. B. Hadley as electrical engineer.

Under the reorganization Mr. R. H. Thomas has withdrawn. The gentlemen composing the new company were all actively connected with the old firm, and will pursue the same vigorous policy under which Messrs. Pierce & Thomas became so well known. The company will still continue to represent the McIntosh & Seymour engines, and will make a specialty of installing electric light and railway plants. It will also go more extensively into the business of engineering and contracting for complete steam plants for electric railway, lighting and manufacturing purposes, also for mining machinery and the construction of plants for the equipping of mines and for the concentration of milling of ores, and in all work the new company will adhere closely to the policy adopted by Pierce & Thomas, of furnishing first-class machinery specially adapted to the work it has to perform, and first-class engineering and construction work, where contracts are to be executed, having in view, first, the economical and convenient operation of the plant, in line with the best engineering practice.

The first McIntosh & Seymour engine used for street-railway purposes in Brooklyn was installed by Messrs. Pierce & Thomas for the Brooklyn City Railroad Company, Brooklyn, N. Y., and it was through their efforts that engines having a total capacity of over 100,000 H. P. have been installed throughout the East. We extend our best wishes to the new enterprise and predict a successful future.

LIFTING POWER OF MAGNETS.

The lifting power of a magnet (also called its "*portative force*") depends both upon the form of the magnet and on its magnetic strength. A horseshoe magnet will lift a load three or four times as great as a bar magnet of the same weight will lift. The lifting power is greater if the area of contact between the poles and the armature is increased. Also the lifting power of a magnet grows in a very curious and unexplained way by gradually increasing the load of itsarmature day by day until it bears a load which at the outset it could not have done. Nevertheless, if the load is so increased that the armature is torn off, the power of the magnet falls at once to its original value. The attraction between a powerful electro-magnet and its armature may amount to 200 lbs. per square inch, or 14,000 grammes per square centimetre. Small magnets lift a greater load in proportion to their own weight than large ones. A good steel horseshoe magnet weighing itself one pound ought to lift twenty pounds weight. Sir Isaac Newton is said to have possessed a little loadstone mounted in a signet ring which would lift a piece of iron 200 times its own weight.

ELECTRIC LAUNCH FOR THE WORLD'S FAIR.

On the afternoon of June 3, on the invitation of the Electric Launch and Navigation Co., 120 Broadway, New York, several representatives of the electrical press and a few other gentlemen took a short ride on the Passaic river, at Newark, N. J., on an electric launch made by this company, to witness the performance of the craft.

This company hopes to get the contract for the water transportation service on the lagoons at the World's Fair, and this launch will be sent to Chicago in a few days for test and approval of the Exposition management, and as a specimen of what the company will supply in case the contract is awarded to it.

The boat is exceedingly attractive in appearance, has fine lines and is elegantly finished, and above all there are none of the disagreeable features that are inseparable from steam or naphtha launches, such as hissing of steam, smell of oil or naphtha, coal smoke, soot, etc., etc. In the electric launch no part of the motive-power is visible, and there is not the faintest suggestion of any thing of a disagreeable nature anywhere about the boat.

The boat is built of white cedar, with oak and brass trimmings, and the cabin, or rather, cockpit, which runs almost the whole length of the craft, is finished in mahogany. The seats are covered with leather cushions, and the floor with a carpet of a color harmonizing with the surrounding trimmings.

The name of the boat is *Electra*, and as she slipped through the water at her normal speed—7 miles per hour—she was exceedingly attractive, and looked capable of attaining a much higher speed with ease.

The *Electra* is 34 feet long over all, 30 feet on the water line and 6 feet beam. She draws 28 inches of water, and her propeller is 18 inches in diameter, with a pitch of 12 inches.

The current is supplied by storage cells which are arranged under the seats on each side, and on each side of the motor in the bottom of the boat. There are 78 cells in all, each with a capacity of 125 ampère-hours, and weight of 38 lbs. The total energy of the cells is 2,250 watt-hours, and the current delivered under normal speed is from 30 to 35 ampères. They carry a charge sufficient to run the boat at normal speed for 10 hours, or 70 miles; for maximum speed the cells are all connected in series, while for normal they are connected in two sets of 39 in parallel. The cells are filled with a jelly electrolyte to prevent spilling by the motion of the boat. They were made by the Consolidated Electric Storage Company, of 120 Broadway, New York.

The motor, which was designed by Mr. Anthony Reckenzaun, of London, lies under the floor of the cabin, and is entirely out of sight. It weighs 420 lbs. and gives four speeds, viz.: 3, 7, 9 and 11 miles an hour, the normal being produced with the armature running at 650 revolutions a minute. The motor is built in an extremely compact form and requires little space, and its

nominal power is 4 H. P. It is series wound, and the armature is of the Gramme ring type.

The electrical fittings and supplies are furnished by The E. S. Greeley & Co., the New York Electrical Works, Alexander Barney & Chapin, The C. McIntire Co. and others, and the wire by The Okonite Co.

The propeller shaft, which is connected directly to the armature shaft, is 1¼ inches in diameter, and is made of Tobin bronze. Ball bearings are used throughout. The power is controlled by a switch-wheel placed concentrically with the steering-wheel. The shaft of the electric switch revolves within that of the steering-wheel but is entirely independent from it; the handling of the boat is therefore a matter of great facility, as both the switch controlling the power and the steering apparatus form practically one wheel. This arrangement was designed by Mr. Fred Reckenzaun, electrician of the Consolidated Electric Storage Company, and works perfectly.

In practical operation the machinery worked with remarkable smoothness and freedom from vibration, and in every respect the boat seemed to be a perfect success.

Gen. C. H. Barney, general manager of the Electric Launch and Navigation Co., managed the boat on the trip with skill, and showed just what could be done in the matter of easy handling. Mr. E. J. Moore, vice-president of the company, accompanied the party, as also did Mr. Fred Reckenzaun, Mr. Gardner and others.

SUIT DISCONTINUED.

The suit for $12,000,000 brought by the Western Union Telegraph Company against the American Bell Telephone Company in the United States Circuit Court, Boston, Mass., has been discontinued, but in such a manner that it can be resumed at any time. The object of the suit was to compel the defendant to transfer to the plaintiff one-fifth of the shares of the capital stock of numerous corporations operating telephone and exchanges throughout the United States, and also one-fifth of the dividends of the companies and one-fifth of the sum paid the defendants for license to connect telephone exchanges, and one-fifth of the bonds and securities received for the license of telephones. The contract which forms the basis of the suit was made Nov. 10, 1879, between the American Speaking Telephone Company, the Gold and Stock Telegraph Company, the Harmonic Telegraph Company, the Western Union Telegraph Company, who are the plaintiffs, and the National Bell Telephone Company, which was the predecessor of the present defendant. The stock of all the companies named as defendants, with the exception of the Harmonic, is controlled by the Western Union Telegraph Company. By the terms of the contract the defendant was given the right to use the Gray and Edison patents, which were owned by the plaintiffs, in return for which they were to receive 20 % of all sums received for royalties. The point in dispute was whether the 20 % was to be returned upon all sums received or only on profit made.

NEW BOOKS.

DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston, A.M. 562 pages; 570 illustrations and diagrams. The W. J. Johnston Co., Limited, New York. Price, $5.00.

The first edition of this work was brought out in 1889, at a time when there was a great need for a book of this character, and since then so many new words and phrases have been coined and put into currency that a complete revision and enlargement of the original work was necessary in the second edition, which is just out.

The book is entirely rewritten, and is much larger than the first. It is a veritable electrical encyclopædia, and will be as valuable to the electrician and electrical student as the unabridged dictionary is to the student of the English language. It includes all of the words and terms in current use, and gives much valuable information in each definition.

Definitions are given under about 5,000 titles, and there are nearly as many more for the purpose of cross-references. Every subject treated of is brought up to date, and taking the work entire, it stands alone in its completeness and scope. No electrical library can be complete without a copy of this valuable book.

AMERICAN TELEGRAPHY: SYSTEMS, APPARATUS, OPERATION. By Wm. Maver, Jr. 563 pages; 450 illustrations. J. H. Bunnell & Co., New York. Price, $5.00.

The object of this book is to present to its readers a comprehensive account of the systems of telegraphy now in use in America, from a practical standpoint, and it is written in a manner intended to be clear to novices in electrical matters, more especially to those who are directly engaged in the practical working of electrical systems of telegraphy. The laws and facts of electricity and magnetism involved in the operation of the systems and methods described are clearly set forth. The illustrations in the book are nearly all original, having been prepared expressly for this work. They are exceedingly clear, and, in conjunction with the relative text, it requires little mental effort to understand the practical details of the subjects discussed.

There are 34 chapters in the book, which cover such a wide range of subjects that it would take more space than we have at our disposal to enumerate them. They not only embrace telegraph systems, but many other subjects, such as fire-alarm telegraphy, police-signal systems, railway electric block-signal systems, underground conduits, etc., and construction and maintenance of telegraph lines.

The author of this book is a well-known electrician, and has a reputation of being careful and exact in the preparation and statement of facts, and backed by such forces the work seems destined to meet with great success. It will "fill a long-felt want," for it is many years since a work of this character has made its appearance. Since the last book of this kind great changes and improvements have been made in all systems of telegraphy, and the object of this work is to bring the descriptions of all these together under one cover for handy reference. There is no doubt that it will meet with great demand. It brings everything up to date.

NEW INCORPORATIONS.

John L. Gisk Ideal Rheostat Company, Jackson, Mich., incorporated May 13, with a capital stock of $10,000, to manufacture and sell John L. Gisk rheostat and electrical appliances. Incorporators: Clarence H. Bennett, John L. Gisk, H. Smith, Jackson, Mich.

The Yonkers Machine Company, Yonkers, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and sell machines, and construct power plants, electric-light plants and other apparatus. Incorporators: Rudolph Eickemeyer, Norton P. Otis, William Delavan Baldwin, all of Yonkers, N. Y.

The Pernaux Electric Company, New York, N. Y., has been incorporated with a capital stock of $2,000, to manufacture electrical instruments. Incorporators: C. Louis Yorston, James D. Croll, New York, N. Y.; James Levre, Brooklyn, N. Y.

Rockbridge Hotel Power and Electric Company, Glasgow, Va., has been incorporated with a capital stock of $150,000. Incorporators: D. Axtile, H. W. Fuller, F. Huges, W. B. Berill, Fitzhugh Lee.

Enterprise Electric Company, Chicago, Ill., incorporated May 20, with a capital stock of $25,000, to buy, sell and deal in electrical supplies. Incorporators: William F. Richardson, F. P. Hill, W. C. McKinlock.

Harrisburg and Mechanicsburg Electric Railway Com-

pany, Harrisburg, Pa., incorporated May 17, with a capital stock of $75,000. Incorporators: E. Z. Wallower, Frank R. Leib, S. W. Fleming.

The South Side Railway Company, Denver, Col., incorporated May 16, with a capital stock of $150,000, to build and operate a system of electric railway lines in the county of Arapahoe, etc. Incorporators: John C. Montgomery, James Leonard, Stanbery Sherwood, Frank B. Gibson, Calvin P. Butler, all of Denver, Col.

The Pine Grove Water, Light and Power Company, Pine Grove, Col., incorporated May 13, with a capital stock of $15,000, to furnish water-works and electricity to the inhabitants of Pine Grove, Col. Incorporators: Charles W. Dake, Theo. W. Herr, Willis B. Herr, all of Denver, Col.

Aluminum Insulated Wire Company, New York, N. Y., incorporated May 12, with a capital stock of $2,000, to manufacture and sell insulated cables and wire and electrical machinery, instruments and supply. Incorporators: William J. Mullan, Charles C. Buddington, Thomas T. Goodenough, all of New York, N. Y.

General Fixture Company, New York, N. Y., incorporated May 12, with a capital stock of $600,000, to manufacture, buy, sell, lease and use all kinds of gas and electric fixtures. Incorporators: Samuel Insull, Joseph Hutchinson, Edward A. Stevenson, all of New York, N. Y.

Elk Ridge Coal and Coke Company, Elkhorn, W. Va., incorporated May 18, with a capital stock of $50,000; among other things it will generate electricity and sell same. Incorporators: J. H. Bramwell, C. W. Seaman, I. P. Mann, Elkhorn, W. Va.

The Electricon Metal Company, Newark, N. J., incorporated May 18, with a capital stock of $15,000. Incorporators: W. M. Whiting, East Orange, N. J.; F. M. Larchar, New York, N. Y.; L. Parker, Newark, N. J.

The Fiberite Company, Ballston Spa, N. Y., incorporated May 17, with a capital stock of $20,000, to manufacture, buy and sell fiberite conduits and battery cells and other electrical specialties. Incorporators: Horace J. Medbery, Stephen C. Medbery, Ballston Spa, N. Y.; Franklin Acker, New York, N. Y.

Edison Electric Light and Power Company of Trenton, N. J., incorporated May 17, with a capital stock of $200,000. Incorporators: F. A. Magowan, W. P. Hayes, Trenton, N. J.; F. Z. Maguire, Washington, D. C.

Universal Electric Company of the City of New York (incorporated in W. Va.), New York, N. Y., incorporated May 19, with a capital stock of $2,000,000, to buy and sell Letters Patent relating to the application of electricity to various commercial objects. Incorporators: C. W. Keep, R. L. Keen, G. P. Platt, New York, N. Y.

Indianapolis Light and Power Company, Indianapolis, Ind., incorporated May 20, with a capital stock of $600,000; among other things it will produce electric current and distribute and sell it for light, power or other purposes. Incorporators: Daniel W. Marmon, Charles Perry, William R. Evans.

City Electric Railway Company, Port Huron, Mich., incorporated May 26, with a capital stock of $100,000. Incorporators: Albert Dixon, S. L. Ballentine, William Canham, all of Port Huron, Mich.

Washington Park and Spring Grove Railway Company, Sioux City, Ia., incorporated May 27, with a capital stock of $150,000, to maintain and operate a street railway by electricity. Incorporators: Ed. Haakinson, Daniel T. Hedges, William V. Hedges, Carl E. Haakinson, E. H. Haakinson, Sioux City, Ia.

Lowell Electric Light Company, Lowell, Mich., incorporated May 25, with a capital stock of $60,000. Incorporators: C. J. Church, Greenville; Otto C. McDonnell, Alice E. McDonnell, both of Lowell, Mich.

The Magnetic Electric Company (incorporated in W. Va.), Boston, Mass., incorporated May 24, with a capital stock of $5,000,000, to manufacture and deal in electrical apparatus. Incorporators: W. D. Northenn, W. F. M. Collins, A. J. Lowd, Salem, Mass.

The McConnellsville Malta Electric Company, McConnellsville, O., incorporated May 21, with a capital stock of $10,000. Incorporators: H. B. C. Vincent, John A. Adair, F. M. Beckett, Irven Traves, Elmer A. Taylor.

Katahdin Mining Company, Spokane, Wash., incorporated May 23, with a capital stock of $100,000. Among other things it will build and operate railways, electric light and water-works. Incorporators: A. M. Mason, H. T. Mallon, B. Norman, Ralph C. Clark, C. Happy.

Norway Water Power and Electric Light Company, Norway, Me., incorporated May 24, with a capital stock of $50,000. Incorporators: H. L. Horne, C. N. Tubbs, F. H. Noyes, Norway, Me.

National Gas and Water Company, Chicago, Ill., incorporated May 25, with a capital stock of $500,000, to build, lease and operate gas, water and electrical works. Incorporators: C. D. Hauk, E. E. Morrell, N. A. McClary.

Chicago Electric Light Enlarging Company, Chicago, Ill., incorporated May 25, with a capital stock of $5,000. Incorporators: Adolph Graeff, Alfred Graeff, Jesse Cox.

Pierce & Miller Engineering Company, New York, N. Y., incorporated May 23, with a capital stock of $100,000. Among other things it will contract for electric and manufacturing plants. Incorporators: Francis M. Pierce, Ferdinand Schmerber, New York, N. Y.; John D. Miller, Brooklyn, N. Y.

The Nutley Electric Light, Heat and Power Company, Franklin, N. J., incorporated May 26, with a capital stock of $100,000. Incorporators: C. H. McIntyre, Newark, N. J.; E. Teeter, H. Edgar, Franklin, N. J.; F. W. Ward, East Orange, N. J.

Johnston Motor and Electric Company, Portland, Me., incorporated May 26, with a capital stock of $250,000, to manufacture and deal in all kinds of electrical appliances. Incorporators: W. C. Johnston, C. W. Higgins, Melrose, Mass.; Charles A. True, Portland, Me.

Chadron Electric Light and Power Company, Chadron, Neb., incorporated May 27, with a capital stock of $20,000. Incorporators: James W. Boyd, Thomas A. Coffey, Chadron, Neb.

Gordon Electric Company, Chicago, Ill., incorporated May 28, with a capital stock of $10,000, to manufacture and deal in all kinds of electrical machines, equipments, materials, instruments, etc. Incorporators: Walter T. Gunthorp, Jean Elliott, Marion E. Moore.

The Electrical Supply and Construction Company, Pittsburg, Pa., incorporated May 25, with a capital stock of $100,000. Incorporators: M. D. Card, H. M. Doubleday, Pittsburg, Pa.; William M. Galbraith, Chartiers, Pa.

Belle Vernon Electric Light Company, Belle Vernon, Pa., incorporated May 27, with a capital stock of $1,000. Incorporators: J. S. Van Voorhis, A. C. Brown, J. C. Cunningham, Belle Vernon, Pa.

The Lewisburg Light, Heat and Power Company, Lewisburg, Pa., incorporated May 23, with a capital stock of $12,000. Incorporators: Charles S. Pardee, Frank S. Marr, John F. Duncan, Lewisburg, Pa.

People's Electric Light and Power Company of Silver Creek, Silver Creek, N. Y., incorporated May 26, with a capital stock of $20,000. Incorporators: Theo. Gresho

Albert H. Stebbins, H. W. Alson, Frank P. Stewart, Charles Hamond, all of Silver Creek, N. Y.

Citizens' Electric Company, Battle Creek, Mich., incorporated May 27, with a capital stock of $50,000, to furnish electricity for lighting Battle Creek. Incorporators: William Andrus, M. M. Lewis, William H. Mason, Battle Creek, Mich.

The Carroll Electric Company, Portland Me., incorporated May 27, with a capital stock of $75,000, to manufacture and deal in electrical apparatus of all kinds. Incorporators: Frederick V. Chase, John B. Kehoe, George H. Allen, Portland, Me.

The Portland Consolidated Street Railway Company, Portland, Ore., incorporated May 26, with a capital stock of $1,000,000, to operate street railways, either by horse, mule, or electric, cable, steam or other mechanical power. Incorporators: George B. Markle, James Steel, R. L. Durham, D. F. Sherman, E. McNeil, Portland, Ore.

The Standard American Electrical Company (incorporated in W. Va.), New York, N. Y., incorporated May 21, with a capital stock of $3,000,000, to manufacture and deal in electrical machinery, contract for electrical plants, for heat, etc. Incorporators: John H. Storm, W. H. Wood, Charles N. Codding, New York, N. Y.

Newton Electric Light and Power Company, Newark, N. J., incorporated May 20, with a capital stock of $150,000. Incorporators: J. A. Seely, Brooklyn, N. Y.; C. O. Baker, Jr., Newark, N. J.; C. F. Porter, New York, N. Y.

The Western Temperature Regulation Company, Chicago, Ill., incorporated May 21, with a capital stock of $60,000, to sell, erect, operate and handle the Johnson Electric Service Company's patents for temperature regulation, and control mechanical fixtures. Incorporators: Charles A. Barker, Pulhemus S. Hudson, Arthur A. Simmons.

Brownville Electric Light Company, Brownville, Pa., incorporated May 20, with a capital stock of $7,000. Incorporators: Frank P. Kifer, Joseph S. Elliot, Bridgeport, Pa.; William E. Ledger, Lucyville, Pa.

The Hope Electric Light and Power Company, Cartersville, Ill., incorporated May 17, with a capital stock of $20,000. Incorporators: A. C. Hope, J. V. Walker, R. H. H. Hampton, W. H. Zimmerman, F. C. Zimmerman.

The Pullman Electric Light and Power Company, Pullman, Wash., incorporated May 13, with a capital stock of $25,000. Incorporators: H. H. Cheatham, S. A. Midge, Alexander McKenzie, all of Pullman, Wash.

The Prospect Street Railway Company, Ashtabula, O., incorporated May 14, with a capital stock of $10,000, to build and maintain a street railroad to be operated by electricity, steam or other power. Incorporators: James Reed, S. F. Conant, C. H. Blakeslee, F. C. Moore, Frank Luce.

BRADBURY STORAGE BATTERIES.

Judging from the continuous increase in its business, and the numerous testimonials received, the Bradbury Storage Battery Company, Lowell, Mass., is manufacturing one of the best storage batteries yet put upon the market. This company has increased its facilities twice within the last three months, and in order to supply the increasing demand for these batteries, has found it necessary to again enlarge its capacity. The following claims are made by the company for the superiority of its storage battery over all others: It is strong and durable. The electrodes are constructed of a hollow gird, braced in all its parts, to insure against buckling. Is made in one piece with two open faces. The braces not only strengthen them, but act as a support for the active material, as well as afford a conductor for the current to act rapidly upon the active material in charging and discharging. This accounts for the remarkably low internal resistance of the battery. It will stand heavy discharges where others would succumb. It will deliver a larger percentage of current than any other. It is lighter and takes up less floor-space than any other. There are no solder joints to burn off. It does not require a current regulator to govern the current, to prevent the lamps from burning out. To fully appreciate the many various uses to which these batteries can be applied, a copy of the company's catalogue, which treats of the subject exhaustively, should be secured.

A PLEASANT AFFAIR.

We are indebted to Mr. A. B. Laurence, New York manager of the Shultz Belting Company, for an account of the reunion of the Shultz family at Shipman, Ill., on May 20 last.

This reunion brought together about one hundred of the members of this family, who reside in four or five States. The occasion of the meeting was the ninetieth birthday of the mother, Mrs. Nancy Shultz, who is still in possession of her faculties. Nine of her children are yet alive, including Mr. John A. J. Shultz, president of the Shultz Belting Company, of St. Louis, Mo.

There were present at the gathering, besides sons and daughters, eighty grandchildren, great-grandchildren and great-great-grandchildren, and other guests from different cities.

The entire number of living descendants of Mrs. Shultz comprises five generations and two hundred and twenty-three living persons.

A reception was held in honor of Mrs. Shultz at the residence of her son Mesback, in Shipman, and an elegant dinner was served, at which addresses were made by her son, Mr. John A. J. Shultz, and others.

Mrs. Shultz is the daughter of a Revolutionary soldier who served all through the war. On the occasion of her ninetieth birthday the members of her family memorialized the event by presenting a new church in Shipman with a bell, to be known as the "Nancy Shultz Memorial Bell."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, June 4, 1892.

MR. G. M. LEE, well known in electric light circles, was in town this week.

MR. SAMUEL INSULL, who was recently elected second vice-president of the General Electric Company, has resigned that position to accept the presidency of the Chicago Edison Illuminating Company.

THE INTERIOR CONDUIT AND INSULATION COMPANY, 42–44 Broad street, has issued a very useful telegraphic code-book to be used in connection with its illustrated general catalogue No. 7.

DR. J. B. DE LERY, 5–7 Dey street, who enjoys great popularity among the electrical fraternity, offers to advance the money necessary for the development of electrical patents and inventions of merit. He also purchases patents outright.

THE KNAPP ELECTRIC MOTOR COMPANY, of Warren street, has increased its manufacturing facilities, which now enables it to turn out over 500 motors a week. The Knapp motor, although new upon the market, is meeting with wonderful success.

THE TYPEWRITER EXCHANGE, 10 Barclay street, New York, of which Mr. George A. Hill is the manager, continues to increase in its enormous volume of business.

Here can be found all the standard makes of typewriters, and the surprise is how Mr. Hill manages to sell machines at one-half the prices asked by the manufacturers; but this he does, as is evidenced by the fact that hundreds of business houses throughout the country have purchased their typewriters from Mr. Hill.

THE MANUFACTURERS' ADVERTISING BUREAU, owing to the large increase in its business, has found it necessary to add two more rooms to its present quarters. An entire floor is now occupied at 117 Liberty street. B. R Western and J. H. Williamson, proprietor and busines. manager respectively, are well known in the trade fos their enterprise.

MR. W. F. D. CRANE who has been widely and favorably known as manager of the railway department of the Engineering Equipment Co., New York, has become connected with the Electrical Department of the H. W. Johns Mfg. Co., 87 Maiden Lane. This department deals with the company's specialties, moulded mica, vulcabeston and monarch insulating materials, extensively known through their numerous applications in the insulation of electric railway trolley lines, and in the manufacture of insulating device for electrical machinery lamp-sockets, and other purposes.

MR. J. E. COSTILO, for many years foreman of the Garvin Machine Works, New York City, has recently established a general tool and machine shop, on the corner of Hudson avenue and Concord Street, Brooklyn, N. Y. A visit to Mr. Costilo's works elicited the fact that it is one of the finest fitted up shops of its kind in Brooklyn, equipped with the most modern machinery for the manufacture of all kinds of tools, milling machinery, sharpers, planers, screw machines, etc. Mr. Costilo makes a specialty of screw and milling machines the former of which has a great run, as is evidenced by the fact, that the supply is not equal to the demand. His milling machine is also in great favor. Mr. Costilo is an expert machinst, and employs only first-class workmen, hence, intending purchasers may be assured of the quality of the goods obtained from his works.

MESSRS. BATEMAN & POLLARD, 143 East 23d street, contractors for electric light wiring of buildings, isolated plants, complete installations, electric railroads, marine works, electric bells, burglar alarms and speaking tubes, have lately completed the isolated plant for the Hebrew Institute, East Broadway and Jefferson street. The installation consists of one 650 light Eickemeyer dynamo, Ball engine, etc. They also wired the building for 750 16 candle-power lamps. The Temple Bethel, 5th avenue and 76th street, was wired by this firm for 1,250 16 candle-power lamps on the Edison system. Messrs. Bateman & Pollard make a specialty of marine wiring. They are at present overhauling and rewiring Wm. H. Starbuck's steam-yacht *Tillie*, putting in 55 storage batteries, and are making an electric band 300 feet long to hold 150 16 candle-power lamps for illuminating the outside of the yacht on special occasions. This band is carried from the stern over the top of the masts to the bowsprit. Other steam-yachts being overhauled and rewired by this firm are John A. Morris' *Cora* and A. B. Claflin's *Seneca*.

MESSRS. HATZEL & BUEHLER, 29 West 26th street, exhibit a line of pictures of mansions, commercial buildings, hospitals and depots where they have installed complete electric-light plants, rewired or newly wired for the installation of electric light and of general electrical appliances, including call systems, watchmen's time-detectors, etc. They lately installed in the New York Hospital one of the finest isolated incandescent electric-light plants in this city. This plant consists of Detroit Motor Company's dynamos, for which they are agents, with a capacity of 760 lamps each. The switch-board is a novelty in itself. The building is wired for nearly 1,500 lamps. The call system for the ambulance surgeons, an exceedingly ingenious device, is the invention of the firm. When a call for an ambulance is received at the main office the clerk on watch pushes a button and establishes connection with the surgeon's quarters, where a bell is rung, and at the same time closing a circuit through a relay, cutting in a 16 C. P. lamp. Before leaving the surgeon pulls a pendant switch and cuts out the lamp. Messrs. Hatzel & Buehler have also invented and built a static electro-medical apparatus with resistance, which can be connected with the lamp circuit in any part of the building for treatment of patients. The apparatus is mounted on wheels, and can be conveniently moved from floor to floor and to all parts of the building. The residence of Henry O. Havemeyer, 5th avenue and 66th street, was also wired by this firm for electric light and all kinds of household apparatus. They also wired the immense building of Austin, Nichols & Co., the large wholesale grocers, and have just completed the wiring of the new quarters of the American Express Company, 63 Broadway. The firm has a large number of contracts on hand, among which is one for another 20 H. P. motor from Austin, Nichols & Co.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	85 00
American Visual Telegraph Co.	500,000	100 00	475 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	115 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 25
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	85 00
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	110 25
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	45 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	20 50
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	53 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	55 09

Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	4 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 75
Thomson-Houston pref	4,000,000	25 00	29 50
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	95 25
Westinghouse Elec. & Manf. Co	7,000,000	50 00	29 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	47 00
Westinghouse Ass. Rects.		50 00	17 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The comparison between British and American public companies is prodigiously in favor of the former. The methods of keeping the public posted on the business of the corporation, with the single exception of that current business which if made public would evidently be taken advantage of by competitors, is accepted as correct; and further, the general or annual meetings are held in public halls, and if the shareholders are not too numerous, all who desire are welcome to enter and listen to the proceedings. No corporation with over one hundred shareholders would be deemed to have acted honorably by holding its meeting without representatives of the press being present, and the report of the proceedings as handed in by the reporter (whose notes he is liable at all times to be called on to swear to) is taken by the secretary, and a copy sent to each shareholder, beside the publicity given by the regular circulation of the paper itself. No particular paper is selected, but the one having the fullest report is generally given the order for copies. This from a company like the Civil Service Supply Assocation, which has nearly 100,000 members or shareholders, is an order worth having. In most cases no charge is made, except for the actual copies sent out at regular prices, but when the company is small and the shareholders scattered, one or two pounds is paid the reporter for his work. The real cause of this is that the directors of companies in Great Britain are educated men, competent to manage the financial affairs of the proprietors, and almost without an exception, strictly honest. A nobleman with a long list of historical ancestry may take a guinea for attending a meeting as a director, but money would not induce him to knowingly, or even if he suspected it, permit the interest of the shareholders to suffer, whether they were present or absent. There are over six hundred members of Parliament who are directors of public companies, and in case of one's conduct as a director being successfully questioned, one of his first acts must be to resign his seat in the House, or unquestionably the hour would very soon arise when he would not be allowed the privilege of resigning. There is at times a humorous side (but who shall say it is not honest?), as is shown by the following from the *Financial World*:

"The following advertisement lately appeared in an English newspaper:

"'Directors wanted of good social standing for a new company now in course of formation; qualification will be found for selected applicants, and remuneration will be on a liberal scale.'

"To this there were 141 replies received: one earl, one viscount, four barons, seven baronets, one knight, thirteen honorables, six members of Parliament, four generals, one admiral, nine colonels, four majors, fourteen army captains, three minor naval officers and seventy-three without rank or title. There were some very amusing letters accompanying the applications. The earl said: 'I need not point out that, should you entertain my proposal, an important leverage in securing a good subscription of public capital will be gained by my title, which is an old one and likely to prove an attraction to investors. I may also state that, if appointed, I should always make it a point of driving to the general meetings in my brougham and pair, with servants in full livery. This, I am told by friends sitting on company boards, is a great factor in inspiring shareholders with confidence.'

"One of the barons wanted to know 'if the fees were paid in advance, irrespective of any profits made by the company.' One of the members of Parliament wrote that he had no doubt that, if he were appointed, it would result in heavy purchases of shares in his constituency, where he was very popular. 'And,' he added, 'it would be well if the bona fides of your scheme were assured, at any rate, on the surface.' The last part of the sentence would seem rather to give the virtuous legislator away, as he evidently did not care whether the scheme was good or not."

It will be a great advance for American investments when five or six hundred of our representatives in Congress assume these responsibilities. There are a few already in the traces, but not enough to give solidity to the mass of directors.

The dividend list increases satisfactorily, and has increased $1,679,042 over the month of June, last year. The amount this month is $28,339,882, and as usual I suggest that a considerable proportion of this, in being reinvested, finds its way into electric securities. The field is growing very fast, and the returns are not only increasing monthly, but the intrinsic value advances at a rate unequalled even by a real estate boom in New York. The market is well supplied with new securities, the latest being the "Leetonia Electric Light and Power Co.," of Ohio, who wish to issue $30,000 ten-year 6 % gold bonds; they have a 30-year franchise and 5-year contract with two cities, and expect a third of the same nature, all to be operated from the same central station. The company now earns $4,500 over all expenses. There is one point in reference to this class of securities worthy of note to the investors; they are situated in the old settled states, free from excitements or opponents, and as electricity becomes more popular, the local company reaps all the benefit. There are a great many of these corporations from one to four or even five years old, who have themselves established a plant, and having constructed and equipped it for their own use and purpose, feel justified in either realizing on part of their interest or borrowing, in the shape of bond and mortgage, money to use for other purposes. There are also a few municipal bonds in the market, the bonds being issued to the construction company for the expenses of installing the plant; one of these is Portland, Conn. (a city I never heard of before, but it is there), surely the bona fides of a $20,000 municipal bond so near by can be ascertained by investors in a few days, and these are offered at an attractive figure.

WESTERN NOTES.

The Railway Equipment Company, 11 Adams street, Chicago, of which Mr. W. R. Mason is general manager, has issued a circular descriptive of the "Chicago Clamp," to be used in connection with its complete standard insulator, and which is the only reliable device made for such purposes. This company always carries in stock a complete line of electric railway supplies.

THE E. P. ALLIS COMPANY, Milwaukee, Wis., will furnish free the chief motive-power for the machinery at the World's Fair. The engine will be furnished as part of the company's exhibit, and will be of gigantic proportions—capable of developing between 3,000 and 4,000 horse-power. It will be of the quadruple-expansion type. The Allis Company's exhibit will cost about $175,000.

EASTERN NOTES.

THE GERMANIA ELECTRIC COMPANY, Boston, Mass., has moved its offices to rooms 46 and 47, 620 Atlantic avenue. It also announces that Dr. F. A. C. Perrine, formerly of the John A. Roebling's Sons Company, has become identified with the company as its treasurer.

MR. GEO. H. SOUTHWICK, superintendent of the Wheelock Engine Company, Worcester, Mass., reports business very good. The company has recently received orders for twelve engines, ten of which are for electrical service. Engines of all sizes from 50 to 2,000 H. P. are built by the company. The entire system of the Chicago City Railway Company is operated by Wheelock engines, and these are giving entire satisfaction.

THE JOHN BECKER MANUFACTURING COMPANY, Fitchburg, Mass., makes a machine which seems almost indispensable in the manufacture of electrical goods, etc. This machine is known as the Becker Vertical Miller, and is made in three styles: Nos. 1, 2 and 3, each of which possesses special merits. No. 1 is designed to perform the most delicate kind of milling operations upon brass, steel, iron, copper, zinc and wood. To meet the requirements to this end, the following very necessary features have been embodied in this tool, viz.: high spindle speed, long bronze bearings, constant and perfect lubrication of same, combined with perfect control of spidule-head and sensitiveness of the table-slides. This machine will be sound of great value in electrical instrument manufactories. No. 3 is designed for various operations for milling with face mills, and has no equal among its class for range of general usefulness. In construction nothing but the best of material and workmanship is employed. These machines are having a great sale; several were recently shipped to Chicago, New York, Newark, N. J., and elsewhere.

THE ELEKTRON MANUFACTURING COMPANY, Springfield, Mass., has found it necessary to keep its men working until midnight for some time past, in order to keep up with the great number of orders which it is daily receiving.

THE HART & HEGEMAN MANUFACTURING COMPANY, Hartford, Conn., reports business exceedingly good. The Company is making some changes and bringing out new novelties in the switch line that will soon be put on the market.

N. D. W.

The Electrical Age's Illustrated Patent Record.

Issued May 31, 1892.

475,759. Electric Meter. Oscar Ericsson, Sioux Falls, S. D. Filed July 23, 1891.

475,781. Electric-Wire Holder. Edwin L. Lloyd Philadelphia, Pa. Filed Aug. 6, 1891.

475,783. Contact-Post for Electric Bells. Frederick W. Manger and Otto H. Huebel, Brooklyn, N. Y. Filed Feb. 29, 1892.



475,998.—SEAL FOR LEADING-IN WIRES.

475,797. Secondary-Battery Electrode and Process of Making the Same. Anthony Reckenzaun, London, England. Filed Sept. 13, 1890. Patented in England, in France, in Belgium, in Germany, in Italy, in Victoria, and in Spain.

475,809. Electric Self-Winding Clock. Frederick M. Schmidt, Brooklyn, N. Y. Filed Oct 9, 1891.

475,877. System of Electrical Distribution. Cyprien O. Mailloux, New York, N. Y. Filed November 25, 1891.

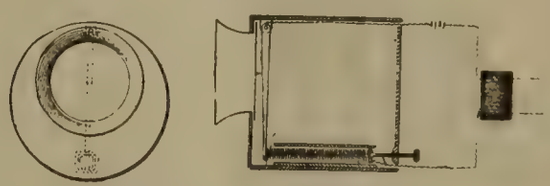
475,898. Rheostat. Frederick W. A. Schneider, Toronto, Canada. Filed July 20, 1891.

475,920. Electric Conductor. Charles W. Bassett, Newton, assignor to the Washburn & Moen Manufacturing Company, Worcester, Mass. Filed Feb. 1, 1892.

475,925. Automatic Fire-Alarm System. Charles Burgher, Newton, Mass. Filed Jan. 29, 1892,

475,938. Telegraphy. Thomas Gothorpe, Rye, N. H. Filed Aug. 15, 1889.

475, 955. Railway Signal System. William G. Wattson, Tappan, assignor of one-half to Joseph B. Stewart, Haverstraw, N. Y. Filed June 17, 1891.



476,026.—TELEPHONE.

475,970. Electric-Railway Motor. Jabea F. Shawhan, Detroit, Mich., assignor, by mesne assignments, to Freeman B. Dickerson, same place. Filed May 10, 1890.

475,998. Seal for Leading-In Wires. Henry D. Burnett, Lynn, and Samuel E. Doane, Swampscott, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed March 7, 1892.

476,007. Submarine Telephone. Henry Finch, Michigan City, Ind. Filed Oct. 23, 1891.

476,021. Electric-Light Shade, etc. Howard A. Miner, Philadelphia, Pa. Filed Dec. 31, 1890.

476,026. Telephone. Stephen F. Sherman, New York, assignor of one-half to George F. Shaver, Yonkers N. Y. Filed March 2, 1892.

476,054. Telephonograph. James P. Magenis, North Adams, Mass. Filed July 23, 1891.

PATENTS.—Continued.

476,080. Electric Terminal. Hercules Sanche, Detroit, Mich. Filed Sept. 29, 1891.

476,128. Conduit for Electric Railways. Walter F. Carr and Charles F. Ferrin, Minneapolis, Minn. Filed Aug. 6, 1891.

476,151. Dynamo-Electric Machine. William Koedding, St. Louis, Mo., assignor of one-half to Edmond Verstraete, same place. Filed Jan 31, 1891.

476,156. Device for Testing Arc-Light Circuits. Albert H. Manwaren, Philadelphia, Pa. Filed Feb. 3, 1890.

476,183. Incandescent Lamp. James Ball, Holyoke, Mass., assignor of two-thirds to James T. Abbe and George N. Tyner, same place. Filed Nov. 23, 1891.

476,207. Insulator-Pin. Fred M. Locke, Victor, N. Y. Filed Jan. 30, 1892.

476,225. Electrical Reciprocating Tool. William P. Carstarphen, Jr., Denver, Col., assignor to the Electric Reciprocating Company, same place. Filed June 1, 1891.

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TIME-BALL SERVICE RESUMED.

The old Western Union time-ball was as familiar an object as anything in this city prior to July 18, 1890. On that date a fire in the Western Union Company's building did great damage, and the time-ball service was necessarily suspended. It has just been resumed after a lapse of two years, and the new apparatus is an improvement on the old.

Thousands of people depended upon the daily dropping of the old ball for the regulation of their timepieces, and it was especially valuable to mariners, with whom accuracy of time is a matter of great moment.

The new ball will be visible on a clear day from Sandy Hook with the aid of a glass, and no doubt the sailors who depended upon the old ball for their time regulation will be glad to know that the service has been resumed and that it will be more accurate than the old, if such is possible.

VALUABLE PAPERS.

We publish in this issue abstracts of some of the papers read at the general meeting of the American Institute of Electrical Engineers, which was held in Chicago last week. Each paper is sufficiently interesting to be published entire, but when the question of space is taken into account it would require a volume as large as a book to do justice to all.

We have endeavored to extract from each paper what is of most practical value to our readers, and in this condensed form we think the matter will be better appreciated and surely read by busy men.

The papers read this year were on a great variety of subjects and add a great deal to our knowledge on electrical development in general.

CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

During the present week the Association of Railway Telegraph Superintendents will hold its annual convention in Denver, Col. This society is composed of intelligent and practical men who meet every year and read papers and discuss subjects pertaining to their important duties. After the business of the convention is over the party will visit various places of interest in Colorado.

Among the papers to be read at this convention will be one by Mr. Charles Selden, superintendent of telegraph of the Baltimore and Ohio Railroad Company, on the subject of "Electricity and its Relation to Transportion." As Mr. Selden is always practical and instructive in his papers, no doubt this one will be full of general interest, especially to those connected with electric street railways, as his theme is largely in this line.

DEATH OF MR. CAVELL.

Mr. E. V. Cavell, late general manager of STREET RAILWAY NEWS, and well known among street-railway people throughout the country, died in Nassau, N. P., June 7.

He went to Nassau last March in the hope of receiving some benefit from the climate in that latitude, but it did him no good.

Mr. Cavell was born in England about 34 years ago, and he had a large circle of friends who will be pained to learn that he is dead, although his death was not unexpected.

VALUABLE SUGGESTION.

A very valuable suggestion, and one that should receive the careful consideration of electrical students, is offered in a paper recently read before the American Institute of Electrical Engineers at Chicago. It is suggested that as students cannot very well afford to take a year from the midst of the college course for outside work, they should during the summer vacation between the third and fourth term seek and accept such employment as would give them an opportunity to put to a practical test the theoretical knowledge acquired during their studies.

THE WESTERN UNION TIME-BALL.

THE Western Union Telegraph Company has resumed its time-ball service at its headquarters in this city, and thousands of people will now be able to keep better time than they have since the service was suspended by the fire, July 18, 1890.

The new service will be an improvement over the old in many respects. It will be remembered that under the old arrangement the mast on which the ball dropped was located on the tower at the Broadway end of the old building. The reconstructed building has a flat roof, and the new time-ball will be dropped on a mast 23 feet high, which surmounts a skeleton tower 82 feet high, erected on the roof at the rear end of the building. The

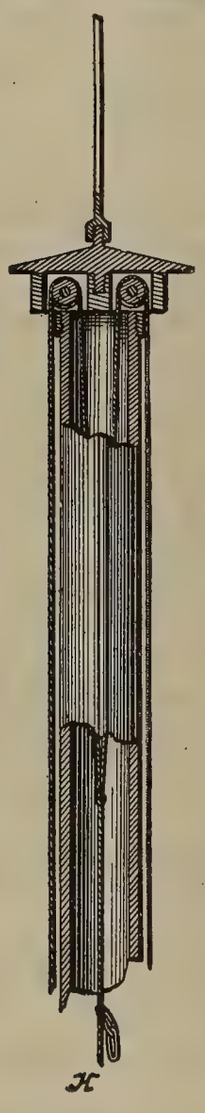


FIG. 1.

new ball when elevated to its highest point will be 265 feet above the sidewalk, and can be seen, on a clear day, for many miles in every direction. Mariners, who used to depend so much upon the old ball for the regulation of their time-pieces, will be able to see the new one from Sandy Hook on a clear day, with the aid of a glass.

The four corner frames of the tower, as they set on the roof, form a square, and the tower tapers towards the top, so that it is smaller at the top than at the base. It is substantially constructed of iron and especially designed for the service that it is put to.

The mast is a hollow metal tube, at the top of which are placed two pulleys, set diametrically opposite each other, on which the ball halyards run. This construction will be understood by reference to Fig. 1. It will be seen that the two ropes on the outside of the mast sus-



FIG. 2.

tain the ball, and after they pass over the pulleys they combine into one which passes down through the interior of the mast. This rope, after it emerges from the mast, is attached to the drum of the drop mechanism.

Fig. 2 gives a general view of the mast and ball, and shows, at *H*, where the rope passes out of the interior of the mast to the winding and dropping apparatus.

The ball is constructed on a different plan to the old one. It is formed with steel ribs and covered with can-

vas. In its descent from the top of the staff it drops into an air-tank, the air in which acts as a cushion and breaks the force of the falling ball. The air gradually escapes from the tank through valves located at the bottom. The diameter of the ball is 3 feet 6 inches.

Fig. 3 shows the method of releasing the ball so as to cause its descent. The rope to which the ball is attached is shown passing through the opening at the right-hand top corner. When the ball is drawn up to the top of the mast, which is done by winding the rope in the drum by means of a handle, the drum is prevented from unwinding before the proper time by the pawl *f*. The construction of the pawl-lever and the lever *G* is such, and they are so placed with reference to each other, that when the sounder armature is drawn down it releases the lower end of the lever *G*, the upper end of which, under the tension of the spring *n*, flies back, and in so doing disengages the pawl from the teeth on the drum. All restraint being thus removed from the drum, the ball drops by gravity into the air-tank before referred to.

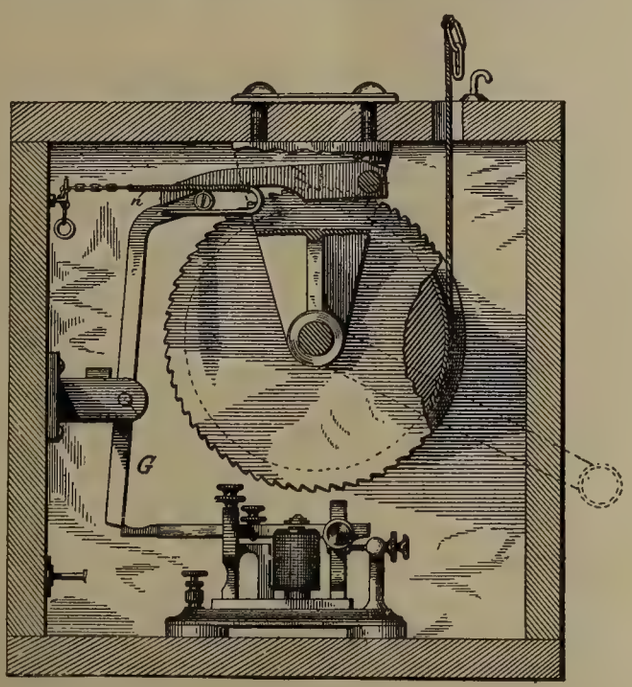


FIG. 3.

The sounder used for this purpose is of the ordinary pattern, and is operated by a relay on which the noon signal is received from the Washington Observatory. Two wires are connected with the Observatory and the time-beats are received on both, but the time-ball mechanism is operated by only one of the wires. The additional wire is a reserve, so in case trouble should appear on one wire just before the noon signal is received the other one is used to receive the signal on. The switching is done quickly by an attendant who has a three-point switch at hand, so he can switch off the defective wire and switch on the good one in an instant. Trouble on both wires at the critical moment is of extremely rare occurrence.

Just a few moments before noon the time-circuit is opened by the clock at Washington, and exactly at noon it is closed again. In this interval the time-ball apparatus is placed in connection with the sounder, as above referred to, and when the current is closed at noon the ball is released and drops.

STEERING BY ELECTRICITY.

During the voyage of the double-turreted monitor *Miantonomoh* to Norfolk, Va., she was steered by electricity. This is the first instance of an American vessel having been steered in this manner. This is looked upon as quite a feat, in view of the fact that it is said to be more difficult to steer a monitor than any other vessel.

A NEW SYSTEM OF ELECTRIC PROPULSION.*

BY H. WARD LEONARD.

PART I.

In the distribution of electricity from a power station for the operation of electric railways the only commercial method to-day is by the use of a system of constant E. M. F. operating the motors in multiple arc with each other, and at the present time every consideration of economy and automatic regulation seems to indicate that the constant E. M. F. multiple arc system will always be the best for such distributions.

In the use of electric energy by motors operating under conditions of varying speed and torque, the best results as regards economy and regulation are obtained when the electric energy utilized has a voltage varying directly as the speed and a current varying directly as the torque, for it is evident that under these conditions the electric energy required will be always proportional to the power developed.

If we could operate from the constant-potential system a shunt-wound motor running at a constant speed, and could interpose between this motor and the axle some device equivalent in its effect to an infinite number of different sets of mechanical gears, so that we could make use of any reduction desired, it would enable us while using a constant power to increase the torque as we decreased the speed, and *vice versa*, which is just what is desired in railway practice, where the least torque is required when at full speed on the level, and the greatest torque is required at the slow speed in starting and in operating on a grade. Numerous and very ingenious devices have been invented for accomplishing this variable mechanical reduction, but on account of the complication, noise and unreliability they have never proved successful.

The writer has recently devised an electrical method of securing all the results which could be obtained from such a set of gears described, with a freedom from the noise, wear, complication and rigidity which such a set of gears would necessarily involve.

Following is a general description of the arrangement proposed, as indicated by Fig. 1:

T, trolley.
M, motor portion of power converter.
G, generator portion of power converter.
P, the propelling motor for the car.
R, the regulating and reversing rheostat in field of G.
E, the connection to ground.
W, the car-wheel.

Each axle is driven by a gearless motor, either directly or by means of a connecting-rod. The fields of these motors are excited directly from the constant E. M. F. of the line and independently of the armature circuit. Beneath the car and between the axles there is suspended a motor-generator, each armature winding being in a separate field. The motor portion of the motor-generator — which will for convenience be called the power converter — is shunt wound and connected just as a shunt-motor is for use upon ordinary constant-potential circuits. The field of the generator portion of the power converter has its field connected across the line, and has inserted in it a regulating and reversing field rheostat. This field circuit is independent of the armature circuit. The generating armature of the power converter is in metallic connection with the armatures of the gearless propelling motors. It will be noticed that this circuit including the armature is a distinct and separate metallic circuit having no connection with the line in any way.

Suppose now that our shunt-motor is running at full speed, and that our controlling rheostat in the generator

* Paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

field circuit is at its central position, so that the generator field circuit is broken. Although the generator armature is being driven at full speed, it is revolving in a field having no magnetism except the residual magnetism, and hence produces practically no volts. Let us now move our controlling-switch so as to place the generator field across the line, but with a resistance in series with the field of ten times the resistance of the field-coils. We now get a slight excitation of the field and a development of volts at the brushes of perhaps 40 volts. This voltage will produce a current through the armatures of the driving motors dependent upon the ohmic resistance of this circuit only; and hence, even at this low voltage, a large current will be produced which, being in a field of full strength, will cause a torque sufficient to start the armature. The speed of the armature will, of course, be governed by the counter E. M. F. which its revolution produces in its strong field; and hence, just as in the case of a shunt-wound motor, its speed will be practically constant so long as the E. M. F. supplied is constant.

If we now gradually increase the magnetic field of the generator by cutting out resistance by moving the controlling-switch, we will gradually raise the E. M. F. of the

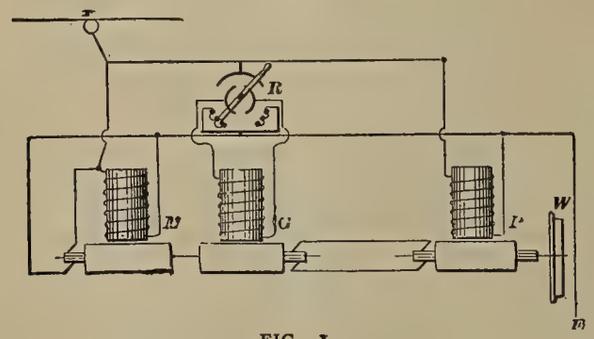


FIG. 1.

armature circuit, and with it the speed of the driving-motors. Since these armatures are revolving in a constant field, the torque they produce will be exactly proportional to the current in them, and the current will automatically flow exactly as is required to produce the necessary torque to maintain a speed such that the counter E. M. F. will approximately equal the E. M. F. supplied by the power converter. Thus it will be seen that the speed of the car will be dependent upon and proportional to the E. M. F. supplied by the power converter, and the torque or tractive effort will be dependent upon and proportional to the current supplied by the power converter.

Let us suppose that 60 ampères flowing through the armatures in fully excited fields will produce a torque sufficient to move the load when upon a grade. It is evident from what we have seen that 40 volts from the power converted will produce this current. Hence, by an expenditure of 2,400 watts in the secondary circuit, or a total power, including field excitation, etc., of about 8 H. P., we can start a fully loaded car upon a grade.

Under the existing systems we would need the same 60 ampères in the same fully excited field, but would necessarily use the full voltage of 500 volts, and therefore consume energy represented by 30,000 watts, as against possibly 6,000 in this system. The current from the line in starting the car under ordinary conditions by this system would be about 12 ampères at 500 volts, instead of from 60 to 100 amperes at 500 volts.

In practice, the controlling switch-lever can be instantly thrown from its central position to its extreme position for full speed. The field magnetism of the generator is rapidly increased, and consequently also its E. M. F., which in turn causes a gradual acceleration of the car.

The current in the armature circuit, and consequently the torque, is quite large in the beginning; but the E. M. F. at this time is quite low, so that the total watts are low; as the inertia is overcome and the counter E. M. F. begins to approximate to the impressed E. M. F., the current falls off and finally becomes constant at an amount necessary to produce the torque required to maintain the speed. The current from the line, and hence the power, gradually increases from zero to the amount required at full speed, but at no time, either at the start or during the acceleration, is the energy from the line greater than that required when we are operating at full speed. It will be noticed that the effect is the same as though we first operated through a set of gear-wheels, giving an extremely great reduction of speed and then rapidly changed the ratio of gearing, until finally we operated at full speed, with no reduction.

With our hypothetical gears we could, when running at speed, rapidly increase the ratio of gearing so that the movement of the car would tend to drive the shunt-motor faster and faster. This would convert it into a generator forcing current back into the system; which production of electrical energy would act as a brake and gradually bring the car to rest.

Just so, if, while running at full speed we suddenly place our switch-lever at its central position, the field of the generator will gradually reduce the strength, and the counter E. M. F. of the propelling motors will soon exceed that of the generator. The momentum of the car will now be driving our gearless motors as generators, which will supply current to the former generator, operating it as a motor, causing it to drive the shunt-motor coupled to it as a generator, which in supplying energy to the line will act as a brake, and smoothly but rapidly bring the car to rest by converting the energy stored up and represented in the movement of the car into electrical energy, which will tend to relieve the work at the central station. Similarly, a car descending a grade and tending to accelerate in speed can be made to move at any desired speed without the aid of any mechanical brakes, and the energy represented by its falling weight will be converted into electric energy, and the car will become a moving feeder supplying energy to assist the generators at the central station in the operation of other cars.

It will be evident from what has preceded that with this power-converter system we can propel a car upon any practicable grade with a consumption of power no greater than is required to operate the car at full speed upon a level, by merely reducing the speed to the required extent.

In street railways of from five to ten cars this is of great importance, for it means that we can equip a road with about six H. P. per car, as regards the engines and dynamos, and that our conductors can be reduced to about one-third of the amount at present necesary, for we will never require more than 20 ampères at the distant point, where to-day we have to provide for 60 ampères with the same loss and same initial E. M. F.

Under the rheostat system the plant is severely taxed when an unusual crowd must be moved from a certain point, and it is then, when it is of the greatest importance that no break-down should occur, that it usually does occur. With this power-converter system we could, upon a five-car road, start up and move with perfect safety 10 or even 20 cars from the most distant point on the road, though of course at a reduced speed, but the crowd would be handled with perfect success and without subjecting any portion of the plant to any unusual strain.

In the large cities it is no unusual sight to see an electric car moving at the slowest possible speed for perhaps several blocks. Perhaps 12 amperes are required to obtain the necessary torque. This at 500 volts is 6,000 watts. The power required for this slow motion by the proposed system would not exeed one-fifth of this amount.

Following is a tabulated statement (Table I.) showing the results we may expect to obtain by this system in operating with fully loaded car under three different conditions: First, at 12 miles per hour on level; second, at three miles per hour on five per cent. grade; and third, at one mile per hour on level.

LEONARD SYSTEM OF ELECTRICAL PROPULSION.

TABLE I.

DUTY OF CAR. SHOWING VARIOUS LOSSES EXPRESSED IN WATTS.

Various Losses Involved.	8 Tons at 12 Miles per Hour on Level. Full Speed, 1-6 Full Torque; Armature Current, 10 Ampères.			8 Tons at 3 Miles (or 5 Tons at 5 Miles) per hour on 5 per cent. grade. ¼ Full Speed, Full Torque; Armature Current, 60 Ampères.			8 Tons at 1¾ Miles per Hour on Level. 1-10 Full Speed, 1-6 Full Torque; Armature Current, 10 Ampères.		
	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.
	Motor part.	Gen. part.		Motor part.	Gen. part.		Motor part.	Gen. part.	
Field.....	250	275	250	250	60	250	250	25	250
C^2R in armature...	160	60	60	250	2000	2000	20	60	60
Friction....	60	60	120	60	60	30	60	30	10
Foucault currents, hysteresis, etc	200	400	400	200	50	50	200	10	10
Total	670	795	830	760	2170	2330	530	125	330
Total watts wasted...	.....	2295	.....	.....	5260	.....	.....	985	.....
Watts of work done	.....	4000	.....	.....	6000	.....	.....	400	.....
Total watts absorbed.	.....	6295	.....	.....	11260	.....	.....	1385	.....
Ampères at 500 v.....	.....	12.6	.....	.....	22.5	.....	.....	2.8	.....

In arriving at the losses, as indicated, the motor part of the power converter has been assumed as having the following features:

E. M. F., 500 V.; current capacity for ten hours' continuous duty, 15 ampères; resistance of shunt field winding, 1,000 ohms; armature resistance, 1.1 ohms.

The generator portion of the power converter and the driving-motor are assumed as having the following features:

E. M. F., 500 V.; current capacity for ten hours' continuous duty, 40 ampères; resistance of field, 900 ohms; armature resistance, 0.55 ohms.

The rolling friction with gearless motors on good level track is assumed as 20 lbs. per ton. Car is assumed to be eight tons in weight full loaded, and five tons for moderate load.

We find that with 12 tons moving at 12 miles per hour on a level we will require 12.6 ampères, which is practically the same as by present series-motor systems. With eight tons moving at three miles per hour upon a five per cent grade 22.5 ampères will be required, which is about one-third of the power required by present systems. With eight tons at one mile per hour on level, 2.8 ampères will be required, which is about one-fifth of that required by present systems. With five tons moving at five miles per hour on five per cent. grade, 18.5 amperes will be required, which is about 40 per cent. of the power required by present systems.

THE TECHNICAL EDUCATION OF THE ELECTRICAL ENGINEER.*

It is impossible for many, and doubtless undesirable for the majority, to take a year from the midst of their college course for outside work. The summer vacation between the third and fourth year should, therefore, be occupied in some such employment as wireman on electric light or telephone construction, or better, in the station and repair-room of an electric railway, under the eye of an appreciative superintendent. Three months spent in this work may seem very little, but it will do a deal of good in giving an apt student a fair idea of how far exact formulas will carry him. It is only by the generous co-operation of employers that students can obtain this summer's work. At first thought it appears that the employer gains no advantage from it, but upon careful consideration an advantage is evident. To begin with, the properly trained student will not prove useless during the summer, and the satisfactory one will usually find employment after graduation, with the interests of those who afforded him summer work, and who thus gain the benefit of his greater advancement during his last year at college. In a similar manner, the manufacturer gains an advantage from placing his apparatus in the technical school laboratories for *proper* use in instruction.

Suppose a student has completed the prescribed college course, and has done a proper portion of repairing armatures, stringing wires, or similar work, at some interval between his terms at college, what shall we call him? A few of the technical colleges of the front rank call their graduates engineers, but we have already seen that they must pass through a transition period during which the claim to the title can be proved. To call an untried graduate an engineer does not seem proper respect for himself or the successful workers in his profession. The transition period may never end for some graduates, while its length must always depend upon the man. Until the graduate has been in practical life a sufficient time to show his capacity, and has reached a position of responsibility, he has no right to claim from his college an engineer's degree. Upon this ground the University of Wisconsin, as do many others, confers degrees in engineering upon graduates of its engineering school of not less than three years' standing, who have held engineering positions of trust for at least one year. The minimum transition period is thus tacitly recognized as three years. Upon completing his college course, the student is given a graduating degree of Bachelor of Science by the engineering school, which is simply an endorsement by the university that he has received a good technical college education and is in a fair way to profit by it.

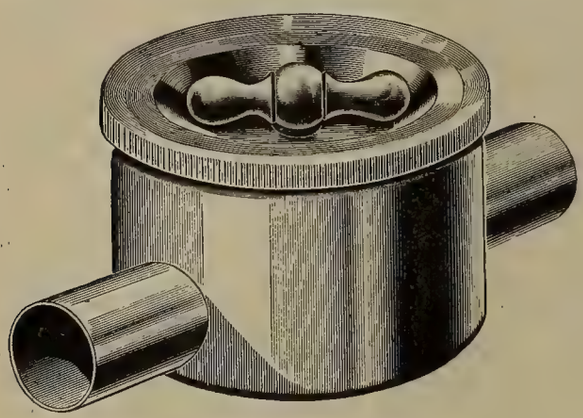
That the rigid specialization required in the technical school may not diminish the graduate's field of vision and thus his usefulness to society, is a matter of much concern. With the college left behind there is little opportunity to gain a broadening culture, except that received by contact with broad men, while we have seen how little opportunity for this can be afforded in the technical course. With this in view we recommend at the University of Wisconsin, that all who can afford the time and money complete a four-years' undergraduate course in the University School of Arts and Sciences before entering the School of Engineering. By proper elections during the general course, the studies of an engineering course can be completed in two additional years. By this plan a solid educational foundation is laid for the specialized studies of the engineering student, and the best conditions are developed for his ultimate success in professional work. The plan offers two other

* Abstract of paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

points of advantage: First, the student comes to his professional studies in the engineering courses with a more matured mind, which is of much importance; second, students without the taste for hard engineering work, which is required for their future success in technical industries, will not often attempt a technical course after having completed a general course.

We can now usefully inquire into the specialized work that should be prescribed for the average electrical engineering student during his last two years at college. Up to this point students in mechanical and electrical engineering courses have received virtually the same instruction. Here, we hold, with several others, their paths should diverge. The student of mechanical engineering goes into careful study of shop practice, designing and utilizing various types of machinery, and similar subjects. The electrical engineering student must receive a good working knowledge of the problems of the mechanical engineer, but he must, above all, be trained in the practical problems of electrical engineering. He therefore goes into a study of that which will aid most in making him truly an electrical engineer. His knowledge must all be based on mechanical laws, but he must be much more than one-tenth electrical.

Before reaching his truly professional studies, the student should gain, during his course in physics, a common-sense grasp of the elementary notions of electricity and magnetism, and of the "all-pervading law of Ohm." The latter can be properly enforced in the laboratory by placing in the student's hands ordinary electrical instruments, such as bridges, galvanometers, ampèremeters, voltmeters, etc. Before beginning his specialized work the student's knowledge of Ohm's law and its common results should have become almost instinctive.



FLUSH SWITCH.

With due regard for his preparation, it seems best to arrange the professional studies for the average electrical engineering student in four divisions, thus:

1st. Electro-magnetism and its application to practical uses, with special reference to dynamos and motors.

2d. Electro-chemistry (including primary and secondary batteries) and electro-metallurgy.

3d. Alternating currents and alternating-current machinery, including dynamos, converters, condensers, etc.

4th. The special application of the preceding divisions in electric light, power, railway, mining and other types of plants.

The last division is allotted about twice the amount of time given to each of the others. . . .

The student who satisfactorily completes a *proper* professional course at college, whether laid down in the college catalogue or carefully selected from that prescribed, is not likely to become one who "turns out results like a cornsheller, and never grows wiser or better tho' it grinds a thousand bushels of them." In order that he may have a fair opportunity of growing "wiser and better" in the practice of his art, he should be given reasonable encouragement. As Mr. Holley one time said, an understanding should obtain—"among the owners, directors, and commercial managers of engineering enterprises that it is not a matter of favor, but a matter of as much interest to themselves as to any class, that young men of suitable ability, and of suitable preliminary culture, however acquired, should have an opportunity and encouragement to master the practical features of technical education *in works*, not as mere apprentices, but under reasonable facilities for economy of time and completeness of research."

A legend on the cover of a circular lately issued by the Engineering School of the University of Wisconsin, gives the true object of the technical college, when it says, "We do not aim to produce engineers, but to produce men with great capacity for becoming engineers." If our product is accorded the treatment advised by Mr. Holley (himself an experienced manufacturer), we feel sure the work of our school and of similar technical schools will not be useless.

FLUSH SWITCH.

The new ten-ampère Flush Switch illustrated herewith is manufactured by the Interior Conduit and Insulation Company of New York, at the suggestion of a prominent architect, and is a production which has received high indorsement and commendation from the electrical trade. The illustration shows the many desirable features of the article. A notched cover is indented so as to allow the handle of the switch to be "flush" with the wall on which it is placed, and a brass rim extends around the edge so as to protect the wall from soiled hands when unscrewing the cover, and at the same time serving to impart a finish to the switch when placed in position.

The advantages of this switch are at once apparent, and the article instantly commends itself to the attention of architects and others interested in rendering the various appliances used in conjunction with incandescent electric lighting ornamental and unobtrusive, as well as useful.

AMMETERS AND VOLTMETERS.

Queen & Co., of Philadelphia, are just issuing a revised price-list of their "Magnetic Vane" Ammeters and Volmeters, in which two forms are given—one with brass and the other with iron cases. The difference in price is occasioned only by a corresponding difference in material used, and external finish, for both types are calibrated to the same degree of accuracy. These instruments are extensively employed for switchboard purposes, and enjoy an excellent reputation. As decided changes in appearance and prices have been made, it will be well for interested parties to obtain a copy of the special descriptive circular No. 330.

UNIVERSAL ELECTRICAL DIRECTORY

J. A. Berly's Universal Electrical Directory for 1892, just out, is more complete than any of the preceding issues. It contains nearly 75,000 entries and covers the entire civilized world in its scope. The rapid increase of all electrical industries and kindred trades is shown, and the book contains 200 pages of new matter. A complete list of electric light stations in America is given, as well as the addresses of those engaged in the electrical industries. It is published by H. Alabaster, Gatehouse & Co., 22 Paternoster row, London, E. C.

RAILWAY CONTROLLING-SWITCH.

In the operation of electric railroads not the least point for consideration is that of facility and rapidity of control of the electric power generators. Until recently the large switchboard has been employed, necessitating extreme agility on the part of the electrician in charge to bring the output of his generators to the desired point, and this plan has been found not only cumbersome but expensive. Improvements were therefore looked for.

In order to secure a thorough, effective and rapid control of the generators in an electric railway station, a new device has been gotten up known as the Railway Controlling Table. On this are mounted all the regulating and indicating apparatus in the most compact and convenient space possible. The framework is of strong bar-iron. In front are the dynamo field regulators operated by wheel handles and duly numbered in reference to the machines they control. On the table are mounted the cross-bar snap-switches—new style switches recently designed—the dynamo fuse-blocks and the equallizing bar-switches, one of each for each dynamo ; a voltmeter of the Weston type and a voltmeter switch of the regulation pattern.

On the upright back piece are the ampéremeters and the galvanometer. These instruments merit particular mention. The ampéremeters are of the standard Edison type, the solenoid of bar-copper, highly polished, being mounted directly on to the marble.

The galvanometer shows when the voltage of the current of one of the generators about to be switched into circuit is the same as that from the other machines already supplying the circuit. If the voltage of the current from the generator ready to switch into the circuit is too high or too low the deflection of the needle indicates the fact, so that the field regulator can be adjusted until the voltage is correct, when the needle presents no deflection. This instrument is mounted directly on to the marble.

With this controlling table in the station, the electrician has no difficulty in swiftly regulating his output of current to meet the varying conditions under which the road may be working. With one hand on the snap-switch handle and the other on the wheel of the field regulator an almost simultaneous movement is possible, and control is thus immediate.

The table shown was designed for four generators, and was invented and constructed by the Edison General Electric Company.



EDISON RAILWAY CONTROLLING-SWITCH.

A LIFE AND EFFICIENCY TEST OF INCANDESCENT LAMPS.*

BY PROFESSOR B. F. THOMAS AND MESSRS. P. MARTIN AND R. H. HASSLER.

There is a great divergence between the published claims of lamp makers and the statements of the experience of station managers. Makers generally say that they will guarantee 600 hours life for their lamps, and from 10 to 14 or more lamps per horse-power, but some station managers insist that they do not get an average of 400 hours life.

Lamp makers have, from necessity, made a study of their own lamps, and of those of other makers also, as to efficiency and life, and they know, better than any one else, the character of the incandescent lamp of to-day. But naturally they, if they say anything on the subject, tell about the good points of their own goods and the bad points of others, and, as naturally, the buying public

*Abstract of paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

say that all their statements are questionable. Much good work has been and is being done in college laboratories on lamp efficiencies, and the results are published and accepted, but on the equally important question of life the laboratories are silent. The tests of the Franklin Institute stand as a model piece of work, but that work is now eight years old. Farther, the lamps tested at that time were furnished by the makers themselves for the purpose of test. Believing that the public would be interested in the results of a test of commercial lamps, as to both efficiency and life, the writers have carried out such a test and give the results in this paper. The test was made at the Electrical Laboratory of the Ohio State University, Columbus, O., and all expenses incurred were paid by the trustees.

Considering it of prime importance for our object that the lamps tested should be of the same character as those usually sold to consumers, we bought some lamps of regular dealers, as in the usual course of business, and obtained others from lots supplied for central station use. Lamps of the following makes were obtained, no attempt being made to get lamps of any given efficiency of any make: A. B. C., Beacon, Columbia, Economic, Packard, Pennsylvania, Standard, Thomson-Houston, Edison, Perkins, Sawyer-Man, and Steuben. In ordering (through persons purchasing for us in Chicago and New York) we called for ten 110-volt lamps of 16 c. p. in each case, but on receiving the lamps we found three lamps out of ten of one make labelled 111 volts. The three were excluded and seven put in, but another lot of ten of the same make, correctly labelled, was obtained. Ten of another make were received with the original marking, 111 volts in ink, changed by pencil to 110 volts. They were also excluded, and a new lot of ten of that make, correctly labelled, obtained. Ten Sunbeam lamps were divided into two lots of five each, evidently supplied as a sample lot, and were excluded. We could not get others of that make in time to enter the test. There were, therefore, in all 127 lamps, labelled 110 volts and 16 c. p., of 12 well-known makes, 17 lamps, in two separate lots of one make, and ten each of 11 different makes.

For convenience in making the photometric measurements, the lamps were mounted vertically in horizontal rows of 20 on a light, vertical rack 6 feet high and 20 feet long. The rack was made in the form of ordinary shelving, having five vertical pieces of pine 4 inches wide and 1 inch thick, and four horizontal strips of the same width, the 4-inch face being horizontal. The whole was rigidly braced diagonally, suspended by strong cords passing over pulleys in the ceiling and counterpoised by weights. This arrangement enabled us to bring each row of lamps to the level of the photometer described below by raising or lowering the rack, and definiteness of position was secured by spiking to the brick wall of the photometer room two two-by-four-inch vertical guides, against which the rack was pressed, and fastened each time by stout inclined pins, passed through the diagonal braces into holes bored in the guides.

A system of positive mains was arranged by fastening a No. 2 wire along the face of each horizontal strip in the rack, and joining them at the middle of the rack by a vertical No. 0 wire. A set of negative mains similarly made was placed on the opposite side of the rack. Flexible Okonite cable of equivalent section joined the No. 0 vertical wires to the ends of the dynamo mains fastened to the wall, which point is called the centre of distribution. Porcelain keyless wall sockets were screwed in place on the horizontal rack strips, and joined to the mains on each side by No. 16 wire. All connections were well soldered.

A Thomson centiampère balance provided also with a resistance for obtaining standard potential readings was used as a standard for current and potentials. Its constants had been repeatedly checked by a voltmeter and by Clark cells, and found correct and constant to within one part in one thousand. Two Weston milliampèremeters and two Weston voltmeters were used in the current and potential readings on the lamps. The ammeters were graduated to 10 milliampères, readable to one milliampère, and the voltmeters in volts, readable to tenths. The Weston instruments were compared with the Thomson balance at intervals, and found correct, or affected by a small constant error, which was applied as a correction. One voltmeter showed a slight change in zero, due to a sub-permanent set of its controlling springs, when it was allowed to remain in connection with the mains for a half hour. This, of course, was not done in the course of measurements.

Current was supplied to the lamps by a 200-light Thomson-Houston dynamo, of the spherical armature type, which proved to be an excellent machine for the purpose. Owing to the variable speed of the engine, due to varying load and steam pressure, a special automatic regulator was devised and applied to the dynamo, to keep the potential at the centre of distribution constant. This was effected by causing a small motor to slide a contact-piece along two vertical German silver wires joined to an extension of the field coil of the dynamo, a current being sent through the motor in one direction or the other, as needed, by relay points, the relays being controlled by an indicator attached to wires leading to the centre of distribution. As used, the combination proved very satisfactory, keeping the potential difference at the centre at 110 volts, within a limit of three fourths of a volt either way. It could readily have been set to a smaller margin, but that was not considered necessary.

For the candle-power measurements a two candle-power Methven screen was used, the gas being passed through a Methven carburetter containing pentane. Its constant was checked by standard candles. Three 32-candle-power Edison lamps were used as working standards. Each was checked at intervals by comparison with the Methven screen on a 100-inch photometer-bar, a slide-wire resistance enabling us to adjust the current through the lamp to a definite strength, which was always the same for a given lamp. The currents used were such as to develop about 18 candle power in the standard lamp. Instead of the usual Bunsen or Leesen disc we used a Summer-Brodhun prism, made by Schmidt & Haensch. It gave us much better satisfaction than the best Leesen discs we have been able to obtain.

In front of the test rack and parallel with it was placed a bench with a guiding-rail, along which a Weber portable photometer was arranged to slide, so as to be placed successively in front of each lamp in a row on the test rack. Instead of the little benzine standard lamp which was removed, a 16-candle incandescent, called the reference lamp was placed at a distance of about 800 centimetres from the end of the tube to which the benzine standard is attached. In taking the candle-power of the lamps under test, the photometer was first placed in front of one of the working standards. By means of a conveniently arranged slide-wire resistance the current through the standard lamp was accurately adjusted to the strength used with it, when its candle-power was measured on the standard photometer against the Methven screen. Care was taken that the adjustment of current was right when the measured potential at the terminals of the reference-lamp was just 110 volts. Readings of the standard lamp against the reference-lamp being taken, the photometer was then moved in front of each lamp under test, and readings taken of each against the reference-lamp. The candle-power of each lamp was then found by comparing these readings with those obtained opposite the standard lamp. The reference-lamp being of the same character as those under tests, and connected to the same mains, the slight

changes in potential allowed by the regulator affected alike the candle-power of the reference-lamp and the test-lamp being read, allowing us to take readings more rapidly than we could have done had it been necessary to adjust and hold the potential at 110 volts.

Before the duration test began the mean horizontal candle-power of each lamp was determined in the usual way, and the ratio of this mean to the candle-power found when the plane of the ends of the filament was perpendicular to the photometer bar was found, and used as the distribution factor. The lamps were placed on the rack in the same position with respect to the Weber photometer, at a distance of about one meter from its plate, the exact distance of each lamp being measured and used in the calculations on it. All results are expressed in terms of mean horizontal candle-power. The unavoidable delays encountered in starting the test made it impossible to determine the sphercal distribution without cutting short the time of run which we had set as desirable, viz., 1,200 hours. The duration test was begun on March 17, and it was necessary to run night and day, Sundays excepted, until the night of May 14, to complete the 1,200 hours. The run began with 77 lamps on the rack. The remaining 50 lamps were received later, and placed on the rack with the others 187 hours after the start.

As the methods used involve nothing particularly new, and have been fully described in print many times, we have considered it unnecessary to do more than state the general outlines, as above.

The object we had in view in undertaking the test was to determine the character of the incandescent lamp as a commercial product, not as a scientific instrument. The number of lamps of each make taken was, of course, too small to base a fair judgment on as to the absolute or relative merit of the lamps generally sold by the makers. For that purpose some hundreds of lamps of each make, taken from different lots, would have to be tested, which it was of course impossible for us to do. For this reason we have considered it unfair to the several makers concerned to give their names in connection with the results on their lamps, but have instead designated each make by a letter, and each lamp by a number. We believe, however, that the average of the results of all makes may be taken to represent fairly well the character of the average commercial lamp.

The results of the test are given in the following tables, the values given being in each case the average for a given make of lamp. Table I. gives in the second column the average value of the distribution factors found for the 10 lamps of make "A," and the average value of the mean horizontal candle powers for those lamps at intervals after the beginning of the duration test, expressed in hours by numbers in the first column. The third column gives corresponding values for the lamps of make "B," and so on. Table I. includes the lamps started March 17. Table II. contains similar data for the lamps started 187 hour later.

TABLE I.

Lamp.	A	B	C	D	E	F	G	K
Distribution factor.	1.05	1.07	1.01	1.11	.989	1.01	1.01	1.02
Hours from start.	M. H.	M. H.	M. H.	M. H.	C. P.	C. P.	C. P.	C. P.
□	16.0	13.1	14.1	16.1	15.9	14.2	17.1	17.0
93	15.0	12.4	14.8	16.1	13.7	12.1	15.9	16.1
233	13.65	12.4	14.9	16.0	13.1	12.9	16.4	16.5
324	12.2	11.0	14.8	13.9	10.9	10.8	14.5	13.9
392	11.7	10.5	14.0	13.2	10.5	10.4	13.6	13.4
441	11.3	10.2	14.2	12.7	10.1	10.2	13.3	13.1
537	10.9	9.9	13.0	12.3	9.9	10.0	13.0	13.0
637	10.7	10.1	13.0	11.9	9.5	10.1	12.4	12.4
785	9.4	9.2	12.6	10.5	9.1	9.1	11.4	10.9
833	9.1	8.6	All out	10.1	8.5	8.5	10.9	10.3
883	8.6	8.2	....	9.3	7.7	8.0	10.4	9.8
972	8.6	8.3	....	9.2	7.6	8.0	10.4	10.0
1,105	8.6	8.2	....	9.2	7.4	8.0	10.3	9.5
1,190	8.2	8.0	....	9.0	7.5	8.0	10.4	9.6

TABLE II.

Lamp.	M. H. Candle Power.				
	L	M	N	O	P
Distribution factor.	1.10	1.00	.911	1.00	1.02
Hours from start.					
□	13.2	12.5	14.1	17.0	11.6
71	12.6	12.5	13.5	....	....
137	10.7	12.6	11.7	16.4	15.9
205	10.1	11.9	11.0	14.8	13.6
254	9.7	11.6	10.4	14.0	13.0
319	9.3	11.8	10.1	13.3	12.3
450	8.9	11.5	9.4	11.6	11.6
598	7.8	10.6	9.3	10.8	9.7
646	7.6	9.6	8.2	9.6	9.2
696	7.1	9.3	7.9	9.0	8.4
785	7.1	9.4	7.8	9.0	8.7
837	6.8	8.7	7.5	8.3	8.5
1,003	7.1	8.8	7.4	8.0	8.4

Table III. gives the average current strength found for each make of lamp, at times given in the first column:

TABLE III.

Lamp.	Mean current strength in ampères.												
	A	B	C	D	E	F	G	K	L	M	N	O	P
Hours.													
0	.567	.532	.693	.639	.589	.532	.662	.613	.458	.547	.568	.659	.536
100	....	....	....	....	....	....	....	....	.444	.532	.557	.665	.534
107	.575	.545	.760	.668	.581	.519	.689	.629	....	....	....	....	....
275	.567	.540	.778	.655	.566	.516	.681	....	....	....	....	....	....
380	....	....	....	....	....	....	....	....	.425	.513	.528	.615	.511
555	.548	.540	.770	.633	.541	.504	.662	....	....	....	....	....	....
615	....	....	....	....	....	....	....	....	.418	.505	.519	.595	.495
790	.540	.535	.770	.619	.530	.498	.654	.581	....	....	....	....	....
930	....	....	....	....	....	....	....	....	.417	.500	.508	.585	.476
1,105	.535	.529	.000	.611	.517	.495	.649	.577	....	....	....	....	....

Table IV. gives the mean percentage of original candle-power for each make at intervals given in the first column:

TABLE IV.

Lamp.	A	B	C	D	E	F	G	K	L	M	N	O	P	Average.
Hours.	%	%	%	%	%	%	%	%	%	%	%	%	%	%
□	100	100	100	100	100	100	100	100	100	100	100	100	100	100
100	93	94	106	101	92	93	95	93	87	100	87	95	107	95.6
[illegible]	86	89	109	99	84	[illegible]	90	87	78	98	79	87	97	90
300	79	83	106	93	77	81	86	83	72	94	72	80	86	84
400	74	80	102	82	72	77	81	78	67	90	67	72	78	78.4
500	69	73	98	75	66	70	77	74	63	[illegible]	63	66	71	73
600	64	70	94	70	61	66	73	70	59	80	60	60	65	68.6
700	61	67	91	66	57	62	70	67	55	75	56	55	60	64.7
800	58	64	90	63	53	59	66	63	54	73	55	51	58	62
900	55	63	All out	60	51	57	63	59	53	70	53	49	56	57.4
1,000	54	62	.....	58	49	56	62	58	54	70	52	47	57	56 6
1,100	52	61	.....	57	47	56	61	57	....	....	....	....	....	55.8
1,200	51	61	.....	56	47	56	61	57	....	....	....	....	....	55.4

Table V. gives the average watts per mean horizontal candle power for each make, at times given in the first column:

TABLE V.

	Watts per mean horizontal candle power.													
	A	B	C	D	E	F	G	K	L	M	N	O	P	
Hours.														
0	3.9	4.4	5.4	4.3	4.1	4.1	4.2	3.9	3.8	4.8	4.4	3.9	4.0	4.2
100	4.3	4.8	5.6	4.5	4.4	4.3	4.6	4.3	4.2	4.7	4.9	4.5	3.8	4.5
[illegible]	4.6	5.1	5.6	4.5	4.7	4.6	4.9	4.6	4.6	4.7	5.3	4.9	4.1	4.8
300	4.9	5.4	5.7	4.8	5.0	4.9	5.0	4.8	4.9	4.8	5.7	5.2	4.5	5.0
400	5.2	5.6	5.9	5.3	5.4	5.1	5.3	5.0	5.2	4.9	6.1	5.4	4.9	5.3
500	5.5	6.1	6.2	5.8	5.7	5.5	5.5	5.2	5.5	5.1	6.3	5.8	5.2	5.8
600	5.8	6.4	6.4	6.1	6.1	5.8	5.7	5.4	5.8	5.5	6.7	6.3	5.6	5.9
700	6.1	6.7	6.6	6.4	6.5	6.1	6.0	5.6	6.1	5.8	7.0	6.9	6.1	6.3
800	6.4	6.9	6.7	6.7	7.0	6.4	6.3	5.9	6.3	5.9	7.2	7.4	6.2	6.6
900	6.7	7.0	....	7.0	7.2	6.6	6.6	6.2	6.4	6.1	7.4	7.7	6.3	6.8
1,000	6.8	7.1	....	7.2	7.4	6.8	6.7	6.4	6.2	6.1	7.5	7.9	6.2	6.8
1,100	7.0	7.2	....	7.3	7.6	6.7	6.8	6.5	....	....	....	....	....	7.0
1,200	7.1	7.2	....	7.4	7.6	6.7	6.7	6.5	....	....	....	....	....	7.0

STILES POWER PUNCHING PRESSES.

The illustration (Fig. 1) shows the entire series of the well-known Stiles Power Punching Presses, from the smallest No. 0 to the largest No. 5. These presses are now made from new patterns and embody several new features, in addition to a greater strength of parts and increased length of bearings.

The eccentric adjustment used in these presses will be understood by reference to Fig. 2. It not only permits of rapid and very accurate adjustment, but transmits the pressure entirely through solid metal instead of throwing it upon screw threads, a decided advantage for heavy work. The graduation of this adjustment enables the operator to keep an exact record of the setting of the dies.

Nearly all the best manufacturing establishments in

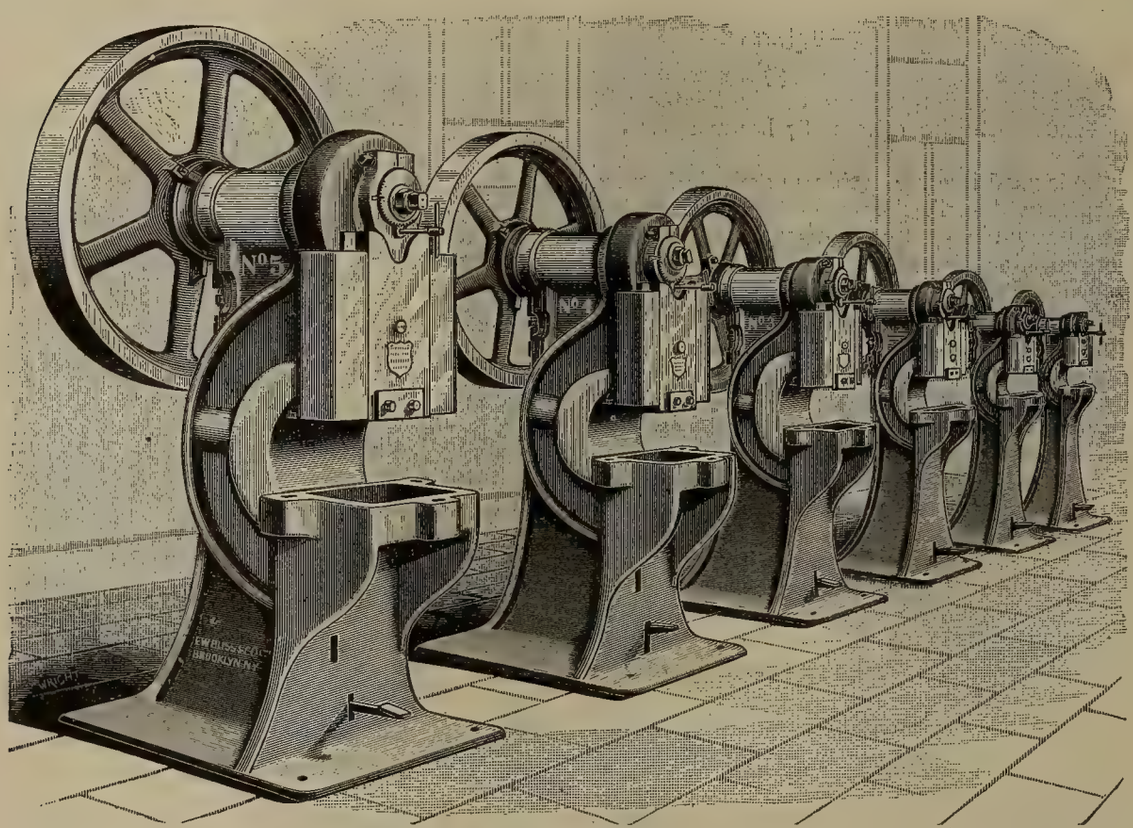


FIG. 1.

this line in America, and many in Europe, employ one or several of these presses. The range of work for which they are adapted covers nearly every kind of blank cutting, punching, perforating, forming and bending. These presses are made by the E. W. Bliss Co., Limited, No. 7A Adams street, Brooklyn, N. Y.

PRACTICAL NOTES ON THE ELECTROLYTIC REFINING OF COPPER.*

BY F. B. BADT.

Stalmann's patent drawings show the vats arranged in either series or multiple. The inventors of the series processes, like the Smith, Hayden, Stalmann and others, claim for their processes very much cheaper first cost of plant, very much less copper carried as idle capital in the vats, much less floor-space and higher efficiency in operation—that is, a larger recovery per horse-power hour. Whether or not these claims can be demonstrated in practice is yet an open question. One pound of copper will be deposited in one hour, theoretically, by a little less than 386 ampères out of a solution of sulphate of copper. If we, therefore, pass 386 ampères through one vat, we will deposit one pound every hour, and if we pass the same current through a series of 100 vats, we will deposit 100 pounds each hour. The amount of power expended in each vat, however, is $C^2 \times R$, but as it is always possible to reduce the resistance of a vat by increasing the surface of the plates, we can greatly reduce the amount of power required for the same output in copper per horse-power hour. We may also reduce the ampère-age for a given production by joining more vats in series, or we may combine both methods.

It is therefore always possible to largely reduce the expenditure of electrical energy, and consequently that of the motive-power. As a matter of fact, theoretically, any amount of copper may be refined with any given horse-power, but as soon as we attempt to largely increase the production of copper with a given power, we find it necessary to largely increase the size and number of vats and the quantity of copper under treatment. These conditions have been thoroughly examined, and the laws governing them have been explained in the several hand-books extant.

As a résumé it may be stated that if power is cheap we may make the internal resistance of the vats greater, employ small vats and less copper under treatment, requiring less floor-space, thus decreasing the first cost of the establishment materially. If, on the other hand, power is expensive, we must make the internal resistance of the

* Abstract of paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

vats as small as possible, have a large amount of copper under treatment, requiring a larger floor-space, and materially increase the first cost of the plant. It can easily be seen that in each special case these conditions must be carefully determined in accordance with principles very similar to those laid down in Sir William Thomson's law.

From these statements, however, we may infer that the claims of the promoters of the so-called series processes are not well founded; because no matter how the plates in the vats may be arranged, we can always arrange the plant for conditions of minimum first cost or minimum operating expenses. It is true that both Smith and Hayden do away with cathodes of refined copper, and thus save quite an item for copper under treatment. On the other hand, there is the advantage that particles of the original anodes will stick to the final cathodes of refined copper, and that it will be found difficult to separate them.

As a matter of fact, it is claimed by some assayers and selling agents that electrolytic copper obtained by these two processes is not so pure as copper obtained by a process employing anodes and cathodes arranged in multiple. Mr. Stalmann in his arrangement obviates the latter advantage by attaching removable plates of refined material to his anodes.

Another important item in order to obtain a pure deposit is the density of the current. American copper refiners usually adopt 10 ampères per square foot of active cathode surface as a maximum. I am told, however, that some of the refineries operating on the "series" processes go even beyond 15 ampères per square foot, which may account for certain impurities found in the electrolytic copper and for a geater efficiency of the plant—that is, a larger output of copper for a given number of vats and amount of copper under treatment.

High voltage in an electrolytic plant of course means considerable saving or less drop in conductors, less trouble from poor contacts, etc., and it is probable that for these reasons the so-called series processes show a greater efficiency per given horse-power than the processes employing electrodes in multiple. For refineries using this latter process low-tension machines and comparatively few vats in series are employed. By adopting as high voltages in the multiple process as in the series process, of course, the same advantages may be obtained.

One advantage of the series proceess is the fact that each electrode will get its proper ampèrage per square foot, as all the plates are in series, and are of uniform size. In the parallel process some trouble is always experienced in properly subdividing the current in each vat, so that each plate will get its share; or in other words, that the curent density will be the same for each square foot of active cathode surface. By proper precautions, however, trouble in this direction may be easily avoided.

Another important item for the obtaining of pure deposits is a good circulation of the electrolyte. This insures a uniform specific resistance in the solution between the parts of the plates. Inasmuch as a solution of sulphate of copper is of greater specific gravity than the acid, which is liberated by the decomposition of the copper upon the surface of the cathode, such acid rises to the surface of the liquid while the solution of sulphate of copper settles toward the bottom. Where plates are arranged vertically, therefore, there is an ascending current before the surface of the cathode, and a descending current before the surface of the anode. If there is not a sufficient circulation of the electrolyte the free acid attacks the other portion of the plates more rapidly than the lower portion, and the deposition goes on most rapidly on the lower portion of the cathode.

In American practice the eleotrolyte is sometimes kept in circulation by arranging the tanks on the cascade plan, and have each higher vat siphon through a pipe whose orifice is near the bottom of the next lower vat.

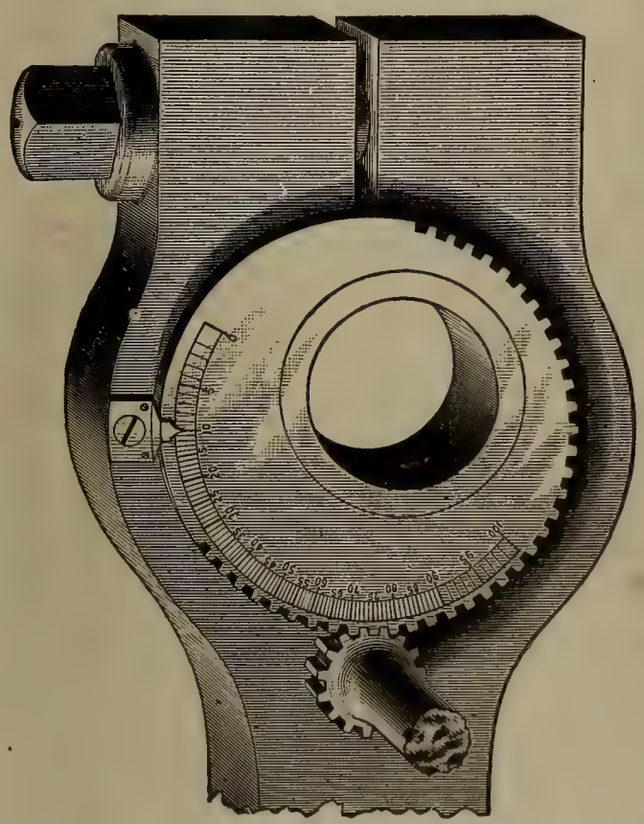


FIG. 2.

A better plan now usually adopted is to have a trough run through the whole refinery, and have each vat fed independently by means of a rubber hose. The electrolyte is raised from the collecting tank into the troughs by means of lead pumps or steam injectors. Both, however, are objectionable. The pumps are always getting out of order, and the steam injector means waste of steam, besides having the disadvantage of putting too much moisture into the electrolyte, which again necessitates the adding of free acid continually. A better plan is to have two collecting tanks, which are to be used alternately. Just as soon as one is full it is made air-tight, and a small air compressor driven by an electric motor compresses the air above the solution and drives the solution under a pressure of, say 25 pounds, through a pipe up into the troughs. Smith claims that in this arrangement no artificial circulation of the electrolyte is required. He claims that the free acid liberated over the whole horizontal surface of the cathode in each cell rises directly through the solution and the screen to the surface of the anode above and acts uniformly over its whole surface. As the deposition also takes place uniformly over the whole surface of the cathode, uniform electrical and chemical conditions are secured over the whole surface of each plate and uniform liquid resistance between the parts of the plates and the action of the cells is entirely automatic. Smith also claims that less heat is wasted by this arrangement than in installations which require the circulation of the liquid.

We might mention another incidental advantage of the multiple process over the series processes. Some of the patentees claim one-fourth of a cent per pound of refined copper as a royalty. In one instance one plant gives the patentee, under this arrangement, an income of over $100 per day. Taking this in combination with the very doubtful advantages claimed for the series process, we need not wonder that there exists prejudice against erecting electrolytic refineries employing these patented operations.

As to the value of the patents, from a legal point of view, I do not care to express an opinion. Some legal authorities state that anybody may arrange the electrodes in series within a vat without infringing if he omits some of the minor details of the combination patents whose claims have already been quoted.

The power installations of some of the electrolytic refineries which the author had an opportunity to visit reminded him very much of electric-light stations put up about ten years ago. The old motto, "Cleanliness is next to godliness," he found missing, and the plants usually excelled by a total absence of voltmeters or ammeters or other electrical testing instruments showing the conditions under which the plant was operating. Such statements, therefore, as "working current of a thousand ampères," or "density of current of 10 ampères per square foot," which we get from electrolytic refiners, must be taken with several grains of allowance.

I could enumerate a long list of defects that exist today in almost all of the electrolytic refineries, and which may all be traced to one cause, and that is the imperfect knowledge of the refiners of matters electrical. Large amounts of money may be saved in the erection and operation of such plants by considering all the conditions carefully before making the final plans. One case came to my knowledge where the lead lining was put in the tanks, and plumbers were commissioned to wipe the seams in the ordinary way instead of having the edges of the lead melted together by means of the hydrogen blowpipe. The latter plan should always be followed, as wiped joints will be destroyed by the electrolytic action of the solution in a very short time.

This is not by any means a small matter, as repairing of the lead lining involves large expenses and great loss of time. In one installation the conductors leading from the dynamos to the tanks are underground, but run in such a careless manner that they are permanently grounded, often get short-circuited, and in a few instances the wood conduit was set on fire. As a matter of fact, all the experiences which we have gone through for the last ten years in constructing electric light and power plants have been of no benefit, it seems, to most electrolytic refiners. Even in the few installations where a voltmeter is used to indicate the proper working condition of the vats, this voltmeter is carried by two men from vat to vat, and the voltage of each vat is taken in this cumbersome manner.

In a plant just being erected, the writer proposes the erection of a potential board in the office of the superintendent. Both terminals of each vat are to be connected with two contact points of the potential board, and a voltmeter is to be so arranged that by simply turning a switch handle the potential of each vat can be taken almost instantaneously. As a matter of fact, the working condition of each vat may be thus ascertained in a few minutes, while it would take hours for two men to do the same by carrying the voltmeter from vat to vat. One of the occurrences which has to be guarded against is the short-circuiting of an anode and a cathode, which in the multiple plan means the short-circuiting of a whole vat. Such an occurrence should be detected immediately, as otherwise the contents of the vat may be spoiled. The author proposed for a plant just being erected an electric tell-tale in connection with the potential board. This tell-tale might be constructed somewhat after the fashion of a hotel annunciator. Each magnet might be permanently in circuit with its corresponding vat, and the tension of the armature spring so adjusted that at the proper potential the armature would be held up, but just as soon as the vat is short-circuited no current, or but very little current, will flow through the magnet and the armature will drop, ringing an alarm-bell and indicating the number of the vat in which the trouble occurred.

All such appliances are labor-saving devices, and their installation would pay well in a plant where many thousand dollars worth of copper and solution is under treatment and liable to be spoiled. In a number of refineries there are T-rails suspended over the vats in such a manner that a pulley carrying a block and tackle can be used for lifting the plates out of the vats and moving them in the gangways for either washing off the slime or for substituting new anodes for the old ones. Some of the electrolytic refineries in the United States buy copper matte of from 45 to 54 per cent. of copper from the mining companies. In these cases they own their own smelters, resmelt the copper matte, producing black copper of from 97 to 98 per cent. of copper. This black copper is then cast into anodes and subject to the electrolytic process. Other refineries buy the black copper direct from the smelters owned by the mining companies. For instance, the Bridgeport Copper Company, of Bridgeport, Conn., buys the entire product of the Parrott Silver and Copper Company, of Butte, Mont., as black copper.

There is another matter which should be mentioned, as it is very often misunderstood by the public and the electric companies. If copper matte contains, according to the assay, 30 ounces of silver or less per ton of matte, no extra charge is made for the silver, but the copper matte is sold at the reigning market price. If it contains, however, over 30 ounces, the silver is to be paid in accordance with the assay. Thirty ounces of silver per ton of matte, of course, means almost double that amount per ton of electrolytic copper. It can easily be seen that electrolytic refineries prefer to buy copper matte containing just a trifle less than 30 ounces of silver per ton.

There are quite a number of points which need the attention of electrolytic copper refiners. There are, for instance, only a few of the refineries which manufacture

their own sulphate of copper, but buy it at high rates in the market. Sometimes the cost of freight and haulage doubles its cost. Each copper refinery should have a little installation of its own for the manufacturing of the necessary sulphate of copper, which it can do at a small fraction of what it has to pay for it. The same holds good in relation to the refining of the slime or mud which collects at the bottom of the vats, and which contains the precious metals. Each copper refinery should have its own little plant for the refining of the mud. These little installations can be run at a small expense in connection with copper refineries, and it is almost nonsensical to have other concerns make large sums of money which could be saved by the refiner himself.

A few words as to electric generators may not be out of place. The author prefers separately excited machines for the reason that they cannot be reversed, and other incidental advantages. When water-power is used as prime mover a good deal of trouble has been experienced in the regulation of the wheels. As a matter of fact there is no water governor in existence which will regulate so perfectly as the governor of a modern automatic engine under varying loads. By running all the exciters from an independent prime mover (either water or steam) the strength of the fields of the generators will be uniform at all times whether there are fluctuations in the external circuit or not; the strength of the field of the generators which, with self-exciting machines, is subject to the fluctuations in the external circuit, and is a variable, becomes a constant. The author proposed this arrangement over three years ago for railway and power stations with the very best results.

Before closing, we might mention some processes which have not been introduced in the United States yet, but about which a good deal has been said during the last few years. There are in Europe processes by which electrolytic copper is produced direct from the "matte" containing from 35 to 55 per cent. of copper. From the reports that have appeared from time to time it seems that these processes have not been a great success. There are other processes which contemplate the extraction of copper direct from the ores by means of electrolysis. The best known are the "Siemens" and "Hoepfner." If we are correctly informed, the Siemens process is now being used in one experimental plant only, which is owned by the Siemens firm. This is at Martinicken fields, near Berlin. Another one, which they have in the Caucasus at their own copper works, is said to have been abandoned because it did not give satisfaction. Dr. Hoepfner's process, it is claimed, is now in operation in three plants: one at Schwarzenberg, which began operations in September, 1890, and two others about which very little has been published. Dr. Hoepfner uses in his process a cuprous chloride solution, out of which a current of one ampère will deposit 2.35 grammes per hour, while out of a solution of sulphate of copper, only one-half of this amount of copper can be deposited per unit of current per hour.

As it was the object of the writer to give practical points on the refining of copper, and as he does not know anything about these two processes from personal observation or from practical experience, he does not wish to comment any further, but prefers to wait until he can see one of these plants in operation in the United States. While these processes do away with the smelting and resmelting of the ores, and while they would make unnecessary the large, expensive plants now used for this process, they seem to be very complicated; their commercial value certainly should be investigated much more closely by American mining companies before they should be willing to invest large amounts of money.

We finally give below the approximate cost of a refinery with a capacity of 1,000,000 pounds of electrolytic copper per month.

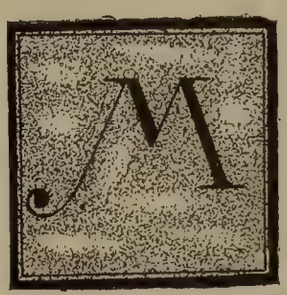
Building	$30,000
Pavement (asphalt)	2,000
Pipes for steam heating	4,000
Vats	6,000
Lead for lining vats, collecting tanks and troughs	28,000
Lead burning	1,500
Copper conductors	11,000
Rails for overhead blocks for handling plates	2,000
Sulphate of copper	3,500
Sulphuric acid	1,000
Steam injectors or pumps or air compressors	1,000
Electric generators, switchboard, instruments	30,000
Shafting and belting	3,000
Total	$123,000

To this sum must be added the copper under treatment, which in this case will amount to at least $80,000, and if a steam plant should be required, another $20,000 must be added, bringing the total of this plant up to $223,000. The above items include labor of erection, but do not include freights. These figures, although approximate and true only under certain conditions, will demonstrate that electrolytic copper refineries are expensive plants, and should be erected on carefully prepared plans and under the supervision of responsible and competent engineers.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Magnetism—What Is It?



AGNETISM is supposed to be closely related to the molecular constitution of a body capable of being magnetized.

It is well known that heat, cold, concussion and torsion affect the molecular constitution of a magnetizable body, and it is as well known that the same conditions likewise affect the magnetism of a magnetized body, and have the effect of destroying it.

The effect on the magnetism of a body of a disturbance of the molecules of that body is well illustrated by filling a glass tube with iron filings, closely packed. The filings represent the molecules of a solid bar of iron, and if we magnetize the contents of the tube by any of the well-known methods, it is noticed that the iron particles will arrange themselves lengthwise in the tube, but if disturbed or shaken the molecules are displaced and the magnetism disappears. The arrangement of the molecules—end to end—as exemplified by the iron filings, is supposed to account for the fact that a bar of iron is slightly longer after being magnetized than it was before, and at the same time its other proportions are correspondingly reduced.

It is supposed that in an unmagnetized bar of iron the molecules are arranged without any order, but under the influence of an electric current or magnetism they arrange themselves end to end, with like poles in the same direction, as did the filings in the tube, the result being a change of form as mentioned above.

Another fact which supports this theory is the slowness with which steel acquires and loses magnetism as compared with soft iron. Soft iron, as is well known, acquires and loses magnetism very rapidly, and this difference in the behavior of the two metals is attributed to the difference of rigidity. Steel resists the change of position of the molecules, while soft iron has very much less degree of resistance to this action.

That there is molecular motion in the magnetization of iron or steel is apparently further proved by the fact that

when a bar is suddenly magnetized by an electric current a faint metallic clink may be heard in the bar, both at the beginning and end of the magnetization, as though the molecules were wrenched into place and released after the influence of the current ceases.

These and other phenomena indicate that magnetization produces a change of position in the molecules, and on these facts the theory that magnetism is a mode of molecular motion is based.

It is not known, of course, what the character of this motion is; but this theory of magnetism is sanctioned by Clerk Maxwell, Hughes and other investigators, and agrees with like theories in regard to heat and electricity.

Ampère proposed a theory to account for magnetization by the presence of electric currents in the molecules themselves. The theory assumes that the molecules of all magnetizable bodies have closed electric circuits in which electric currents are constantly flowing ; that in an unmagnetized body these currents neutralize one another because of their difference in direction, and that the act of magnetization polarizes the particles, so as to cause the currents to flow in the same direction.

Hughes propounded a theory which is somewhat similar to that of Ampère. He assumed that the molecules of matter possess naturally opposite magnetic polarities ; that these molecules when arranged in chains or closed circuits neutralize one another, which is indicated by the non-magnetic condition of the body, and that the act of magnetization polarizes the molecules, or arranges their axes so that one set of poles tend to point in one direction while the other set point in the opposite direction, exhibiting the power known as magnetism.

Hughes' theory seems to be strengthened by the facts that a bar of iron or steel becomes elongated when magnetized, and that no matter how many magnets we may divide the original one into, each part exhibits opposite polarities. This, it is supposed, would hold good if we could subdivide the bar into its constituent molecules—each molecule would become a magnet itself.

NEW INCORPORATIONS.

The Delaware Electric Street Railway Company, Delaware, O., incorporated May 31, with a capital stock of $60,000, to build and operate an electric street railway and furnish light and power, etc. Incorporators: James K. Newcomer, Velerios T. Hills, John D. Van Demon, Beverly W. Brown, William A. Hall, Christian Riddle, Francis M. Marriott, Robert G. Lybrand, Harvey J. McCullough, Henry A. Welch, James Crawford.

Santa Anna Electric Power and Development Company, San Bernardino, Cal., incorporated May 31, with a capital stock of $1,000,000. Incorporators : Andrew E. Paris, F. C. Finkle, W. S. Hooper, San Bernardino, Cal.; William H. Coucher, F. M. Frazee, Los Angeles, Cal.

Suffolk Electric Company, Portland, Me., incorporated June 3, with a capital stock of $300,000, to manufacture and deal in electrical appliances of all kinds. Incorporators : Albert N. Reynolds, Albert W. Rounds, Boston, Mass.; Henry W. Boyd, Wareham, Mass.

Alleghany Hotel Company, Goshen, Va., incorporated May 31, with a capital stock of $100,000. Among other things it will construct and operate electric and horse railways and electric plants. Incorporators: C. W. Meyer, W. A. Anderson, J. R. A. Hobson, S. M. Taylor.

El Paso Electric Company, El Paso, Tex., incorporated May 31, with a capital stock of $100,000, to operate street railways and supply light and motive-power. Incorporators: George Davis, J. N. Carnes, Charlestown, W. Va.; E. B. Bronson, Peyton F. Edwards, El Paso, Tex.

The Forest City Electric Light, Heat and Power Company, Forest City, Pa., incorporated June 2, with a capital stock of $1,000. Incorporators: John McLaughlin, W. H. Leek, H. O. Purple, Forest City, Pa.

Delaware Railway Company, Philadelphia, Pa., incorporated June 4, with a capital stock of $51,000, to construct and operate an electric railway. Incorporators: Edward W. Patton, J. Lee Patton, Samuel Crothers, Philadelphia, Pa.

The Bloomsburg Electric Street Railway Company, Bloomsburg, Pa., incorporated June 1, with a capital stock of $12,000. Incorporators: J. L. Dillon, C. W. Miller, C. W. McKelvey, Jr., Bloomsburg, Pa.

Shickshinny and Huntington Valley Railway Company, Huntington Mills, Pa., incorporated May 31, with a capital stock of $60,000, to construct and operate an electric railway. Incorporators : F. A. B. Koons, Huntington Mills, Pa.; R. M. Tubbs, Shickshinny, Pa.; C. R. Eberle, Philadelphia, Pa.

New Kensington Street Railway Company, Pittsburg, Pa., incorporated June 2, with a capital stock of $15,000, to construct and operate an electric railway. Incorporators : S. E. Moore, James P. Anderson, Howard Childs, Pittsburg, Pa.

The Columbia and Marietta Electric Railway Company, Columbia, Pa., incorporated May 31, with a capital stock of $50,000. Incorporators : J. K. Sigfried, Pottsville, Pa.; Robert T. Ryon, James A. Ryon, Columbia, Pa.

Citizens' Passenger Railway Company, of Williamsport, Pa., incorporated May 28, with a capital stock of $13,500, to construct and operate an electric railway. Incorporators : James B. Krause, W. W. Champion, A. M. Champion, Williamsport, Pa.

The Electric Railway Supply Company, Chicago, Ill., incorporated June 1, with a capital stock of $200,000. Incorporators : George H. Graham, Francis L. Graham, Thomas Clarke.

O'Neil Electric Company, Chicago, Ill., incorporated June 3, with a capital stock of $5,000 ; among other things it will manufacture and sell electrical apparatus. Incorporators : John D. O'Neil, William Edelstein, M. R. Fletcher.

Lacon Electric Company, Lacon, Ill., incorporated June 3, with a capital stock of $16,000, to construct and maintain an electric light and power plant. Incorporators : I. S. Baldridge, C. C. Travis, Annie J. Travis.

People's Electric Light and Power Company, Benton Harbor, Mich., incorporated June 7, with a capital stock of $100,000, to purchase and sell electricity for light and power. Incorporators : Peter English, John Bell, Benton Harbor, Mich.; Willard W. McDonald, Chicago, Ill.

Hopedale Electric Company (incorporated in W. Va.), Boston, Mass., incorporated June 6, with a capital stock of $5,000,000, to manufacture and sell electrical batteries, dynamos, motors, etc. Incorporators : E. H. Abbott, Cambridge, Mass.; W. F. Draper, Hopedale, Mass.; Moses Williams, Brookline, Mass.

New England Electric Heating Company, Portland, Me., incorporated June 4, with a capital stock of $250,000, to manufacture and deal in electric heating apparatus. Incorporators : Edward Jewell, Boston, Mass.; Arthur B. Smith, Levi L. Parsons, Saugus, Mass.

American Electric Heating Company, Portland, Me., incorporated June 4, with a capital stock of $1,000,000, to manufacture and deal in all kinds of electrical heating apparatus. Incorporators : Edward Jewell, Fred A. Cook, Samuel B. Jenkins, Boston, Mass.

CATALOGUES.

THE "C & C" ELECTRIC MOTOR COMPANY, 402–404 Greenwich street, New York, has just issued its general catalogue for 1892. It is the most elaborate catalogue yet issued by this company, and contains not only a full list of its motors and dynamos, but also a careful description of all supplies necessary for the equipment of electric light and power plants. The specialties manufactured by this company, and to which attention is directed, are the switches on pages 18 and 19, the automatic motor starting-box on page 84, the organ rheostat and organ attachments on page 89, and the fans, blowers and other ventilating machines described in the last ten pages. The catalogue is printed on fine paper and profusely illustrated.

THE catalogue and price-list for June, 1892, issued by J. Elliott Shaw & Company, 632 Arch street, Philadelphia, manufacturers and dealers in electrical supplies, air compressors and Burgess atomizers, contains full descriptions and prices of the large number of specialties handled by them. The catalogue contains 100 pages and is freely illustrated.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, June 11, 1892.

MR. JAMES H. MASON has resumed the managership of the business of A. M. Mason, manufacturer of Mason batteries, motors, etc., 366 Myrtle ave., Brooklyn, N. Y.

THE new motor recently produced by the Interior Conduit and Insulation Company, 42–44 Broad street, is being generally praised around town. This motor is of high efficiency and regulated for three speeds. All the parts are enclosed, and freedom from dust and dirt thus assured. It is so arranged that the air is drawn down through the armature in such a manner as to always keep it cool.

MR. LEMUEL BANNISTER and Mr. H. McL. Harding, the enterprising and energetic representative of the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., are doing good work in the interest of their company. We hear that they have secured the contract for the equipment of the Newark and Orange horse railroad company with the Westinghouse system at a cost of over $100,000.

MR. S. L. PHILLIPS, president of the Seneca Falls Electric Railway Company, of Seneca Falls, N. Y., is in town for the purpose of organizing a general electric motor and supply business. Mr. N. M. Garland will be the New York representative. The new concern has accepted the New York agency for the Emerson Company, of St. Louis, manufacturers of the Emerson motors, which are very compact and efficient.

MESSRS. MORRIS & HARRISON, of the railroad supply department of the Thomson-Houston Electric Company, Boston, Mass., have, we understand, secured large storerooms on West street, this city, and are placing nearly $200,000 worth of street-railway supplies, motors, etc., for immediate delivery to convenient points to New York city.

THE BLAKENEY ELECTRIC COMPANY, of Brooklyn, report business very good.

PORTER BROS. & COMPANY, 78 Worth street, are sole agents for an insulating material employed in the manufacture of key-socket handles, bushing lamp socket bases, lightning arresters, arc-light insulators, etc., and claim it to be the best yet put on the market. Some of the firms using their material are the Edison General Electric, Thomson-Houston, Electric Construction and Supply Company, and others. They also supply it to firms in Germany. Messrs. Porter Bros. state they are finding a ready market for all they can supply.

THE BRADY MFG. CO., 83 Washington street, Brooklyn, has the best of facilities for the manufacture of electrical apparatus of all kinds. The most delicate instruments and the largest dynamos and motors are made by this concern, showing the great range of work it is able to carry on. Besides this the company designs and perfects labor-saving machinery of all kinds, and gets up drawings, patterns, tools, gauges, dies and models. With its large experience back of it, this company does things well and with dispatch.

MR. BENJAMIN F. LEAVITT, of the Porter Leavitt Motor Company, Providence, R. I., gave the ELECTRICAL AGE a call this week. Mr. Leavitt reports the motor business very good. The demand for his motors is constantly increasing.

MR. R. S. Vivian, of Kansas City, Mo., broker in first mortgage bonds, street-railway bonds and investment securities, gave us a call during the week.

THE "C & C" ELECTRIC MOTOR COMPANY, 402–404 Greenwich street, reports large sales of its standard generators during the past few months, and states that this department of its business is rapidly attaining equal importance with that of its regular line of motors.

THE WADDELL ENTZ COMPANY has removed its offices from 302 Produce Exchange to 203 Broadway.

W. T. H.

WESTERN NOTE.

A REPRESENTATIVE of the ELECTRICAL AGE, while in Buffalo last week, called at the show-rooms of the Edison General Electric Company, on Niagara street, and found the place well stocked with an elegant line of fixtures, motors, etc. Mr. H. B. Oakman, the company's resident agent, reports trade good.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE
American Dist. Tel., N. Y.	$3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	85 50
American Visual Telegraph Co.	500,000	100 00	475 00
Ashley Engineering Co	200,000	10 00	5 00
Bell Telephone	17,000,000	100 00	203 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	115 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*102
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	85 00
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	109 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	43 50
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 50
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99

Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Car Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	54 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	15 50
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*97
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Ongley Electric Co., N. Y	250,000	100 00	85 00
The Siemens & Halske Co., Ill	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 25
Thomson-Houston pref	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	95 00
Westinghouse Elec. & Manf. Co	7,000,000	50 00	29 25
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	46 75
Westinghouse Ass. Rects		50 00	17 00
West Point W. Lt. & P. Co., Va	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

To those pecuniarily interested in the advance of the electric art, it is most satisfactory to know that scarcely a turn in or on the great wheel of the world we inhabit can be or is being made without disbursing a generous amount of wealth to some one or other of the electric interests. The whole mind of the people at the present time centres on the various nominations for candidates for the principal offices for the ensuing four years, and all are informed of the current action simultaneously with its changing condition at Minneapolis and Chicago—by electricity, of course, with profit to the shareholders. To be sure the Western Union and Postal Telegraph Companies are reaping the greatest benefit, but the money itself, to the extent of at least seventy five per cent., is distributed among electricians of one kind or another, and the supply and construction houses, which only for the technicality of language must be numbered among the electrical family. The local electric light and car companies should, if the convention lasts a week, make enough to pay a half years' interest on their fixed charges, at all events. Further than this, while a presidential year is considered an off one for all general business, the electric industries will be called on to the utmost of their capacity. Electricity this year will no doubt stand next to wet refreshments in the amount of net profits contingent on the elections, and this fall be the most active we have experienced in many years in both the securities and extension of the industry. The embryo telephone companies which are mysteriously rumored to be very active should assume tangible and aggressive shape before the end of the year. There are several complete systems in the market lacking but two things—capital and right of way; only one of these is fairly offered, a clean sale for the American, Canadian, English and French patents for $500,000, half cash and half stock in the new company, or one fourth of all for $5,000 cash, which will enable the present owners to exploit successfully a company on lines they have laid out. It is claimed to be a vast improvement on the present system. Investors would also be safe in putting a few thousand dollars into a corporation in full working in this city, manufacturing and selling electrical machines for transmitting messages from one typewriter to another any distance under 1,000 miles; the money is needed to fill orders for equipment all over the country, the north Atlantic seaboard only being served at present. The safety of the system lies in the fact that, while the telephone by induction is quite sure to leak and the click of the Morse alphabet is known to thousands, this is a single click for each letter from keyboard to keyboard. The system also includes train messages, danger signals, police news, fire alarms, quotations and all matter of a private nature; only $30,000 of the 8 % pref. stock can be had, and if taken soon in one block a bonus of common stock goes with it, otherwise it is held at par flat. Another new matter is an electric hinge, control of which can be had for $15,000, self contained; it quietly closes a door automatically, has the appearance of any first-class hinge, and is strong enough to support the door. The field for this is equalled only by the number of respectable houses and doors. The profits are large, and the business will increase for years to come. The time has come when investors must look to such enterpries as those named, to have a voice in the disposition of their money. What show has a $50,000 holder, for instance, in the Western Union or a corporation of similar magnitude; but in the other case, while not requiring his absolute personal attention, he is acquainted with the condition of the business, and can suggest with effect. Let the institutions and estates invest in the large corporations; they can through their employed counsel get more information, while individuals desire to have their funds better in hand.

The Electrical Age's Illustrated Patent Record.

Issued June 7, 1892.

476,236. Electro-Magnet. Andrus D. Ayres, Kalamazoo, Mich. Filed Sept. 15, 1891.

476,292. Apparatus for Trimming Carbon Points. Philo Moses, Fremont, Ohio. Filed June 25, 1891.

476,296. Electric Battery. Richard P. Osgood, Methuen, Mass. Filed Jan. 18, 1892.

476,311. Electrical Governor. Mark A. Replogle, Mattawana, Pa. Filed Dec. 12, 1890.

476,317. System of Testing Electric Circuits. Charles H. Rudd, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 4, 1889.

476,330. Safety Device for Electric Motors. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 16, 1889.

476,331. Dynamo-Electric Machine. Elihu Thomson, Lynn, Mass, assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 14, 1889.

476,346. Alternating-Current Motor. Merle J. Wightman, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 14, 1888.

476,368. Brush-Holder for Dynamo-Electric Machines and Motors. Frank B. Daggett, St. Joseph, Mo. Filed Sept. 8, 1891.

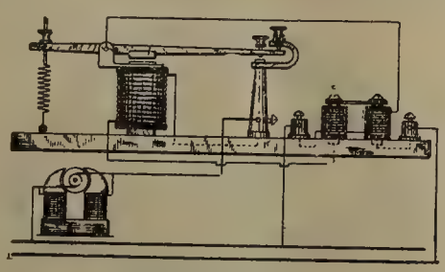
476,376. Electrically-Controlled Valve. William B. Fleming, Philadelphia, Pa. Filed Nov. 3, 1888.

476,422. Electric-Lighting System. Albert Sechrist, Denver, Col. Filed Dec. 1, 1891.

476,425. Electric-Arc Lamp. Edward F. Smith, Cincinnati, Ohio. Filed Oct. 5, 1891.

476,426. Electric Generator or Motor. Elmer A. Sperry, Chicago, Ill. Filed April 3, 1886.

476,437. Electric Locomotive. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Filed May 28, 1890.



476,330—SAFETY DEVICE FOR ELECTRIC MOTORS.

476,463. Electric Chime or Bell. Joseph H. Hunter, Pittsburg, Pa. Filed Feb. 29, 1892.

476,464. Metallic-Circuit Cable. Charles E. Jackson, Boston, Mass. Filed Nov. 12, 1891.

476,483. Secondary-Battery Plate. Edward C. Paramore, Philadelphia, Pa., assignor, by mesne assignments, to the Paramore Electric Company, of West Virginia. Filed Sept. 2, 1890. Renewed Oct. 31, 1891.

476,484. Electric Cable. William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 29, 1891.

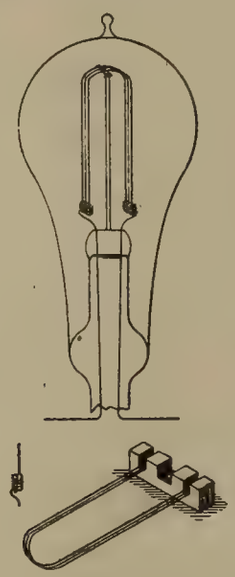
476,490. System of Testing for Electric Circuits. Chas. H. Rudd, Evanston, assignor to the Western Electric Company, Chicago, Ill. Original application filed Jan. 19, 1888. Divided and this application filed Oct. 25, 1888.

476,492. Circuit for Test-Batteries and Cords of Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 1, 1885.

476,493. Electric-Arc Lamp. Charles E. Scribner, Chicago, Ill., assignors to the Western Electric Company, same place. Filed Oct. 13, 1891.

476,494. Keyboard System for Metallic Circuits. John A. Seely, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 15, 1886.

476,501. Incandescent Electric Lamp. Ephraim E. Weaver and Gustavus B. Manypenny, Philadelphia, assignors of one-fourth to John Woolman Comfort and William Steele Ambler, Jenkinton, and John Cunningham, Jr., Philadelphia, Pa. Filed Dec. 5, 1891.



476,528—INCANDESCENT ELECTRIC LAMP.

476,509. Keyboard-Circuit for Multiple Switchboards. Oro A. Bell, New York, N. Y., assignor to the Western Electric Company, of Illinois. Filed Sept. 30, 1891.

476,527. System of Electric Lighting. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed August 7, 1882. Patented in England, in Belgium, in Italy and in France.

476,528. Incandescent Electric Lamp. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed March 16, 1883.

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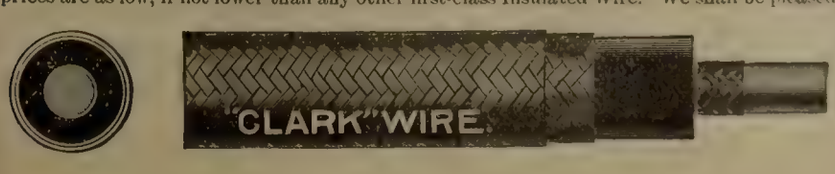
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HERBERT H. EUSTIS, President and Electrician.

476,529. System of Electrical Distribution. Thomas A. Edison, Menlo Park, N. J. Filed Oct. 10, 1883.

476,530. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed June 4, 1887.

476,531. Electric-Lighting System. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed April 26, 1881. Patented in England, in Germany, in France, in Belgium, in Italy, in Portugal, in Victoria, in India, in Spain, in New South Wales, in Austria-Hungary, in Queensland and in New Zealand.

476,544. System of Electrical Distribution. Harry W. Leonard, New York, N. Y. Filed Dec. 28, 1891. Patented in England.

476,570. Fuse-Block for Electric Circuits. Elmer A. Sperry, Chicago, Ill. Filed March 19, 1891.

476,573. Electrical Valve-Controller. John V. Stout, Easton, Pa. Filed Dec. 22, 1891.

476,582. Microphone, Cæsar Vogt, Posen, Germany. Filed May. 27, 1891.

476,583. Magnetic Telephone. Cæsar Vogt, Posen, Germany. Filed Sept. 14, 1891.

476,603. Conduit for Electric Railways. William Bradley, Fort Wayne, Ind. Filed June 22, 1891.

476,604. Insulator-Bracket. Thomas H. Brady, New Britain, Conn. Filed April 9, 1892.

476,607. Electric-Light Mast-Arm. John H. Caldwell, Philadelphia, Pa. Filed June 19, 1891.

476,613. Electric Switch. Charles E. Davis, Chicago, Ill. Filed Feb. 20, 1891.

476,618. Apparatus and System for Compound Telegraphy and Telephony. Francis W. Dunbar, Newark, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed Jan. 25, 1892.

476,653. Electroplate Attachment. Christian Keck, Cincinnati, Ohio. Filed Dec. 22, 1891.

476,700. Electric-Arc Lamp. Robert H. Thurston, Ithica, N. Y. Filed Feb. 27, 1892.

476,730. Telegraph-Instrument. Charles B. Carr, St. Johnsbury, Vt. Filed Jan. 7, 1892.

476,733. Galvanic Battery. Martin M. Clark, Chicago, Ill. Filed Dec. 26, 1888.

476,739. Electric Street-Lamp Post. Thomas Flaherty, Pittsburg, Pa. Filed March 23, 1891.

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AN INTERESTING PAPER.

Mr. Nelson W. Perry in a very interesting paper recently read before the general meeting of the American Institute of Electrical Engineers at Chicago, asks in view of the fact that in the application of electricity in telegraphy where long distances are concerned, and in telephony where more than two instruments are on the same circuit, and again where large amounts of energy are to be transmitted great distances, as is illustrated by the arc light, the series system is the only one equal to the demands; why should it not also be applicable for the operation of electric railroads which are run long distances?

The practical application of such a system would, as Mr. Perry says, possess many valuable features, especially in the case of extensions of roads which must necessarily occur. The necessity for erecting extra generating stations with the accompanying expenses for real estate, building material, machinery, additional labor, etc., would be obviated. This would mean the saving of thousands of dollars, as a comparatively small expense would be incurred for the additional copper required. Every dollar saved means just so much more for dividends and where it is gained without detriment to the equipment investors are sure to be pleased.

Mr. Perry explains in an exhaustive manner how this may be possibly accomplished, and illustrates his remarks with diagrams by reference to which his suggestions may be the more readily understood. For the benefit of our readers we will produce the paper in full.

A UNIQUE SUGGESTION.

A decidedly unique, interesting and novel suggestion, thoroughly original in its conception, is made by Mr. A. A. Knudson in another column in this paper. Mr. Knudson's suggestion, if carried into effect, cannot fail to excite the greatest interest throughout the length and breadth of the land. His idea is that the formal opening of the World's Fair should be announced in all the large cities from the Atlantic to the Pacific and from the Dominion to the Gulf, by the simultaneous discharge of cannon, the thundrous tones of which would proclaim that the greatest Exposition the world has ever seen, or probably will see for many years to come, had been opened to all nations. In a very clear and succinct manner Mr. Knudson demonstrates the complete feasibility of his plan, which will be the more readily understood by reference to the diagram. He proposes through the cooperation of the telegraph company or companies to have cannon connected in electrical circuit in as many of the cities as may be determined upon—the more the merrier. Then, when everything is in readiness, the President, or whoever may be delegated to perform the ceremony, by simply pressing the key and closing the circuit, will cause the cannon to be discharged in each city, announcing to the multitude of expectant citizens that all nations had commenced the celebration offered in honor of the great Columbus.

The suggestion offered by Mr. Knudson is probably the most interesting that has yet been made in connection with the Exposition, and deserves the careful, and we would say favorable, consideration of the Fair authorities. As but a period of two minutes would be occupied for the purpose of signalling, firing and restoring the circuits to their normal working condition, we feel quite sure that the telegraph company or companies would be only too glad to lend assistance.

A SUGGESTION FOR THE COLUMBIAN EXPOSITION.

BY A. A. KNUDSON.

THE World's Columbian Exposition at Chicago next year will afford greater opportunities than any other event in the history of the development of the arts and sciences for the display of genius of every kind.

It is well known that the ingenuity of scores of minds throughout this country is being actively exercised with a view to evolving something for the great Fair that will be entirely original and attractive, and it is the desire of all Americans to have as many original features as possible in connection with the great Exposition.

The attractions and novelties at the Chicago Fair no doubt will be innumerable, and it is reasonable to presume that the hundreds of thousands of visitors who will come to America next year from foreign lands will get a good idea of what a great and energetic people the Americans are.

Although there have been many attractions proposed for this great occasion, I wish to offer a suggestion in the line of a novelty in connection with the opening exercises of the Fair that I think might prove of extreme interest throughout the country.

Three years ago a very successful electrical exhibition was held in the city of St. John, New Brunswick, and as part of the programme of the opening exercises cannons were fired in St. John by electricity, the current being transmitted from Montreal, and also from Vancouver, on the Pacific coast, some 3,500 miles away. The use of the lines of the Canadian Pacific Telegraph Company were freely tendered for the purpose, and its president, Mr. Van Horne, personally touched the key in Montreal which caused the current to speed with lightning rapidity to the gun in St. John, and fire it off, Mayor Openheimer, of Vancouver, doing the same there. Telegrams of congratulation were afterwards sent by both of these gentlemen to the lieutenant-governor, who presided at the opening exercises, and who declared the exhibition open, after his speech, by discharging three guns himself from the platform, the cannon being in a fort conveniently near the building.

This feature of the exhibition attracted probably more notice and interest than any other. It was entirely successful in its operation, and was easy of accomplishment. I had the honor of being the general superintendent of the exhibition, and devised this attraction which, with the liberal help of the telegraph company in affording the use of its line across the continent for the purpose, brought forth such successful results.

Some time ago it occurred to me that a similar feature of this character would be eminently appropriate and interesting in connection with the opening exercises of the World's Fair, and having given the matter considerable thought I have evolved a scheme which I hereby submit for the consideration of the proper authorities of the Fair.

My idea, briefly, is to provide means by which a cannon stationed in the capital city of every State in the Union can be discharged by the touch of a key on the platform at Chicago—one touch of the key discharging all the cannons simultaneously—or, should circumstances require it, cannons in a greater or less number of cities; the object of course being to give general and audible notice that the great Fair has been formally opened.

In the development of my plans I have kept in mind the necessity of disturbing existing arrangements in telegraph offices as little as possible, and it will be noticed by reference to the accompanying diagram of connections that there is no interference with the main telegraph lines at the cities where the guns are to be fired. The "gun circuit" in every case is entirely local, and is controlled by a switch *m* (Fig. 2).

The diagram shows the proposed connections at Chicago and, for example, Boston, the connections in the latter city being, of course, identical with those in each place where a gun is to be fired.

Fig. 1.

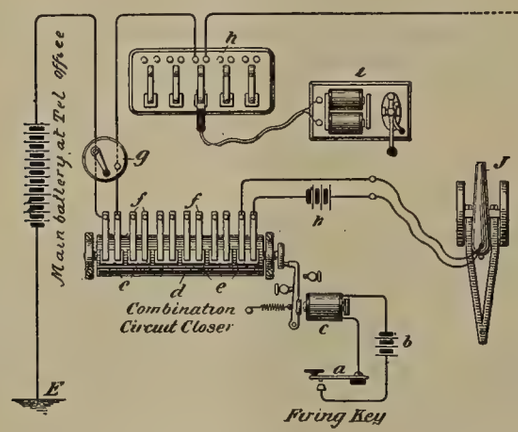
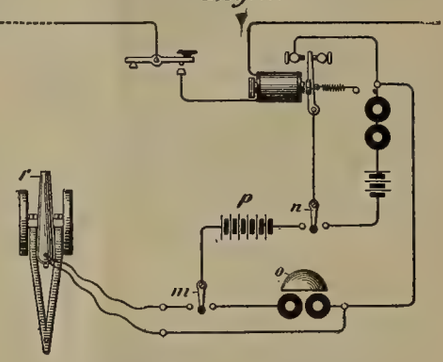


Fig. 2.



The firing-key *a* (Fig. 1) is an ordinary open-circuit strap key. It is connected, as shown, with a battery *b* and an electro-magnetic device *c*, which releases a catch, causing the combination circuit-closer *d* to operate. This circuit-closer consists essentially of a cylinder of some insulating substance—hard rubber, say—on the outer surface of which is attached, longitudinally, a series of metal plates *e*.

The cylinder is revolvable by suitable mechanism, which is put into operation when the catch is released by the electromagnet *c*, when the latter is charged by the closing of the key.

Before the circuits are closed the strips of metal on the surface of the cylinder are not directly under the finger-bars *f*; but when the cylinder is made to turn by the operation of the electromagnet, the metal plates form a contact between every pair of the finger-bars (which are also made of metal and represent the terminals of an open wire), thus closing the circuit connected therewith and firing the gun on that circuit, in the manner to be explained further on.

A switch *g* is placed in the main telegraph circuit for the purpose of cutting in and out of circuit the combination circuit-closer; and on the same circuit in the telegraph office is a test switch *h*, for the purpose of test-

ing the gun circuits just previous to the operation of firing.

By previous arrangement all such circuits can be tested a short time before the firing current is to be transmitted, in order to insure a clear wire, free from trouble, and to give time for the substitution of a good wire in case of derangement of any one of them. The test instrument *i* enables the chief operator to test each of the gun wires by simply inserting the plug in the switch, which may be of the ordinary jack-pin pattern.

The gun *j*, at Chicago, is so connected that when the circuit-closer revolves and the two finger-bars are connected by the metal plate on the cylinder surface, the circuit is closed and the gun fired by the heating to incandescence of the fine wire in the fuse. The current for heating this wire is generated by the battery *k*, which is of sufficient size to heat the wire to incandescence as soon as the circuit is closed.

This explains the operation of transmitting the firing currents.

The arrangement of the circuits at the receiving ends (all being similar to the one shown in the diagram) is shown in Fig. 2. The regular main-line connections in the telegraph office are not disturbed at all, the only change consisting of the insertion of a three-point switch *n* in the local circuit which controls the sounder. Connected with one of the wire terminals of the sounder is an extra wire which runs to a bell *o*, the circuit continuing through the bell to one point of another three-point switch *m*, thence to the battery and the left-hand point of the switch *n*. The gun *r* is connected in the manner shown, and the operation of the arrangement is as follows : When the time arrives to make preparations for the firing of the gun, the switch *n* (at the telegraph office) is turned to the left, and the testing operator at Chicago, at the proper time beforehand, sends a signal over each of the gun circuits by cutting in on the switch *h* (Fig. 1). This signal rings the bell *o* (Fig. 2), which is located at a point convenient to the gun operator, the switch *m* being turned to the right. When the gun operator hears the bell ring he turns the switch *m* to the left, which cuts the gun into the circuit, and it is all ready to be fired by the closing of the circuit at Chicago, by the President of the United States or whoever may be the person delegated to perform this extremely interesting ceremony.

In an instant all the guns in electrical connection with the Chicago platform, scattered as they would be all over the country, separated by thousands of miles, would simultaneously with the gun at Chicago speak in a voice of thunder, and announce to the thousands of expectant citizens gathered around each that the greatest World's Fair in history had been declared open to all nations.

It may be noted here that by this plan, after the guns have been discharged the telegraph lines can be instantly restored to their normal working condition, a period of two minutes, at the longest, being sufficient for the purposes of signalling, firing and restoring the circuits.

This arrangement, I believe, would create much additional interest in every part of the country in the exhibition, and would tend to make the affair memorable.

A NEW SYSTEM OF ELECTRIC PROPULSION.*

BY H. WARD LEONARD.

PART II.

Let us examine some of the advantages that this method seems to offer over the existing methods, starting at the car and considering the entire equipment back to the boiler.

In order to place before you the opinions of some of the best authorities on the questions involved, I shall quote freely from "The Electric Railway" (Crosby & Bell); Parshall's "Methods of Electrically Controlling Street Car Motors," "Comparative Test of High and Low Speed Engines in Electric Railway Work," by Charles W. Wason (*Electrical Engineer*, April 27, 1892); "The Practical Operation of the Gearless Motor," by S. H. Short (*Electrical World*, April 16, 1892); "Load Diagrams of Electric Tramways and the Cost of Electric Traction," by A. Reckenzaum (*Electrical Review*, London, March 25, 1892).

The cost of car equipment will be increased by the cost of the motor-generator, but as a partial offset to this we have saved the rheostats, two expensive controlling switches and a complex system of wiring.

Our motors, having constant and fully-excited fields, will operate absolutely without spark under all conditions. The control of the car will be entirely accomplished by a small switch and rheostat, handling never more than one-half of an ampère and occupying a space of one foot square and one inch deep over all.

As regards efficiency, we will have the advantages of the present system under all conditions. For long runs upon the level we will, by a suitable switch, connect the driving-motors directly to the line and secure an efficiency of 90 per cent. for our motor.

As regards depreciation, we will have the advantage of no rheostats or controlling switches to burn out and with no sparking and no connection with the field circuit we will have the minimum liability of burning out armatures.

Our fields will have no tendency to burn out, since they are not subject to the excessive currents which the present series fields are. The current in our field will be independent of the load.

As to field windings and rheostats in existing methods, Parshall says:

"With 25 H. P. motors, an external resistance of 10 to 12 ohms is required.

"Lessening the duty of the rheostat is a very important point, since as yet it has been found exceedingly difficult to construct a cheap rheostat that could be placed under the car in the small space available and dissipate so large an amount of energy as is required when the car is to be run for a considerable time at a speed so low as two or three miles an hour. Any method of control that has lessened the energy to be dissipated in the rheostat has in general been considered with favor, since there has been a corresponding diminution of trouble in each case that the energy to be dissipated has been lessened.

"The range of speed without the use of a rheostat is determined by the limit to which it is safe to heat the magnets."

Crosby and Bell say :

"In using this method (commutated fields) the principal difficulty has been met with in disposing of the excessive heat necessarily generated in the compact mass of field windings."

"The practical problem has been to secure a convenient rheostat.

"The principal sources of loss in our present street railway motors are the regulating devices and the gearing.

"With the motors and the gearing generally employed, the average commercial efficiency of the combination is probably not often in excess of 65 per cent., giving a total commercial efficiency for the system, from engine to car-wheel, of 39 per cent.; this of course is but an estimate. But taking all the factors into consideration it is probable that the average of the roads now in operation would fall quite nearly to the point indicated. In very few cases would it fall below 30 per cent.; in still fewer would rise above 40 per cent."

Regarding the power required to start a car on exist-

*Paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

ing methods and to operate it upon levels and grades Crosby and Bell say:

"With the ordinary car equipment of two 15 H. P. motors and the usual speeds, from eight to 12 miles per hour, experience has shown that five to six electrical H. P. is necessary on nearly level tracks.

"The amount of current ordinarily taken in starting a car is momentarily more than 50 ampères, which at the ordinary voltage corresponds to about 25,000 watts."

Reckenzaum says:

"If we calculate from the accepted coefficients of resistance to traction on common tram-rails, we find that an ordinary tram-car will require but three to four H. P. for its propulsion when once in motion."

He says of the Thomson-Houston car:

"The maximum current at any time was 75 ampères."

Of Sprague motors:

"Here again we observe a maximum current of 75 ampères.

"Westinghouse motors, maximum current 95 ampères."

Short finds that 80 to 100 ampères are required to start a car, and says:

"On this road the traffic is very heavy, although grades are light."

Leaving the car, let us now consider the line. It will be evident from what we have seen that we can reduce the amount of copper to one-half the present requirements, as we never will require the enormous currents at present called for in starting and upon heavy grades. Or, to put it in another way, with the existing conductors we could run twice as many cars as at present, with the same loss in the conductors.

Now let us look at the generators and the prime movers, whether steam-engines or water-wheels.

Under existing systems for roads of from five to 10 cars, it is necessary to install about 20 indicated H. P. (rated at ¼ cut-off) per car and about 16 kilowatts per car in generators. Also about 20 H. P. per car in boiler capacity. This large equipment is necessitated by the occasionally very large demands for power and the inefficiency consequent upon this.

Under the proposed system it is not necessary to provide power in excess of 15 H. P. for any car under any conditions, and since in practice most of the cars will be operating at less power than this, we need only install engine, dynamo and boiler capacity of 8 H. P. per car, instead of 20. Or, to express it another way, we can operate with existing boilers, engines and dynamos at least double the number of cars they can at present supply.

Crosby & Bell recommend, for a five-car road:

"An equipment consisting of two 40,000 watt dynamos, one 80 H. P., high-speed, simple engine belted directly to them, and two boilers of about 50 nominal H. P. each."

Now let us look at the economy of the operation of the station. With the extremely fluctuating loads of existing systems, the economy of the entire generating plant is very low. The stations of three roads which have been tested give for the combined efficiency of engine and dynamo 40 per cent., 54.6 per cent. and 62.8 per cent. respectively. If the load can be kept approximately constant, the combined efficiency of engine and generator should be about 75 per cent., and in the proposed system the load will be sufficiently uniform for us to expect an efficiency equal to this, and because of the nearly constant load we can produce a horse-power on about 25 lbs. of water, while in present practice for small roads about 50 lbs. of water per horse-power is a fair figure, and the best published result thus far obtained, even when the average horse-power rose to 750 H. P., is 28 lbs. per H. P., as found by Wason, at Cleveland, in operating a total of 71 motor cars.

With the present systems the average indicated horse-power per car is about 12 horse-power, which on account of fluctuating load, requires at least 36 lbs. of water per horse-power, or about 420 lbs. of water per car per hour.

With the proposed system we will operate with an average of about eight indicated horse-power per car, which, on account of the steady load, will be produced with about 25 lbs. of water per horse-power, or 200 lbs. of water per car per hour. That is, we require about 50 lbs. of coal per car per hour by present systems, and about 25 lbs. of coal per car per hour by proposed system, or a saving of 50 per cent. in the coal and water required in favor of the proposed system.

On this subject of fluctuating loads and their effect, Crosby and Bell say:

"A record of ten minutes on a recording ammeter may give some faint idea of the condition of things. It will be seen that at one point the output jumped from zero to 150 H. P. and back inside of a single minute, and during the latter five minutes shown in the diagram there were no less than 25 sudden *variations* of 50 to 100 H. P., each taking place within a few seconds. The road from which this record was obtained is four miles in length, and was operating seven cars at the time of the test."

Reckenzaum says:

"These abrupt changes have the effect of reducing the efficiency of the whole system to a comparatively low figure."

Church says (*Electrical Engineer*, April 27, 1892) that the best compound engines will show an economy of only 28 lbs., and the usual compound engine "an average duty not better than 35 to 40 lbs. The same is true of every form of non-compounded engine, whether high-speed or low-speed, both of which show a tremendous falling back of fuel duty under variable load."

Let us now examine the comparative first cost of a railway of moderate size, say from five to ten cars, equipped by present systems and by the proposed system.

The detailed figures per car are given in Table 2.

TABLE 2.

SHOWING PROBABLE COMPARATIVE FIRST COST PER CAR BY PRESENT AND PROPOSED SYSTEM.

	Present System.	Proposed System.
Steam plant, generators and conductors per car (steam plant 1,000, generators 700, conductors 500)	$2,200	$1,700
Motors (2 H. P. equipments)	1,800	1,400
Power converter	0	900
Controlling switches, cables, rheostats, etc	200	30
Total first cost per car	$4,200	$3,430
Saving in favor of proposed system per car		770

Table 3 gives a summary showing the features of the proposed system as compared with the corresponding features of the present system.

TABLE 3.

	Present System.	Proposed System.
First cost of steam plant, generators, conductors and car equipment per car	$4,200	$3,430
Ampères at 500 volts required to start full load on level	75	2.8
Ampères at 500 volts for full load at full speed on level	12.5	12.5
Ampères at 500 volts to start full load on 5 per cent. grade	125	10
Ampères at 500 volts for working speed on 5 per cent. grade	60	22.5
Ampères fed back to system in coming down 5 per cent. grade	0	10
Pounds of coal per car per hour	50	25

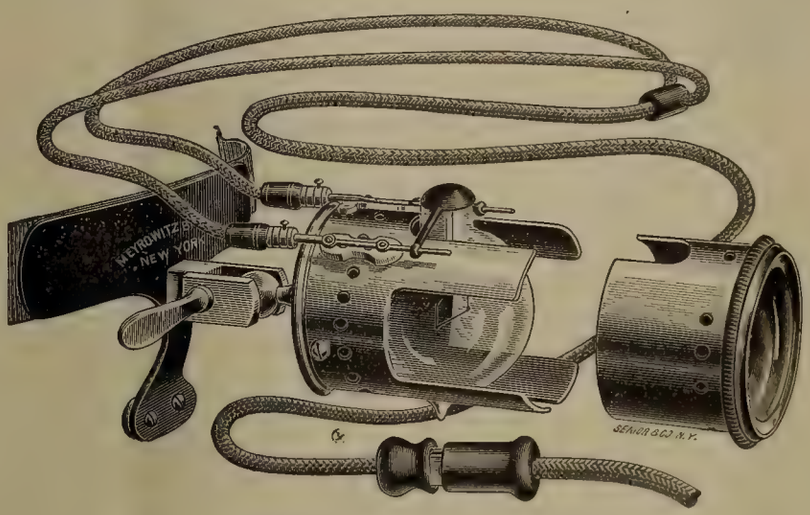
The features of the proposed system which seem, at first sight, to be very objectionable are: The increased cost of the car equipment and the fact that we are adding an additional machine, having two fields, two

armatures and three bearings; but, as we have seen, there is only an apparent increase in the first cost, for the saving in the generators and distributing plant far exceeds the additional cost of the car equipment; and the use of the motor-generator for elevators, travelling cranes, etc., has demonstrated that, as regards the attention it requires and the depreciation it suffers, it has a marked advantage over the rheostat or commutated field used in the present methods of operation.

ALUMINUM ELECTRIC PHOTOPHORE.

In the old style electric photophores the metal parts were so heavy as to be supported on the forehead with great fatigue. It was in order to obviate this decidedly objectionable feature that E. B. Meyrowitz, 104 East 23d street, New York, a practical manufacturer of optical, ophthalmological and surgical instruments, etc., designed and perfected the photophore illustrated herewith.

The metal parts are constructed of aluminum, and in this way the desired result has been accomplished, as that metal is of extremely light weight. Many new features and improvements have been introduced, and no pains spared to make it a first-class article. The lamp used in connection with this photophore is of 4 C. P., the light being projected in parallel rays by a strong plano-convex lens. It can be operated by the Meyrowitz two-cell storage battery, or direct with the Edison current by employing the Gish ideal rheostat. In filling a long-needed want, this photophore should meet with large sales among the medical fraternity.



ALUMINUM ELECTRIC PHOTOPHORE.

ELECTRICITY AND ITS RELATION TO TRANSPORTATION.*

BY CHARLES SELDEN.

Eminent motive-power people have told me that experience shows that under the best conditions the locomotive can only be utilized to the extent of 25 per cent. of its power, and 15 per cent. under unfavorable conditions which are met daily. There are several factors that brings this about—partial consumption of fuel under high speed is one, loss of fuel through exhaust is another, lack of traction is another, and so on. You build an enormous machine in order to secure certain traction effects, and you mine and handle and rehandle and haul and rehaul millions of tons of coal, every movement of which means money, and added to that you get only a low per cent. efficiency of what you finally at great cost deliver to your fire-box. Assuming (and I have reason for the assumption being well grounded) that you can take the power out of your coal at the mine, and after conversion you transport, not the coal, but the resultant power and energy by means that are, so far as record shows, practically everlasting, and deliver to your motive device a high per cent. of your power, are you not operating at an immense saving? And will it not enable you to meet the requirements of low rates, large tonnage and high wages?

Again, where your road is so located as to enable you to utilize water-power, there is still more inuring to your benefit. I know that owing to the sluggish response of the turbine to a sudden call for increased power, that in operating a number of speed trains it is not all that could be desired, but that will be remedied, and for slow freight movement I believe that it will fill the bill even now; if it does, so much the better; practical trial alone will demonstrate it, and can be made upon many roads that are located beside streams and following their courses, where thousands of horse-power energy is wasting in its passage to the sea.

Owing to the brief time the electric motor has been employed as a practical tonnage mover, an attempt to show its economies as against the locomotive is an arduous task, and it is hard to believe how difficult it is to get figures in such shape as to admit of proper comparisons being made. One reason is that the street-railway companies figure on the number of passengers carried, regardless of distance, as all pay the same fare for either long or short haul, while the steam railroads figure on the number of miles each passenger is carried.

The electric motor has practically dealt exclusively, up to this writing, with the carrying of passengers. There are a few isolated cases in which a freight car or two have been utilized, and records show that in one instance a single car in one year carried 10,460 tons, but unfortunately the records do not show the mileage made by the car, nor its earnings ; and hence we cannot reduce the figures to tons carried per mile and earnings. Another difference in the method of accounting is that the figures are based upon the earning and expense per car-mile, instead of the ordinary method employed by steam railroads. I selected as a fair comparison a steam road that pays a dividend, and upon which the earnings from passenger service exceeded the expenses about 25 per cent., taking the passenger car mileage and reducing it to miles per car, likewise showing earnings per car-mile and expenses per car-mile.

The expenses were $4,552,992.84, or per car, $7,367.30 ; or per car-mile 12.41 cents, a net earning per car-mile of

*Abstract of paper read at the Convention of the Association of Railway Telegraph Superintendents, held at Denver, Col., June 15 and 16, 1892.

6.89 cents. The mail and express included in the above earned over $1,100,000, or in the neighborhood of one-seventh of the whole.

From an average of a number of electric roads, good, bad and indifferent, I have found the earnings per car-mile to be 30.31 cents per mile, and expenses, 11.10 cents per car-mile, leaving a net of 19.21 cents per mile, or a net gain over the steam road of 12.32 cents per mile.

These figures seem to show that the average of electric roads earned much more per car mile than the steam roads, and at an expense of only 1.31 per cent. per car mile less than the steam road. This slight difference in expense looks somewhat discouraging, but it must be borne in mind that the electric road figures are an average of a number of roads compared against a dividend earner and a net passenger traffic. There are electric roads operating for 7.8 cents per car mile and earning 24 cents per car-mile, a difference in their favor in both earnings and expenses that catches the eye at once. Again, the steam road enjoys cheap fuel as against the electric road's high-priced fuel and water. A crew of five men to five-car trains steam, as against ten men to five electric cars, and a proportion of taxation is charged against electric and not against steam in the figures given, and there are other matters entering into the expenses of operation that do not enter into the maintenance of steam roads, such as street paving, per centage of gross receipts, park tax, etc. Hence, when we analyze we have no reason to complain, and I think we can safely assert the economy of electric motive-power over steam, at least in certain localities and under certain conditions, and I believe in nearly, if not all.

The electric roads of recent date are not cheaply-constructed affairs either. You will find girder-rails running from 60 to 85 pounds per yard, giving a track that would enable them to use it for rapid travel as well as heavy tonnage.

In contrasting the two methods of transportation one should also remember that the electric roads, generally speaking, traverse thickly-populated districts and carry a great number of people over a short mileage, while the steam railroad is scattered over a large extent of territory. Just whether this is in favor of one or the other (rate per mile being taken into consideration) I leave for some abler hand to determine, but I feel sure if you will take up some steam roads and analyze them, division by division, you will find where comparatively short mileage is covered by a large number of people, and hence the near approach to parallel comparison with the operation of electric power can be made with this view of, upon some portions of a road, largely increasing the net results from passenger traffic.

There is, apparently, good reason for the layman to suppose that the electric motor is very limited in its power, because he naturally views it from what he has seen it perform, and hence argues that the best foot has been put forward, but he was never more mistaken in his life. The electric motor introduction is a revolution, and like all revolutions, it meets with many obstacles. The first thing capitalists interested in street-railway traffic met it with was, "We shall have to throw away millions of dollars in car equipment we now own." What then was to be done? *Build a motor to fit the existing equipment;* and it was done. Restricted, therefore, to certain dimensions, certain space and certain weight, the electric motor must necessarily be restricted to certain power; but how is it in other instances? An electric motor of, say, fifty horse-power may be arranged to actuate one set of drivers, and then duplicates of the same until the one combined motor may have 300 or 500 horse-power; and hence we find ample power to draw trains, just as has heretofore been done with the locomotive, and, it is claimed, more economically.

We know it is now practicable, at slight increase in cost of motor, to so construct it as to carry a train of several cars at an even less cost per car than by small motors; and the progress in the distribution of high electric pressure, which can be translated, makes possible the acquiring of greater power at less relative cost than was heretofore deemed probable, and it will go right on in that line.

Electricity, in a commercial sense, has never retraced a single step, and it will not do so now.

Let me ask the general managers whether there is not some piece of road that is now operated at a loss, that could be operated at a profit by electricity? You have track, you have coal, you have power-houses. Is there not some such territory on your own road?

Take suburban roads, or suburban points upon a through line—do you not strive and spend money to build up the locations? Do you not, sometimes for years, maintain a non-paying territory clearly on hope and speculation as to the future? Do you ever satisfy the commuter? Does not a percentage want the 11 o'clock train made 12 o'clock, and *vice versa*, and perhaps both? You meet this by saying you are doing the best you can and losing money at that. Now, then, how much quicker could you build up such a territory by more frequent and less expensive trains, and carry freight-cars too, one by one, or two or three, and thus supply your local traffic; or, if needs be, steam must haul freight, let it be done on the same track; they will work right along together. But, say you, "the question of speed comes in." So it does, yet I think you will find that the suburban public would rather have twenty-four trains a day at twenty miles an hour than twelve trains at forty miles an hour, and I do not intend here to beg the question of speed. When it comes to speed, *per se*, rotary motion is undeniably capable of it with less strain and wear and tear than the reciprocating.

We feel that you do not want to make any expensive useless experiments. Now to avoid that, suppose you have some such territory as named; without the expenditure of a dollar, you can get estimates as to the cost of construction and maintenance and operation. This association is talking to you because we are all proud of the roads we represent; we are proud of the fact that electricity as a motive-power is now so rapidly advancing, and to the extent that we can aid the roads in saving money and bettering the service we shall be proud also. We are your loyal subordinates; your success is ours; electricity in its relation to transportation has never failed you yet. We and our loyal coworkers constitute your electric safeguard, with its train orders, its signals, block and otherwise; and you will doubtless recognize that being in the confidential arm of your service, we feel as if we should call your attention to the great question of the day.

With singular appropriateness and, perchance, strange coincidence, it falls to the lot of the same corporation that first bore the imprint of electricity in its relation to transportation, to be the one upon which the great task is now thrown of demonstrating the power of the electric motor as a tonnage mover.

In the Baltimore and Ohio tunnel at Baltimore, arrangements are now making for a demonstration which cannot fail to be of great moment to the transportation world. The question of expediency and comfort, rather than economy, prompted the trial of a motor, and so sanguine is such a corporation as the Thomson-Houston Company, that it has contracted to equip the tunnel in such manner that the electric motor shall be capable of a speed with passenger trains of 30 miles an hour, and freight trains at 15 miles an hour.

It is expected that three motors will be more than sufficient to move 200 trains per day, each freight train's maximum weight to be 1,200 tons; and the motors will

encounter grades varying from 45 to 90 feet per mile. There is specified a draw-bar pull or pressure of 32,000 pounds.

The motors will be simplicity itself, the armatures being fastened directly to the axles and without gearing. Each driver can be operated singly, or they can be multiplied indefinitely and act in concert. The motors will be used in two capacities. Going down grade they will act as a brake, and going up as a motive-power.

Upon entering the tunnel the locomotive furnace-door will be thrown open, and no steam used, the motor drawing or pushing the engine and train.

Trains will be protected by electric block signals, and the tunnel will be ventilated by electric fans; thus the great experiment will be surrounded by everything conducive to comfort, speed and safety that electricity affords, and I feel sure will be an undoubted success.

Awaiting the result of this experiment in Baltimore stands the Baltimore and Lehigh Railroad. Rather than expend money at the moment for further steam-power, for use in its suburban work, it proposes to await the outcome, and if the experiment be successful, then the Baltimore and Lehigh Railroad Company will employ electricity as the motive-power for all its suburban trains.

Objections are raised to trolley systems generally, and the high cost of storage batteries has precluded the extensive use of that system, but brave brain of mankind will assault again and again, and, tireless in its perseverance, will finally find the way. In this connection, and simply to show you the channels through which mentality is at work, I present in a rough way the idea of Mr. Elias Reis, of Baltimore, whereby he proposes to move cars by electricity without a storage battery, a trolley wire, a slotted conduit, or a rail connection. Whether or not he will succeed the future will show. I have been informed that arrangements have been made to try the idea practically upon a section of road.

The method is the use of an alternating motor upon the car operated by induction. I have here an iron double trough casting having a central core. Traversing up one channel, lying against the core, and down the other channel is a coil of wire. These castings are presumed to be 50 feet or of any desirable length, having a depth of, say, four inches, and a width of, say, six or eight inches, and the trough, as I term it for want of a better name, is flanged on each side for a width of, say, three or four inches. After the coil of wire is placed, you can fill around the coil with gum, paraffine, asphalt or cement. The terminals of the coil are to be connected to an underground subfeeder carrying a current which has been transformed from a high to a low voltage. The high-voltage wire is in a properly protected cable and carried underground. The troughs are placed in the centre of the track, and then paving, such as asphalt, is laid in contact with and over them from rail to rail, thus affording a smooth, unbroken roadway. The motor car has an exact counterpart trough suspended underneath the car and as close to the surface of the street as is practicable; the terminals of its coil are connected to an alternating-current motor, which in turn is so geared as to propel, by its motion, the car. It will thus be clearly seen that the two troughs and their component parts practically form a converter, one side of which is stationary and the other side moves with the car.

I have a small model car here with which to demonstrate the results obtained, and if I succeed in getting the current, I will perform some experiments for you, lighting glow lamps through asbestos, wood or glass, and then under the same conditions you will see the car propelled, although there is no physical electric connection between the car and the wires carrying the current from the power-house. Paving, such as wood, asphalt or stone, will be permeated as easily as the glass, and one may walk on the surface without feeling the slightest electrical effect. The same principle is involved here as is used daily in electric lighting by converters, and with this Mr. Reis expects to propel cars at a first cost, as to plant, but little, if any, above the trolley system, and with an economy of operation that cannot now be obtained; thus offering to electricity still another channel in its relation to transportation.

ELECTRIC HAIR-BRUSH.

A genuine electric hair-brush that actually supplies and delivers an electrical current is the one shown in the accompanying illustration.

This brush is furnished with a Faradic cell, placed under the cover on the back, the current being applied in an agreeable and efficient manner to the scalp.

As the action of this brush does not depend upon the



ELECTRIC HAIR-BRUSH.

imagination, its value to sufferers from over-fatigue, congestion, nervous headache, neuralgia and kindred affections where the application of electricity is known to produce good effects must be apparent.

The brush is very little larger and not much heavier than an ordinary hair-brush.

SERIES ELECTRIC TRACTION.*

BY NELSON W. PERRY, E.M.

Part I.

In telegraphy, that application of electricity where pre-eminently long distances are concerned, the series system is alone adequate to the demands. In telephony, where more than two instruments are concerned, as in the case of several subscribers on the same circuit, or where, as in small towns, several of them are connected on a single wire, they are all connected up in series; and again, where larger amounts of energy are to be transmitted to considerable distances, as in the case of the arc light, the series arrangement is the only practical one now at hand. Why then should not this system commend itself for long lines of electric railroads? Mr. T. Carpenter Smith, in a series of valuable articles on "Some Views of Central Station Management," now running in one of the weekly electrical journals, lays down as one of his canons in the establishment of a plant, that it should be so planned as to permit of its ready extension as the demands increase; or, in other words, that in laying our plans we should provide for the future rather than for the present. If this be good advice in the case of electric lighting stations, how much more force must it have if it be applied to electric railway systems, which, as we all know, are being rapidly extended, in many instances to double and treble the distance originally contemplated, only to be increased again as soon as these further limits are reached.

In railway practice it is the distance rather than the quantity of current that forms the most important factor

* A paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

of increase, though the latter cannot be neglected in planning for the future.

In street-railway construction, assuming the distance to remain the same but the traffic to double, the amount of copper required to maintain the same relative economy must also be doubled. This is a minor matter as compared with the case where both distance and traffic are doubled. In this latter case, to maintain the same economy, the weight of copper must not only be doubled but squared. The limit of extention even on these lines is, however, soon reached, and the only recourse, by existing methods, is to erect at or near the further point another generating station, with all that implies in the way of additional investment in real estate, machinery, etc., and a duplicate set of employés.

In long lines, the bugbear of the multiple arc system of distribution is the drop in potential at the further end. The potential may be amply sufficient near the generating station, but it becomes less and less so as this proximity is departed from, until at the further end the lights which burned brightly near the station dim down to scarce more than a dull red, and the cars are operated under heavy loads with difficulty or not at all. There are two remedies for this drop in potential

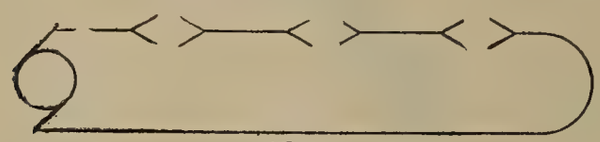


Fig 1

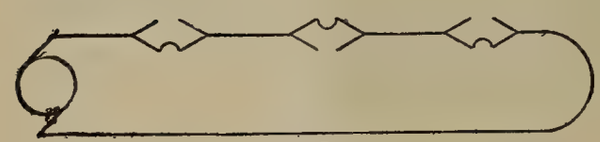


Fig 2

at hand—either to increase the amount of copper in the feeders, which within commercial limits is but a partial remedy, or to increase the pressure, using the same amount of copper which, when the multiple arc method of distribution is employed, introduces as many difficulties as it obviates. There is still a third remedy, and that is to employ the constant-current method, in which, under all circumstances, the current remains the same and the pressure varies as the work performed.

In the one case the copper must vary as the demands and distances—the pressure remaining the same, and in the other the pressure varies, the copper and current remaining the same.

In an arc light (series) circuit the wire will be of the same size whether it be erected to supply one lamp or sixty—whether the distance be one mile or five, and it, at any future time, it be desirable to extend the line of double or treble the distance, the wire already erected is amply sufficient for the part of the line it covers, and merely requires extension to the desired point to meet all the demands. There are in this country numerous arc light circuits in successful operation, twenty miles and more in length, yet I doubt if there is anywhere in the world a direct current constant potential circuit in operation to-day of anywhere near this length.

If energy can be so much more advantageously distributed to long distances by the constant-current method for arc lamps, why should this method not commend itself to the ever-increasing distances to which our electric street railroads are reaching? If the steam locomotive is ever to be supplanted by the electric motor, why should not this method of distribution be the one to be adopted?

The answer is that the constant-current method, as heretofore developed, has not been sufficiently elastic to meet the requirements, and although the generation of a constant current involved much less complex machinery, and the cost of distribution to distant points necessitated a much smaller initial outlay, still the difficulties introduced by this method largely outweighed all its advantages.

With the arc lamp or other stationary translating device, arrangements were readily devised for automatically shunting the current around in case of disability of the translating device, or the desire to throw it out of service. Not so with a moving object, such as a street car. No means had been found to shunt the current around the latter, or in case it got out of circuit by means of the trolley getting off the wire, or automatically closing up the gap thus made, and the disability of one car became the disability of the whole line and of every car on the line.

Could this and some other difficulties be surmounted, the constant current possesses many advantages over the constant potential that seem to me would bring it into almost universal use for traction purposes, especially on interurban lines and in other cases where long distances are concerned.

It is my purpose to show how all this has been accomplished, and how the constant-current system may be made as elastic in every way, at least on paper, as the constant potential, without sacrificing in any way any of the advantages peculiar to the system, and how it is possible to make each unit in such a system nearly if not quite as independent of every other unit as is the case in the system now in vogue.

The most ambitious and painstaking, and withal successful attempt up to the present time, to adopt the series or constant-current method to electrical traction, was that made by Prof. S. H. Short, now of Cleveland, Ohio, and he actually constructed and operated for a considerable length of time, and with some success, two roads, one a single track road at Huntington, W. Va., connecting that city with Guyandotte, about three and a half miles distant, and the other a belt and double-track road on South Broadway, St. Louis, which was, I think, about

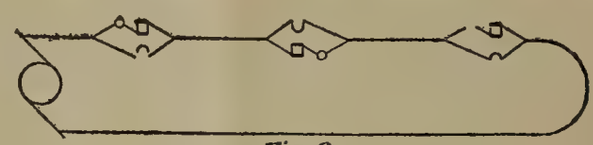


Fig 3

three miles in circuit. Prof. Short employed two wires, divided up into sections of any desired length, but necessarily not less in number than the number of cars to be operated. These sections were connected together by switches operated by a peg on the trolley mast, the peg on one car throwing the switch in one direction, and that on the succeeding car throwing it in the opposite direction. The current coming up one line of wires crossed over through the motor to the other line, by which it was carried to the next car motor, through which it passed back again to the original line of wires. Each car as it passed a switch set it so that the current in the section it was entering would come up on the same wire as it had in the section just left, and the succeeding car would set the switches so that the current would come up to it on the opposite wire, and so they alternated.

Since the continuity of the circuit depended upon the presence of the motor between the two lines, if either of the trolleys got off its wire the circuit was broken and all cars had to stop for lack of current, just as if we had an arc lamp without an automatic cut-out, and the carbons should become broken or the arc blown out, the en-

tire circuit would be disabled, and any irregularities in the resistance of the arc of one lamp would affect all the other lamps on the circuit.

Since the switch must be thrown to opposite wires by each succeeding car, if one car failed to do this, as would be the case if an odd number of cars were added to or removed from the line, it would again become broken by reason of the failure to throw the switch in the proper direction. Cars had, therefore, to be added to or removed from the route in even numbers. This precluded the intercommunication of two or more systems, for the reason that if a car was run off from one line onto another, it would be a case of the removal of an odd number to the other line, and both lines would become broken. So, too, it was impossible to operate a branched road on which part of the cars took one branch and a part the other, for the succeeding car, after it passed the forks, whichever route it took, would either break the circuit itself, by reason of failure to properly turn the switch, or would leave the switches in such a position that they could not be operated by the next car.

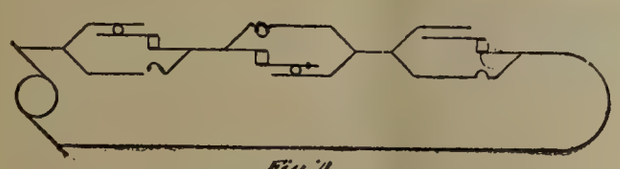


Fig. 4.

On a single-track road where the cars passed each other on sidings, it was necessary to wire the whole route, as though it were a double-track road, the cars going up one pair of wires and returning on the other which followed the siding. This was the case at Huntington, where, although there was but a single siding perhaps fifty feet long, where the two cars passed each other, the whole three and a half miles had to be double-wired to enable them to pass, else the two cars would be thrown into multiple with each other and neither could run. I succeeded in devising a means by which if there were but two cars and one siding on the road, the only double-wiring required was at the siding, but the plan failed where more cars and sidings were involved.

In Short's system the switches were purely mechanical, exposed to the vibration of the trolley wires and to the elements, and had to fit tightly else they would burn out. If they fit sufficiently tightly to obviate this, they were liable through corrosion or ice or some other cause to fit too tightly and fail to operate, in which case the line again became broken.

I speak more freely of the defects of the Short series system from the fact that it has been abandoned by the Short Company, and because its failure has been officially announced by its projectors. My object in dwelling upon it at such length being to point out more clearly some of the defects that must be remedied before the series can become a practical working system.

The system which I am about to explain may properly be described as consisting of a circuit interrupted by a series of breaks in multiples of two; or one consisting of a circuit interrupted by breaks in multiples series with each other—the breaks being in multiples of two. The conception then would be like Fig. 1.

But in order that a current shall pass around this circuit, it is necessary that *one* of the breaks in each multiple shall be normally closed. It matters not which one is closed, so our plan would now look like Fig. 2.

If a translating device should successively occupy each of these breaks, it would receive current during the time that its terminals connected the ends of the two broken wires, in proportion to the relative conductivity of the two paths open to the current. But we are not satisfied to have a portion only of the current pass through our motor—it is necessary that *all* the current must so pass. We must, therefore, make the resistance of the other branch infinite during the time in which the motor is bridging, through its terminals, the break; or, in other words, the normally closed branch must be broken.

If, therefore, we place an electro magnet in *series* with the normally broken branch, so that when vitalized it will open the switch in the normally closed branch, and allow it to close again by gravity or otherwise, when the magnet is devitalized, we have provided in a crude way for operating travelling translating devices in series. Our conception now would be represented somewhat by Fig. 3.

By this arrangement, the moving device only receives a momentary impulse as its terminals touch the ends of the break, and would have to rely upon its acquired momentum to carry it to the ends of the next break. It will be apparent, however, that it is immaterial whether the device receives its next impulse by closing the next break in the circuit or whether it skips that one and gets it from any other break, either on that circuit or from one connected with an entirely different dynamo. It is this feature that permits the use in my system of sidings on single-track roads, and of forks (the skipping of one or more breaks), and the intercommunication between separate circuits (the jumping from a break on one circuit to a break on another).

It is desirable, however, that the moving device be impelled by as nearly a continuous force as possible, instead of by a succession of momentary impulses. Instead, therefore, of having the ends of the normally open break face each other as represented heretofore, we may extend these wires for some distance parallel with each other, and our plan assumes the form shown in Fig. 4.

And it is desirable that the interval of time during which the device is without current, viz., that occupied in passing from one break to the next, shall be as small as possible. This naturally suggests having the normally open breaks all on the same side of the normally closed breaks, and if these parallel wires be continued, so as to overlap those constituting preceding and succeeding

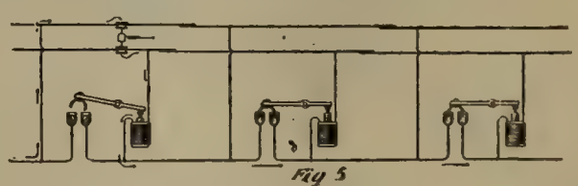


Fig 5

breaks, a car or other moving translating device may pass from one break to another without even momentary interruption of current. In Fig. 5, the lower line, which I call the "feeder," contains all of the normally-closed breaks, represented by mercury cups normally connected electrically by a fork taking into them, which constitutes a double-pole switch actuated by an electro magnet in the manner to be described.

GOOD RESULTS.

NEW YORK, June 17, 1892.

TO THE ELECTRICAL AGE PUBLISHING CO.

Gentlemen: The results obtained from our small four (4) issue "adv." in your journal have been very satisfactory.

It has undoubtedly brought in good orders that will keep our factory busy for some time.

We feel gratified in saying that we have received good and prompt returns for our money.

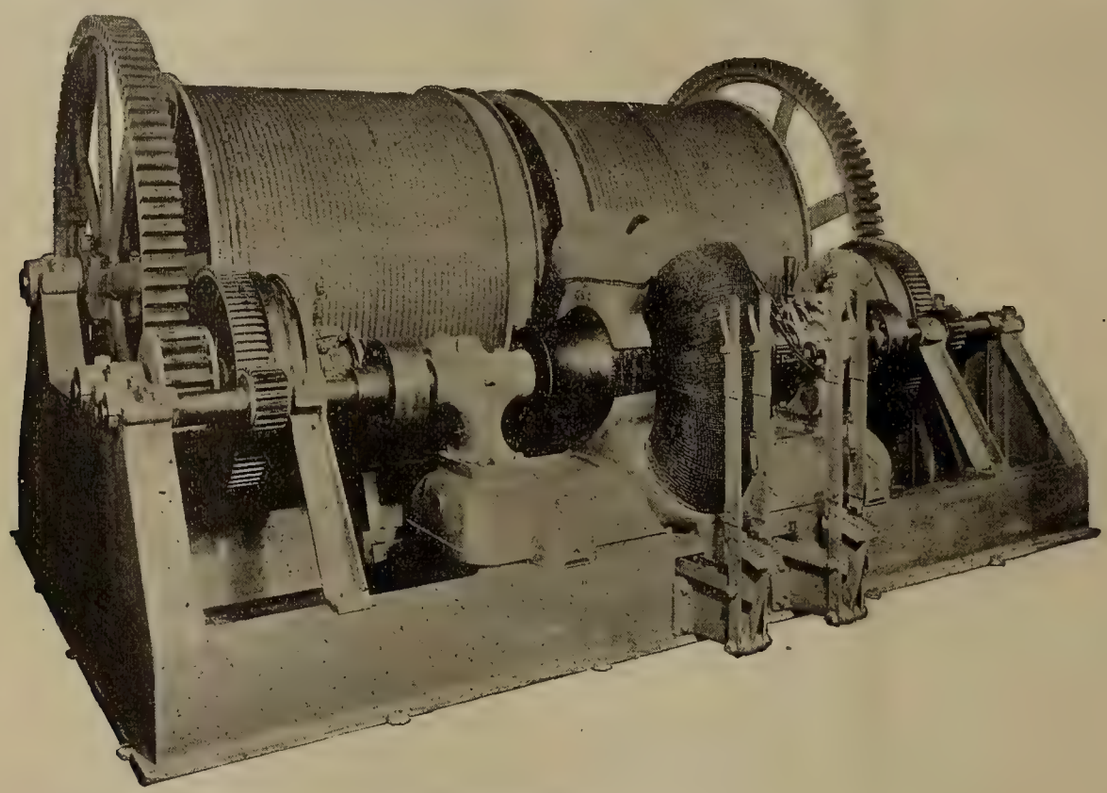
Very respectfully yours, HERO ELECTRIC CO.

ELECTRIC MINE HOIST.

The accompanying illustration shows an electric mine hoist recently installed by the C. & C. Electric Motor Co., of New York, in a mine at Corbin, Montana. At a rope speed of 400 feet it lifts a weight of 5,000 pounds. There are two drums, each five feet in diameter by forty inches long, intended to run either separately or together, independently geared by two reductions to each end of the motor shaft.

The motor pinions are rawhide. Their motion is transferred to the intermediate shafts by means of two Frisbie friction clutches.

The motor is 65 horse-power, and is reversible. The reversing and speed-regulating switch (not shown) is placed conveniently near the operator of the four levers shown. Two levers are for throwing the clutches in and out, and two for applying the brakeband on the inner peripheries of the drums. The bearings have ample length, and the whole machine is substantially and well made. It occupies a floor-space of about ten by thirteen feet, and has a total weight estimated at sixteen tons.



ELECTRIC MINE HOIST.

AMPÈREMETERS AND VOLTMETERS, AND THEIR USES.*

BY FRANK KITTON.

The ampèremeter and the voltmeter have been designed more particularly to meet the wants of the practical man rather than for laboratory use, although such instruments have been so far perfected as to give results which are remarkable for their degree of accuracy. To measure the strength of a current flowing through a circuit with a direct-reading ampèremeter, or to determine its E. M. F. with a direct-reading voltmeter is perhaps a simple matter, and may be accomplished by one having but slight knowledge of electrical laws, under ordinary directions. The application of these instruments, however, for other than simple current and voltage measurements requires a somewhat more extended knowledge of the science of electricity.

To consider this application more particularly is our purpose at this time. As a rule, these instruments contain permanent magnets for producing a strong magnetic field in which the coil conveying the current is placed, and on the constancy of these permanent magnets depends the continued accuracy of the readings, as any change in the intensity of the magnetic field would cause the instrument to give a different reading from that previously obtained under the same conditions of current or E. M. F., and therefore necessitate a recalibration of the instrument.

To calibrate a galvanometer is to determine by comparison with some standard the value of the different deflections, which are then marked off on a scale in practical units of current strength, or E. M. F. (ampères and volts). It is apparent, therefore, that it is of first importance that the permanent magnets shall retain their magnetic strength unchanged indefinitely. To insure this they are treated by a process called "aging," which is accomplished by subjecting them to rough treatment, such as pounding, etc.

Between the poles of the magnet in the magnetic field is pivoted a small coil of wire free to rotate around its vertical axis, to which the pointer is affixed. This coil is so arranged that a current flowing through it causes it to rotate against a spiral spring tending to retard or restrain its movement, and the degree to which it is deflected is nearly proportional to the strength of the current flowing through the coil. There is practically no difference in the construction of the ampèremeter and the voltmeter; their difference lies more particularly in their application. In one the divisions on the scale represent ampères, signifying the strength of the current passing through its coils, and in the other the divisions indicate in volts the difference of potential of the current at its two terminals. In the former the scale might as readily show the voltage, and in the latter the current strength.

In order to measure the voltage of a current—that is, the difference in potential at any two points in the circuit

* Abstract of paper read before the Buffalo Electrical Society, May 16, 1892.

—the two terminals of the voltmeter are connected at those points. For instance, to measure the difference of potential at the terminals of an incandescent lamp, the instrument is attached on each side of the lamp. In order to do this and not disturb or alter the potential difference at those points, the voltmeter must offer a very high resistance as compared with that of the lamp.

The fall of potential in a circuit is uniform with the resistance; that is to say, if a generator developing 110 volts is connected in a circuit of 220 ohms resistance, the potential of the current falls 1 volt in passing through each 2 ohms resistance.

Instead of stating the difference of potential to be between zero and 110, + or —, the zero or neutral line is drawn through the centre of the generator and the centre of the lamp (Fig. 1), and it may then be stated that the difference of potential is 55 volts + (or above zero), and 55 volts — (or below zero). The object of this arrangement is to enable us to show the fall of potential through each of the wires leading from the generator to the lamp; or, in other words, to show on one side a fall from 55 + towards zero, and a fall on the other side from 55 — towards zero, as will appear presently. In Fig. 1 the E. M. F. is 110 volts; resistance of circuit, 220 ohms; and fall of potential, 1 volt in each 2 ohms resistance. Twenty ohms of this resistance, as shown, is in the wires leading to the lamp (10 ohms in each wire) and 200 ohms lamp resistance; then if the potential of the current falls 1 volt in passing through each 2 ohms resistance, it follows

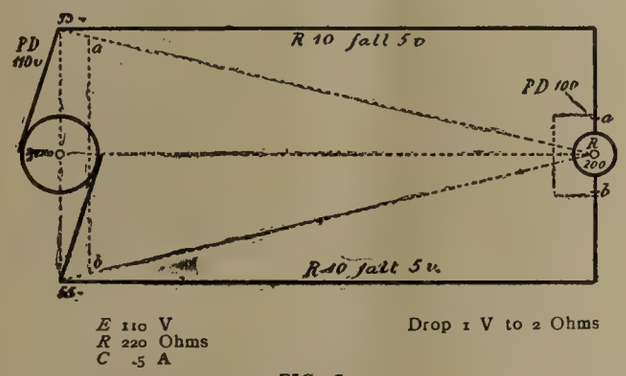


FIG. 1.

that 5 volts are lost in each wire before reaching the lamp; therefore the difference of potential (or voltage, as it is commonly called) at the lamp terminals is 110—10, or 100 volts. Now then a voltmeter of low resistance (200 ohms) is connected as shown in Fig. 2. The total resistance of the circuit is reduced and the current increased proportionately. (Ohm's law: decreasing the resistance increases the current.) The resistance of the circuit is now 120 ohms, therefore the ratio of fall of potential is changed, and is now nearly 1 volt through each ohm resistance (more precisely, 1 volt through each 1.09 ohms). The loss in the leads is then about 20 volts, instead of 10 volts, as was the case in the previous illustration; and the difference of potential at the terminals of the lamp is only 90 volts—10 volts less than it was before the voltmeter was connected. Under such conditions then, the reading of the voltmeter does not indicate the true E. M. F. at the lamp terminals under normal conditions. With a voltmeter of high resistance, say 20,000 ohms, which is about the resistance they actually contain for that range, the conditions of circuit with the voltmeter connected are: total resistance of circuit, 218 ohms (2 ohms less than when voltmeter is not in circuit); the fall of potential is in this case 1 volt to each 1.99 ohms; a fall through the 20 ohms resistance of the leading wires of a fraction over 10 volts (5.05 volts in each), leaving a difference of potential at the lamp terminals of 99.9 volts, or only one-tenth of a volt less than was the case without a voltmeter in circuit—a very much smaller error than was found with a voltmeter of lower resistance. As a matter of fact, in actual practice it is rare, if ever, that such exaggerated conditions exist, and the error is so small that it may be overlooked entirely, because ordinarily more than one lamp is being operated on the circuit, which reduces the lamp resistance, as they are connected in parallel or multiple arc, and the resistance of the lamps is the resistance of one lamp divided by the number of lamps; consequently there is a much greater difference between the

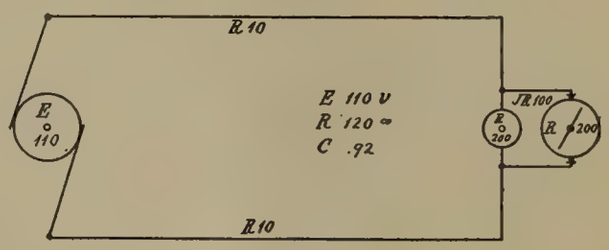


FIG. 2.

resistance of the circuit and that of the voltmeter, and, as has been shown, the greater this difference the less the error.

In order to measure the strength of a current flowing in a circuit with the aid of the ammeter, it is connected in series with the other apparatus, that all of the current may pass through it. Then, as will be shown, the conditions are such as to make it desirable to use an instrument which offers a very small resistance; just the opposite of the conditions previously considered in connection with the voltmeter.

In practice, ordinarily a large number of lights are operated on a circuit requiring a much greater current, and ammeters capable of measuring currents ranging from 1 to 150 ampères introduce only about 2 or 3 ten thousandths (.0002) of an ohm resistance, instead of .05, the resistance shown in this case.

Yet the statement that ammeters and voltmeters differ essentially only in application is true; as a matter of fact, the coils in this ammeter and this voltmeter may be identical as far as the amount of wire and the number of turns in the movable coil is concerned. Their real difference is the manner in which the movable coil carrying the pointer is connected with the extraneous resistance contained in the instrument. Here the term "extraneous" is used to distinguish this resistance from the resistance of the movable coil. The extraneous resistance is so placed as to have no inductive influence on the magnets or coil. In the voltmeter it is connected in series with the movable coil, and the resistance of the instrument is the sum of the two resistances. In the am-

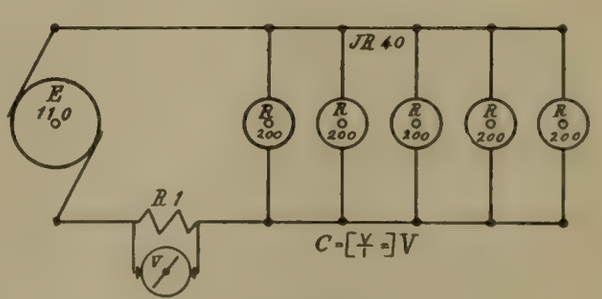


FIG. 3.

meter the coil and extraneous resistance are connected in parallel or multiple arc. Then the resistance of the instrument becomes the joint resistance of the two. As the resistance of the movable coil is large compared with that offered by the extraneous resistance as arranged in ammeters, only a small portion of the current passing

through the instrument finds its way through the movable coil. The path for the greater portion of the current is provided by the extraneous resistance, which shunts the movable coil. For this reason it is possible to construct ammeters that offer so little resistance; in practice it may be neglected and the instrument may be placed in circuit without causing any approachable change in the current, or left there without waste of energy.

How the total current may be calculated when only a portion passes through the movable coil will appear in connection with Fig. 3. It is now apparent why the voltmeter is arranged to offer a very high resistance to the passage of the current that comparatively little passes through it, while the ammeter offers but little resistance that all of the current may traverse it. In both cases the chief object is to admit of placing either instrument in a circuit without materially changing the pre-existing conditions of the circuit.

Ammeters and voltmeters may be employed for measurements beyond their normal range by utilizing suitable known resistances.

To increase the range of an ammeter a resistance is placed to act as a shunt to the instrument, carrying a certain portion of the current around it. If the shunt is equal to one-half the resistance of the ammeter, then two-thirds of the current passes around the instrument, and one-third through it, and its reading would then be multiplied by three.

To increase the range of a voltmeter the extra resistance is connected in series with the instrument, and the readings are then multiplied by the ratio of the fall of potential through the extra resistance and through the resistance of the voltmeter. If the extra resistance is twice that of the voltmeter, then two-thirds of the fall of potential is through it, and one-third through the voltmeter; therefore its reading must be multiplied by three.

ELECTRICAL SOCIETIES.

CANADIAN ELECTRICAL ASSOCIATION.

The first annual convention of the Canadian Electrical Association was opened at Hamilton, Ont., on Tuesday, June 14, and ended on Thursday, June 16.

The first day's session was opened by an address from the president of the association, Mr. J. J. Wright, at the conclusion of which Mayor Blaicher welcomed the delegates to the city.

The annual report was then read by the secretary, Mr. C. H. Mortimer, after which the election of officers took place. The result was as follows: President, Mr. J. J. Wright, Toronto (re-elected); first vice-president, Mr. K. J. Dunstan, Toronto (re-elected); second vice-president, Mr. John Carroll, Montreal (re-elected); secretary-treasurer, Mr. C. H. Mortimer, Toronto (re-elected). Executive committee: Messrs. D. A. Starr, Montreal; H. O. Fisk, Peterboro; W. A. Johnson, Toronto; S. J. Parker, Owen Sound; A. B. Smith, Toronto; D. Thomson, Hamilton; Thomas H. Wadland, Hamilton; L. B. McFarlane, Montreal, and John Yule, Guelph.

This finished the first day's proceedings.

The second day's session was opened with the reading of a paper on "Long Distance Telephoning," by Mr. Hugh Neilson, of Toronto. Mr. D. Thomson, manager of the Hamilton Electric Light and Power Company, followed with a paper on "Central stations." Mr. Lask, who is in charge of the machinery department of the Dominion of Canada's exhibition at the World's Fair, addressed the convention in reference to electrical exhibits. Mr. H. O. Fisk read a paper on "Carbons." A visit was then made to the Telephone Exchange.

The afternoon session was devoted to reading of papers on "Multiple Switchboards," by Mr. James A. Baylis, and "Steam and Electric Power," by Mr. J. J. Wright, and discussing the date and place of holding the next meeting, Toronto being the place, and January the month selected. In the evening the delegates were entertained at the Beach, where an elegant repast was served. Speeches were made, songs were sung, and all thoroughly enjoyed themselves.

The last day's session was opened with the reading of a paper on "Safe wiring," by Mr. A. B. Smith, of Toronto. In the absence of Mr. S. J. Parker, of Owen Sound, who was prevented from being present, Mr. J. J. Wright read his paper on "The Financial Aspect of Electric Lighting." A motion offered by Mr. K. J. Dunstan, pledging the association to do everything possible to make the Canadian exhibition at the World's Fair thoroughly satisfactory was unanimously adopted. A vote of thanks was then tendered the board of trade, Mr. C. R. Smith and the local press. *The Canadian Electrical News* was chosen as the official organ of the association.

The proceedings were then terminated, and the convention adjourned.

INTERESTING DECISION.

A point of interest to stockholders in business corporations was decided June 17 by the Court of Appeals in the case of Thomas Commerford Martin vs. the W. J. Johnston Company, Limited.

Mr. Martin, who was and is a stockholder of the W. J. Johnston Company, believing that its affairs were being improperly managed by its president, obtained from Judge Lawrence, of the Supreme Court, through Masten & Nichols, his attorneys, a peremptory writ of mandamus, requiring the company to exhibit its books to him and to allow him to make extracts or memoranda therefrom. The company resisted the application, claiming that Mr. Martin was not a stockholder; that he had no right in any event to make extracts from the books, but only to inspect them; that his demand was irregular, having been made upon the treasurer instead of the secretary; and that his motives for the examination were improper, as he was interested in a rival corporation.

The case was very strenously litigated by the company, which not only endeavored to obtain a stay of the writ, but also carried it twice to the Court of Appeals. This court has now finally held, affirming the decision of the General Term, that the writ was properly issued, and that Mr. Martin was entitled to the granting of the application as fully as it was allowed.

NEW BOOKS.

EXPERIMENTS WITH ALTERNATE CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY. By Nikola Tesla. 146 pages, illustrated. The W. J. Johnston Company, Limited, Publishers, New York. Price, $1.00.

Under the above title the publishers have reproduced in book form the celebrated lecture delivered by Mr. Nikola Tesla before the Institution of Electrical Engineers, London, England. The work is prefaced with an interesting biographical sketch of the author.

ANNUAL REPORT.

We have received a copy of the verbatim report of the tenth annual meeting of the American Street Railway Association, held at Pittsburg, Pa., Oct. 21 and 22, 1891. Containing as it does papers and remarks from some of the best-informed street-railway men in the country, it will be found very interesting reading.

J. C. HUBINGER Co., Electric Light Co., of Keokuk, Iowa, has just installed a 300 H. P. Cross Compound Condensing engine, built by the Ball Engine Co., Erie, Pa. The engine is giving good satisfaction.

A CURIOUS WAY OF ADVERTISING.

In the show window of a store in Wilmington there is a glass case in which is a pivoted Crocker-Wheeler motor with a fan and about two pounds of feathers. When the motor is in operation it revolves completely around in a circle, throwing a strong current of air and causing the feathers to fly around in all directions. The crowd about the window is so great that it requires two policemen to keep them away, and as a natural result the dealer is growing rich from his sales of motors. We learn incidentally that the Crocker-Wheeler people are receiving more orders for these pivoted motors than they can fill, and they will undoubtedly have an immense sale. The Crocker-Wheeler Electric Company owns the fundamental patent upon this principle as well as the patents on the special devices, and will hold the field against all comers.

NEW INCORPORATIONS.

Kansas City Gas and Electric Company, Kansas City, Mo., incorporated June 7, with a capital stock of $10,000. Incorporators: George H. Nettleton, J. S. Chick, George Kumpf, Kansas City, Mo.

The Hamilton Electric Light and Power Company, Hamilton, Wash., incorporated May 31, with a capital stock of $30,000. Incorporators: J. L. Warner, H. R. Berndt, C. B. McDowall, Hamilton, Wash.

The Amethyst Electric Light and Power Company, Creede, Col., incorporated June 13, with a capital stock of $200,000. Incorporators: E. N. Magner, B. F. Kelly, J. P. Wallace, A. W. Brownell, Creede Amethyst P. O., Col.

Electric Construction Company of St. Joseph, Mo., incorporated June 7, with a capital stock of $5,000, to deal in wholesale and retail electrical machinery, etc. Incorporators: F. M. Atkinson, C. C. Hyatt, M. M. Crandall, St. Joseph, Mo.

The Platte Valley Electric Railroad Company, Denver, Col., incorporated June 7, with a capital stock of $500,000. Incorporators: D. F. Carmichael, Brighton; Jerry N. Hill, Edward A. Reser, David J. McCanne, John A. Thompson, Denver, Col.

The K. and W. Electric Company, Bridgeport, Conn., incorporated June 13, with a capital stock of $10,000, to buy, sell and manufacture all kinds of electrical appliances. Incorporators: James L. Kimball, Herbert C. Wirt, W. C. Bryant, Boston, Mass.

New York Electric Equipment Company, New York, N. Y., incorporated June 9, with a capital stock of $200,000, to manufacture and sell every kind of electric apparatus. Incorporators: Sigmond Bergmann, Edward H. Johnson, Philip H. Kelin, jr., all of New York, N. Y.

Northwestern Electric Fixture Manufacturing Company, Chicago, Ill., incorporated June 9, with a capital stock of $2,000 dollars, to manufacture electric, gas and combination fixtures and parts thereof. Incorporators: Charles Laubmayer, James P. Holmes, Lessing Rosenthal.

Kester Arc Lamp and Manufacturing Company, Chicago, Ill., incorporated June 9, with a capital stock of $50,000, to manufacture arc lamps, electrical appliances and specialties. Incorporators: J. F. Kester, C. J. Langhren, Thomas E. Mays, C. W. McMahon, Samuel I. Jacques.

Electric Power Company, of Staten Island, New Brighton, N. Y. Incorporated June 8, with a capital stock of $250,000, to produce electricity for light, heat and power. Incorporators: William Dwight Wiman, Norman S. Walker, Jr., Samuel H. Libby, Erastus Wiman, all of New Brighton, N. Y.

The Cuyahoga Falls and Akron Railway Power Company, Cuyahoga Falls, O., incorporated June 6, with a capital stock of $100,000, to construct and maintain a street railway to be operated by electricity or other motive-power. Incorporators: W. J. Price, C. F. Parmelee, G. F. Harris, Jas. Anthony, S. S. Leonard, R. H. Carlisle, Z. M. Hubbell.

Manhattan Electrical Supply Company, Jersey City, N. J., incorporated June 8, with a capital stock of $20,000, to manufacture and sell electric and acoustic apparatus, appliances, machinery and supplies. Incorporators: H. T. Johnson, John J. Gorman, James Pembrooke, New York, N. Y.; Richard Fodan Greenville, N. J.; Edgar Whitmore, Brooklyn, N. Y.

Denison Normal School Association, Denison, Ia., incorporated June 9, with a capital stock of $60,000. Among other things it will construct and operate an electric-light plant. Incorporators: C. Sievers, J. H. Carstens, R. Heffelfinger, M. Goldheim, W. J. Scriver, T. J. Garrison, Joseph Brogden, P. E. C. Lally, Henry Kelly, C. Green, G. Gronan, L. M. Shaw, J. B. Romans, A. C. Balle, C. F. Kuehnle, F. W. Mueller, Denison, Ia.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, June 18, 1892.

MR. H. WHEELER, the Pittsburg, Pa., representative of the Thomson-Houston Company, is in town. Mr. Wheeler is an old-timer in street-railway specialties, and holds his own.

MR. C. E. AINSWORTH, New York agent of the Jewel Belting Company, with offices at 136 Liberty street, is reported to have secured some very large orders lately.

H. G. MADDEN, 136 Liberty street, 1st floor, is doing all the buying for some of the largest light and power companies, and also handles an excellent line of electric light specialties.

MR. C. D. MARSH, who is introducing the Enholm primary battery, has one on exhibition in the show window of the A. B. C. Co., 20 Cortlandt street. It is operating a small Porter fan motor.

MR. GEO. F. SWAIN, 136 Liberty street, New York representative for the Syracuse automatic sprinklers, reports an excellent business. These sprinklers are of ingenious construction, thoroughly reliable and non-corrosive.

MR. FRED C. ROSS, manager of the Eddy Electric Manufacturing Company, 136 Liberty Street, makers of the well known Eddy motors, dynamos and electric hoists, is meeting with great success. He is securing many new customers.

A REPRESENTATIVE of the ELECTRICAL AGE met Mr. H. W. Leonard on his return from the meeting of the electrical engineers in Chicago. He looked smiling and happy, and it is pretty safe to assume that his trip was thoroughly agreeable and satisfactory.

MR. CHARLES H. DAVIS, C. E., consulting and supervising electrical and mechanical engineer, 120 Broadway, has issued a circular entitled "Facts and figures interest-

ing to electric railroad men." It is replete with statistics and contains much valuable information.

Mr. Morris W. Mead, the well-known superintendent, Bureau of Electricity, Pittsburg, Pa., also president of the Pittsburg Electric Club, was in town this week and gave the Electrical Age a call. Mr. Mead is as jolly as ever and still tips the beam in the two hundreds.

The Rheumatic Electric Ring Company, 45 Broadway, is selling a great number of its rheumatic rings. Sufferers from neuralgia, sciatica, etc., who have given it a trial cannot speak too well of it. We personally know a number of people to whom it has afforded great relief.

Mr. S. L. Phillips, general agent, 120 Liberty street, New York, has accepted the agency for the Meston alternating current motor fan. This fan is a perfectly built, strong, durable and handsome machine, finished in polished bronze and black enamel, or nickel-plated if desired.

Mr. Wallace, of the Eastern Electric Supply Company, of Boston, was in town lately and reported active business, and large orders received. Mr. Wallace's company is supplying one of the big manufacturer's of street railway motors, etc., with all of their railway specialties.

Huebel & Manger, manufacturers of electrical and brass goods, 286 Graham street, Brooklyn, are working on their new patent contact bell-post, and will soon be able to place it on the market. This firm makes a specialty of bells and push-buttons. They report business exceedingly good.

Mr. C. E. Chapin, 136 Liberty street, is doing a good business. He is resident buyer for quite a number of out-of-town houses. His specialty is Packard lamps, which are being sold as fast as they can be made. Porcelain goods are holding their own in competition and large orders taken.

The Baehr Electric Company, formerly 110 Livingston street, Brooklyn, has removed to 290–292 Graham street, same city, where it has more commodious quarters for the manufacture of electrical specialties, switches, fan motors, etc., the demand for which has increased to such an extent that the company is four weeks behind with its orders.

Mr. Randolph Brandt, 38 Cortlandt street, manufacturer of the Selden packings, has largely increased his facilities and just refitted his office and warerooms, where he is prepared to extend every welcome to his friends. The "square" Selden which has been on the market for a short time, is meeting with much success for both the Corliss and high-speed type of engine.

Mr. J. E. Wyman, manager of the Bush Revolving Store Fixture Company, 4 Benson street, has a few of their popular motors and turntables left, that he will dispose of at low figures. The turntables are made in the very best manner and will carry from 50 to 100 pounds. The motors are wound to be operated by batteries, and there are several good primary batteries that will run them satisfactorily for months without renewal. The Edison-Lalande battery is specially recommended.

Mr. C. H. Copeland, manager of the Rice Automatic Engine Company, 136 Liberty street, reports having received an order for a 25 H. P. horizontal engine from the Hunt Engineering Company one morning, and the next day the Hunt Company was installing it in the temporary arc-light plant at Green Isle, N. Y. This engine will be replaced later on by a larger one, it having been made use of by the Hunt Company to enable them to have the plant in operation within the time specified in their contract.

Our representative called upon the McLean Engineering Company, 136 Liberty street, this week. Mr. McLean is exceedingly proud of an $\frac{1}{8}$ H. P. fan-motor of the Edison type which he has buzzing away in these hot days; it is equipped with a 3-point speed-switch and rests upon rubber feet, causing the motor to run almost without any noise. These people are very busy just now, but notwithstanding are always pleased to welcome their friends.

Mr. S. J. Lenher has been connected for a long time with Edward P. Hampson & Company, engineers and contractors, 36 Cortlandt street, which has every facility for furnishing estimates, plans and specifications for the installation of complete steam plants for electric light and railway service. This firm has been the New York representative for the popular Armington & Sims engines ever since their introduction years ago, and have placed thousands of horse-power. They also represent the Eclipse Corliss engines. To enumerate the number of electric light and power plants installed by this firm would occupy too much space. Mr. Lenher recently secured an order for a complete steam plant from the Rahway, N. J., Electric Light Company; it will consist of two 90 H. P. Armington & Sims engines and 2 boilers. They will also remodel the old plant and move it into the new building that was recently erected.

"Ward" arc lamps are selling just as largely as ever. The new ornamental "Ward" arc lamp is the talk of the trade, and is in great demand. A number of them were recently installed in Koster & Bial's big concert hall on 23d street, near 6th avenue, and many more of them are being placed in halls, etc. This lamp was specially designed for use in theatre lobbies, hotel corridors, etc., wherever an elegant effect is desired. The Electrical Construction and Supply Company, 18 Cortlandt street, are the makers of a popular search lamp. They recently sold a large number of them for use on steamers. They are constantly installing some of the focussing lamps for theatrical effects, photo-engraving, etc. The company make "Ward" arc lamps to suit any electric-light circuit. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age.

Names of Companies.	Capital.	Par.	Price.
American Dist. Tel., N. Y.	3,825,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	85 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	204 25
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	113 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,500,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	84 00
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	108 75
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	44 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00

Interior Conduit & Ins. Co., N. Y....	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Laclede Gas Co.....	7,500,000	100 00	19 25
Laclede Gas pref.....	2,500,000	100 00	60 00
Laclede Gas 5s.....	10,000,000		*84
Law Telephone.....	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s...	30,000		*99
Livingston E. Lt. Co., Mont., 6s.....	30,000		*92
Marshalltown Elec. Co. 6s, Iowa.....	65,000		*98
Marysville L. & W. Co. 6s, Ohio.....	60,000		*104
McLeod Car Equip. Co.....	3,000,000	25 00	35 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver.....	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s.....	26,000		*107
Morristown L. H. & P. 5s, N. J.....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co.....	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	55 50
N. Y. and N. J. Tel. and Tel. 5s.....	1,500,000		*98
N. Y. and N. J. Telephone Stock.....	2,535,000	100 00	98 00
North American Railway Co.....	39,767,200	100 00	13 25
Postal Telegraph.....	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston.....	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum....	1,000,000	100 00	105 00
Rockaway Elec. Light.....	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston.....	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N.Y.....	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.....	5,000,000	10 00	8 00
Swan Incandescent.....	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.....	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.....	50,000		*97
The Gamewell Fire Alarm Tel. Co.....	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.....	100,000	100 00	105 00
The Ongley Electric Co., N. Y.....	250,000	100 00	85 00
The Siemens & Halske Co., Ill.....	500,000	100 00	par
The Washington Wat. Pow., Wash.....	1,500 000	100 00	90
The Wells & French Co., Ill.....	600,000	100 00	par
Thomson-Houston Electric Co.....	6,000,000	25 00	65 25
Thomson-Houston pref.....	4,000,000	25 00	29 00
T.-H. Electric Co. 5s, Boston.....	500,000		*99
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N.Y.....	1,250,000	100 00	26 00
Western Union.....	86,188,852	100 00	95 00
Westinghouse Elec. & Manf. Co.....	7,000,000	50 00	29 25
Westinghouse Elec. Co. pref. 7s.....	4,000,000	50 00	46 75
Westinghouse Ass. Rects.....		50 00	18 00
West Point W. Lt. & P. Co., Va.....	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The annual meeting of the North American Company passed off very smoothly in Newark, N. J., on the 15th of June, and the balance sheet which so many wished to see was presented, as given below. This corporation is so largely interested in electric matters, that it is substantially an electric company. The last official report was submitted as long ago as July 1, 1890, at which time the stock was estimated to have an intrinsic as well as a market value of about $50 per share; now the report, made up to May 31, shows total assets of $10,718,513, including $2,987 in stocks, $4,368,390 in bonds and $912,080 in cash. The liabilities are $2,846,822, leaving net assets of $7,371,691, which makes the $40,000,000 of stock equal to 19½. In the year ending May 31 the receipts were $418,119, and the net cash income $146,873.

But here is the report, for those of our readers who are or who intend to become interested, so that they can figure out at their leisure the point at which they will invest:

ASSETS.

$7,450,200 Northern Pacific common at 19¾.....	$1,471,414
533,000 Chicago and Northern Pacific at 16.....	85,280
32,500 Wisconsin Central preferred at 30.....	9,750
216,200 Edison General Electric at 111.....	239,982
90,100 St. Paul Edison Electric Co. at 140.....	126,140
2,887,000 Milwaukee Street Railway Co. at 25.....	721,750
333,300 Cincinnati Edison Electric Co. and Queen City Electric Co. at 100.....	333,300
604,000 Northern Pacific consols at 77	465,080
276,000 Chicago and Nor. Pac. 1sts at 78½.....	216,660
45,333 Wisconsin Central incomes at 30.....	13,600
3,276,000 Milwaukee St. Railway 5s at 90.....	2,948,400
699,000 Minneapolis, Lyndale & Minnetonka Street Railway 5s at 85.....	594,150
145,000 Cicero and Proviso Railway 6s at 90.....	130,500
West Side Street Railway, Milwaukee, cash paid on purchase contract	301,350
Milwaukee Street Railway Co., current advances on construction account.....	626,358
Secured accounts ($316,724 since paid off).....	753,186
Bills receivable ($36,000 since paid off).....	175,151
Miscellaneous securities.....	357,472
Advances under contract with T. A. Edison and Edison General Electric Co. for electric railway inventions, patents and appliances.....	52,701
Interest and dividend account, balance.....	184,207
Cash in banks and trust companies.....	912,080
Total value of assets.....	$10,718,513

LIABILITIES.

Bills payable, time loans secured and since reduced by payments of $136,529.....	$2,808,162
Accounts payable.....	38,660
Total of liabilities.....	$2,846,822

In Cincinnati the company is establishing a very large electric plant which will be completed before Dec. 1. The company has recently acquired the capital stock of the Queen City Electric Company, of Cincinnati. The general purpose of the company will be to push the substitution of electricity as a motive-power, and the North American Company will have exclusive right to the devices of the consolidated electric companies here and the General Electricity Company, of Berlin.

President Henry Villard says that the company was intended to operate in railroad financiering, electric lighting, power, etc. The company did purchase the capital stock of the Milwaukee street railroads, and also made contracts to furnish electric light and power for Milwaukee. It controls the entire street-railroad system, with over 100 miles of operated track. The company has 1,554 arc lights and 15,000 incandescent lamps in service. A large amount of electric power is also being furnished. The Milwaukee enterprises are expected to yield a net annual return of $500,000.

If the company continues active purchase, construction and equipment of electric light, heat and power, I predict that the stock in the fall booms—or if the presidential campaign interferes, then in the very early spring—will reach the 40's.

The annual meeting of the Brush-Swan Electric Light Company of New England was held at the company's office in this city on the 15th of June, for the election of directors for the ensuing year, and resulted as follows: William L. Strong, D. L. Einstein, Edwin Einstein, Chas. W. Spear, G. McFall, Joseph Sawyer, W. L. Pomroy, W. G. Wilson and J. W. Houston, Messrs. Geo. W. Stockley and Mr. Rowley retiring.

The financial history of this, practically the original electric light company of New York or the United States, has been what is called in Wall street steady and firm; steady, because so very few changes have occurred among the shareholders, and firm, because there have been no shares offered for sale, consequently no fluctuation in price. There are but fifty shares for sale to-day at less than the price for the whole corporation. Had the late General C. P. Stone and the late E. H. Goff never met, the Brush-Swan Company would have had a 50,000 candle-power plant on the Statue of Liberty, and an illumination worthy of the torch, and which would have reflected from the clouds an unmistakable glimmer to the incoming sailor, with favorable conditions, 200 miles at sea. The contract price was only $11,600. Well done, as this would have been, it must have proved a grand and lasting advertisement. Poorly done, as it was, neither glory, honor or profit redounded to the credit of any one connected with the illumination. As the company owns the territory east of Buffalo and north of Washington, with all the Brush systems, it will now take a more active position.

SPECIAL NOTICE.

The New York office of the Consolidated Electric Storage Company, 120 Broadway, is the sole agency for the sale of storage batteries for New York and vicinity. Purchasers desiring to secure the best terms should apply at that office to E. J. Moore, manager.

WESTERN NOTES.

Mr. Gilbert M. Smith, manufacturers' agent, 925–927 Unity Building, Chicago, who has recently opened an office at the above address, will represent a few leading manufacturers of brass and copper, bare and insulated copper wire, hardware specialties, etc. As Mr. Smith has had eleven years' experience with the Ansonia Brass and Copper Company, and was for the past four years manager of their Chicago office, he is thoroughly competent to successfully attend to the requirements of the business. The trade generally will do well to correspond with him before closing contracts.

THE SIOUX CITY ENGINE WORKS, owing to the great demand for their engines, have found it necessary to open a branch office at Room 513, Security Building, St. Louis, Mo., which has been placed under the managership of Mr. W. J. Brock, a well-known electrical and mechanical engineer.

TRADE NOTES.

For some time the managers of the Smith Premier Typewriter Co. have felt the necessity of considerably enlarging its factory to accommodate its rapidly increasing business. The company has now been in existence for twenty-seven months, having been organized in February, 1890, and up to the present time has sold nearly 16,000 machines. When the present large five-story building was erected, Mr. Lyman C. Smith, the general manager, believed that he was making ample provisions for many years to come, but the business has already far outgrown their present quarters, and ground has been broken for a new building adjoining their existing factory. Mr. E. W. Baxter, of Syracuse, is the architect, and work is being pushed on as rapidly as possible. The new building will be ready for occupancy by September 1 at the latest. The building will be 130 x 60 ft., and eight stories high. The company is now fully 2,000 machines behind its orders, and this fact, together with the constantly increasing business, makes additional room necessary. It is estimated that the increase of the last year over the business of 1890 was more than 100 per cent. There are employed at present between 350 and 400 men, and when the new building is completed, the number will be increased to between 800 and 900.

The company has fifteen branch offices, employing more than 150 people. Between 70 and 80 salesmen are sent out from the factory and branch offices, and they contemplate opening five or six more offices as soon as the output from the factory is increased. The Smith Premier Typewriter Co. recently secured an order from the government for 150 of their machines, to be used in the War Department, after an expert examination. This is the largest order that has ever been given at one time for typewriters. The present monthly output is between 1,000 and 1,500 machines, and this number will be doubled when the new building is completed. Some idea of the success of the company can be formed from the fact that all of the machines sold by them have been disposed of in the United States. Up to the present time they have not been able to fill the orders from the home market, and therefore have sought no foreign business.

THE enamelled signs manufactured by F. E. Marsland, 84 West Broadway, New York, are made of a material that will withstand the effects of the weather in all climates, thus making them the only durable sign in use. They are made of any color that can be fired up to 4,000 degrees of heat. The base is of iron, and is coated with the required color, which is amalgamated with the iron in furnaces at a white heat; only a greater heat than this can destroy them.

These signs are particularly adapted for advertising street names, railway signs and for all kinds of business signs. Having a glazed surface they require no cleaning. They can be made in any size up to ten feet long by three feet wide, and even larger, by making them in two or more pieces.

The New York Central and Hudson River R. R. Co., the Manhattan Railway Co., the Long Island Railroad Co. and others, have adopted these signs as a standard for station names, notices, etc. The cost is surprisingly small, even for signs that would only last a year or two, whereas these will last for fifty years. They can be removed and replaced if desired, and will be found at all times just as good as the day they left the kilns.

In writing for estimates, the quantity, size and colors required should be mentioned.

W. R. FLEMING & Co., new Mail and Express Building, New York city, agents for the Harrisburg Foundry Machine Works, have handed us a list of recent contracts for furnishing Ide and Ideal engines. When it is remembered that the sales mentioned below represent only a comparatively small proportion of the United States, and that we happen to know that other agents as well as the factory themselves have each been shipping almost as large a number as is handled through New York city, it is safe to infer that not only is the sale for the Ide and Ideal engines rapidly increasing, but they are doing as large a business as any other engineering concern in this country.

The following list covers the last few weeks' business done by W. R. Fleming & Co. alone, and equals over twenty-five hundred horse-power:

1 70 H. P. standard ideal engine; 1 150 H. P. steel horizontal tubular boiler. Edison Electric Light Co., North Plainfield, N. J.

1 60 H. P. standard ideal engine; 1 60 H. P. vertical boiler. Bar Harbor, Me.

1 30 H. P. standard Ide engine; 1 30 H. P. vertical boiler. McMahon & Wren, Bridgeport, Conn.

4 100 H. P. special direct connected ideal engines, Mail and Express Building, New York city, N. Y.

3 100 H. P. standard Ide engines. Pope Manufacturing Co., Hartford, Conn.

1 25 H. P. ideal engine for steamship service. Harlan & Hollensworth Co., Wilmington, Del.

1 16 H. P. standard ideal engine. Steam yacht *Clarion*, Newport.

1 45 H. P. standard ideal engine. Central Stores, New York city, N. Y.

1 55 H. P. standard ideal engine. Wild & Williams, New York city, N. Y.

2 225 H. P. standard ideal engines. Clarion Mills, Pa.

1 25 H. P. ideal engine. Weehawken Ferry Co.

1 30 H. P. standard ideal engine; 1 50 H. P. standard ideal engine. Naval Observatory, Washington, D. C.

1 55 H. P. standard ideal engine; 1 steel horizontal tubular boiler; complete steam plant. Brazil.

1 12 H. P. standard Ide engine. Whitlock Coil Pipe Co., Elmwood, Conn.

1 55 H. P. standard ideal engine; 1 60 H. P. standard ideal engine. Century Club, New York city, N. Y.

1 150 H. P. special railway ideal engine; 1 80 H. P. special railway ideal engine; 1 55 H. P. standard ideal

engine. Chillicothe Street R. R. and Lighting Co., Chillicothe, O.

1 55 H. P. standard ideal engine. Hyland Paper Co., Johnsonburg, Pa.

2 60 H. P. standard ideal engines. Hotel St. Lorenz, New York, N. Y.

5 25 H. P. standard ideal engines. Pacific Mail Steamship Co., New York city, N. Y.

The Electrical Age's Illustrated Patent Record.

Issued June 14, 1892.

476,781. Electric Switch. Francis Broadnax, New York, N. Y. Filed Nov. 3, 1890.

476,792. Electric Switch. William M. Goodridge, Highland Park, assignor to the Western Electric Company, Chicago, Ill. Filed Oct. 19, 1888.

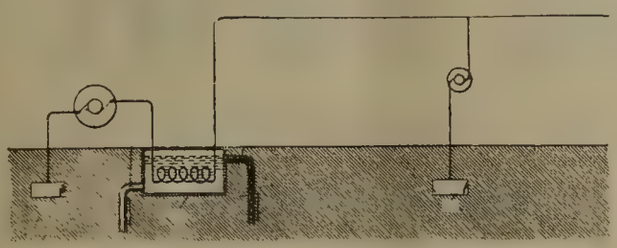
476,793. Metallic-Circuit House-Telephone System. William M. Goodridge, Highland Park, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Sept. 30, 1889.

476,816. Electric Converter. Gustav Pfannkuche, Exeter, N. H., and Alfred Pfannkuche, Cleveland, Ohio, assignors to the Brush Electric Company, Cleveland, Ohio. Filed May 14, 1887.

476,818. Magnetic Inductor for Dynamo-Electric Machines. Lazarus S. M. Pyke and Edward S. Harris, London, England. Filed Feb. 5, 1892.

476,819. Field-Magnet for Dynamo-Electric Machines. Lazarus S. M. Pyke and Edward S. Harris, London, England. Filed Feb. 5, 1892.

476,826. Telephone-Exchange Apparatus. John A. Seely, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 25, 1889.



476,855.—LIGHTNING-ARRESTER.

476,828. Circuit-Breaking Insulator. Albert P. Seymour, Syracuse, N. Y. Filed March 21, 1892.

476,829. Electric Switch. Albert P. Seymour, Syracuse, N. Y. Filed March 21, 1892.

476,830. Compensating Alternating-Current Dynamo. Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Feb. 13, 1889.

476,843. Current-Alternator. Harry L. Tyler, Corning, N. Y., assignor of two-thirds to George W. Drake and Charles E. Drake, same place. Filed Oct. 6, 1891.

476,845. Limiting-Stop for Armatures. Richard Varley, Jr., Englewood, N. J. Filed July 27, 1891.

476,855. Lightning-Arrester. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Jan. 21, 1892.

476,873. Electric Train-Signal. Nathaniel B. Cregier, Chicago, Ill., assignor of one-half to De Witt C. Cregier, same place. Filed Oct. 27, 1890.

476,887. Telephone System. Bélizaire Marinovitch and Géza Szarvady, Paris, France. Filed Sept. 5, 1889. Patented in France and in England.

476,889. Pole for Electric Wires. Julius Meyer, New York, N. Y., and Carl Binder, Chicago, Ill., assignors to the Edison General Electric Company, New York, N. Y. Filed March 17, 1892.

476,914. Process of and Apparatus for the Extraction of Aluminium. Myrthil Bernard and Ernest Bernard, Paris, France. Filed Jan. 20, 1888. Patented in France, in Belgium, in Luxemburg and in England.

476,933. Spark-Arrester for Electric Lamps. Walter M. Spencer, Chicago, Ill. Filed Feb. 5, 1892.

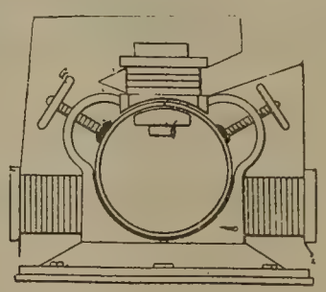
476,964. Insulating-Tube for Electric Conductors. Albert P. Seymour, Syracuse, N. Y. Filed March 5, 1892.

476,983. Pyromagnetic Generator. Thomas A. Edison, Llewellyn Park, N. J. Filed June 13, 1887.

476,984. Expansible Pulley. Thomas A. Edison, Llewellyn Park, N. J. Original application filed June 10, 1890. Divided and this application filed Aug. 28, 1890.

476,985. Trolley for Electric Railways. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 20, 1890.

476,986. Means for Propelling Electric Cars. Thomas A. Edison, Llewellyn Park, N. J. Filed March 2, 1891.



477,101.—ELECTRIC WELDING.

476,988. Lightning-Arrester. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug. 14, 1891.

476,989. Conductor for Electric Railways. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug. 14, 1891.

476,990. Electric Meter. Thomas A. Edison, Llewellyn Park, N. J. Filed Aug 25, 1891.

476,991. Method of and Apparatus for Separating Ores. Thomas A. Edison, Llewellyn Park, N. J. Filed May 21, 1888.

476,992. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed Jan. 24, 1891.

476,993. Electric-Arc Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 1, 1891.

477,049. Electric Clock-Synchronizer. James W. Du Laney and Charles F. Du Laney, Canton, Ohio. Filed Sept. 4, 1891.

477,058. Spark-Arrester. Carl G. Luthman, Altoona, Pa. Filed Feb. 23, 1892. Patented in Sweden and in Finland.

477,068. Fire-Alarm System. Lewis G. Rowand, Camden, N. J., assignor to Henry C. Terry, Philadelphia, Pa. Filed Dec. 14, 1891.

477,069. Fire-Alarm System. Lewis G. Rowand, Camden, N. J., assignor to Henry C. Terry, Philadelphia, Pa. Filed Dec. 14, 1891.

477,070. Fire-Alarm System. Lewis G. Rowand, Cam-

den, N. J., assignor to Henry C. Terry, Philadelphia, Pa. Filed Dec. 14, 1891.

477,071. Annunciator. Lewis G. Rowand, Camden, N. J., assignor to Henry C. Terry, Philadelphia, Pa. Filed Dec. 14, 1891.

477,100. Electric Elevator. John H. Clark, Boston, Mass., assignor to the Whittier Machine Company, same place. Filed June 5, 1891.

477,101. Electric Welding. Charles L. Coffin, Detroit, Mich. Filed Nov. 6, 1889.

477,146. Electric-Lamp-Socket Switch. Gwynne E. Painter, Baltimore, Md., assignor of one-half to James F. Morrison, same place. Original application filed March 17, 1891. Divided and this application filed July 24, 1891.

477,175. Detachable Commutator. Charles H. Gaylord, Cleveland, Ohio. Filed Dec. 17, 1891.

477,182. Secondary Battery. Henry H. Lloyd, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Gloucester City, N. J. Filed Feb. 27, 1892.

JOHN A. CROSS,
Consulting
Electrical and Mechanical Engineer and Expert,
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A VALUABLE SUGGESTION.

It is well known that many railroad companies are compelled to operate portions of their lines at a loss, particularly in cases where suburban districts are newly opened up for settlement. Mr. Charles Selden, in his paper read before the Convention of the Railway Telegraph Superintendents at Denver, last month, suggests that such unprofitable lines might be operated at a profit by the substitution of electric for steam power.

There is considerable food for reflection in this suggestion, and it would be well for railroad managers to give it some consideration. There is no doubt that electricity can do the work.

TWICE VISITED BY FIRE.

The headquarters of the General Electric Company in this city were twice visited by fire last week, and the damage, while not very extensive in dollars and cents, was irreparable in that many valuable papers and documents were destroyed. The fire will cause some of the officials considerable inconvenience, as it destroyed their office furniture. Fortunately no damage was done beyond the floors on which the fires originated, and this fact proves that a fire-proof structure is essential for the headquarters of a vast concern like the General Electric Company. It is not yet known what caused the fires.

THE DENVER CONVENTION.

We publish in this issue a record of the proceedings of the convention of Railway Telegraph Superintendents, which was held in Denver, Col., June 15 and 16.

This convention was the most successful one ever held by the association, both as regards the character of the papers read and attendance. It is growing in importance more and more every year, and its influence for the good of the service represented by its members is being felt. The knowledge that the members acquire at these meetings is of extreme value and practically applicable to the needs of their respective roads, and it is evident that nothing but good can result in favor of the railroads with which the members are connected. The association is a worthy one and deserves the hearty support of every railroad company in the country. All railroad managers recognize the fact that they cannot get along without the telegraph in the operation of their roads; for this reason they should lend all the aid possible to their telegraph superintendents in their laudable efforts to improve the telegraph service, on the efficiency of which so much depends.

The association now possesses the distinguished honor of being the first organization before which a scientific paper from Mr. Thomas A. Edison was ever read. Mr. Edison's paper was of a high character, and a most valuable contribution to our knowledge on "insulation." Every sentence of it contains a fact of very great value, and furnishes a subject for investigation and experimentation.

The other papers read were of great practical value and of exceeding interest to the members, who, when they get settled down to work again, will carefully digest the contents of the various papers, with the object of picking out and applying practically what may be of value to their companies.

HIGH INSULATION.

The insulation of oil of wood tar, according to Mr. Edison's tests, is no less than 1,670,000,000 megohms. This is well-nigh infinity.

A NEW FAN-MOTOR.

Now that the warm weather is upon us and the advertisements of the various manufacturers of fan-motors are beginning to be displayed in our columns, it is a fitting time to make note of the various improvements that have been recently made in these valuable appliances, which add so much to our comfort during the warm summer months. The Interior Conduit and Insulation Company of New York are bringing out an

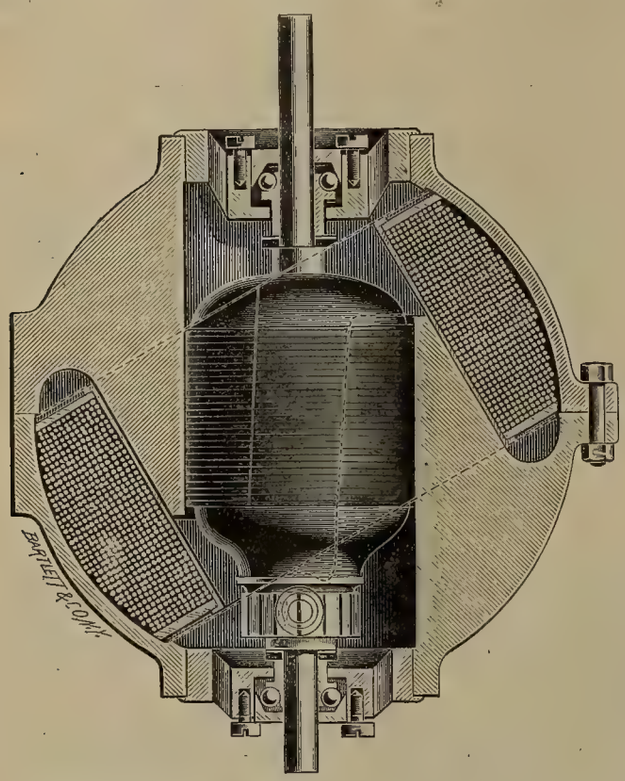


FIG. 1.—VERTICAL SECTION LUNDELL FAN-MOTOR.

entirely new form of fan motor, the invention of Mr. Robert Lundell, who is connected with the company.

Many attempts have been made to design dynamos and motors in which there should be practically no magnetic leakage; but until the appearance of the new Lundell Motor, which they now offer, these attempts have not met with any marked degree of success. In an ordinary well-designed motor the leakage amounts to from 40 to 50 per cent., thus requiring an extra heavy magnetic circuit and producing a field-magnet of low efficiency. The practical elimination of all magnetic leakage constitutes the chief factor of superiority in the

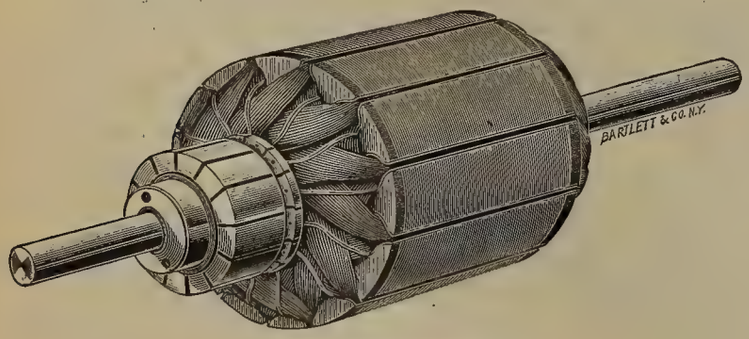


FIG. 2.—ARMATURE.

new Lundell Motor, although it is not the only one. This great desideratum is attained in the following manner, as shown in Fig. 1.

The armature and pole-pieces are surrounded by a single magnetizing coil, which in turn is itself totally surrounded by the keeper or yoke, thus leaving no chance for stray magnetism. It is a true ironclad field-magnet, having at the same time the shortest possible magnetic circuit. The keeper would form a perfect sphere were it not for the slight projections constituting the bearings.

The motor assumes wonderfully small dimensions for any given capacity, due to the fact that every cubic inch of space inside the spherical keeper is effectively utilized. It is also very light, on account of a short magnetic circuit having smallest cross-section, with comparatively few turns of wire in the magnetizing coil.

The type of armature adopted is the very best, being a modern Pacinoti drum, proportioned with a view to maximum efficiency. In the design of the motor particular attention has been paid to the shape of pole-pieces in relation to the reaction between armature and field-magnet. Thus the motor has been rendered sparkless, and the point of commutation remains fixed between the limits of load and at reversal of rotation. The need

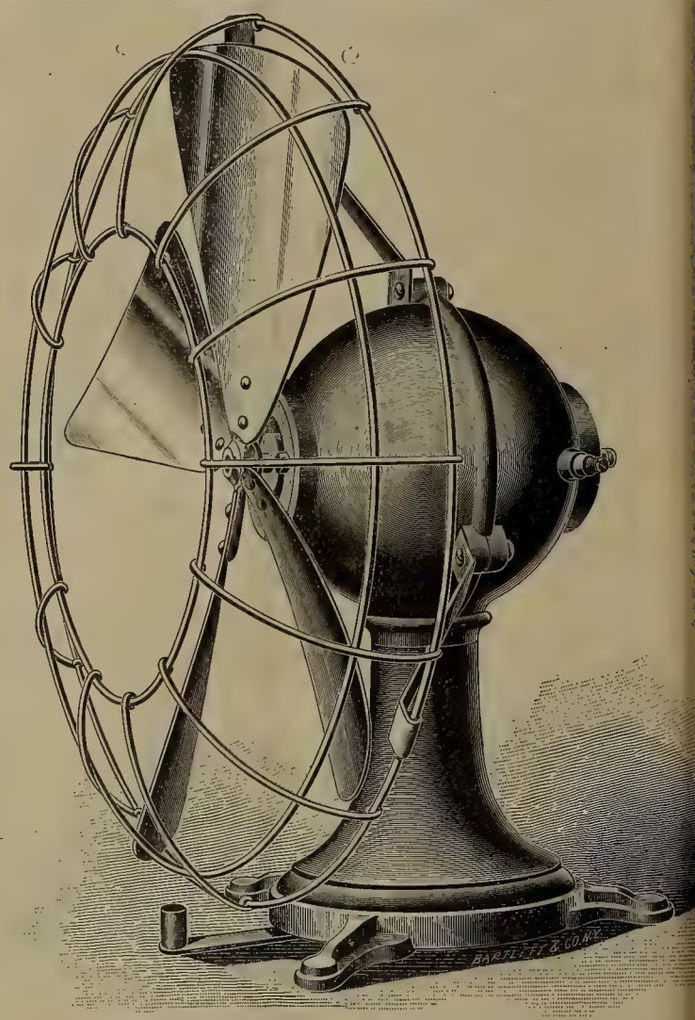


FIG. 3.—$\frac{1}{6}$ H. P. LUNDELL FAN-MOTOR.

for a special rocker-arm for supporting and adjusting the brushes is consequently obviated.

The brushes themselves are small carbon pencils, fitted in bayonet-jointed holders, and held upon the commutator by a small spiral spring.

The new motors are furnished in five different styles. They are superbly finished in rich black japanning, with red and gold striping.

The $\frac{1}{12}$ H. P. motors are all fitted with ball-bearings which require no oil, a most valuable consideration.

The $\frac{1}{12}$ H. P. motors run at a maximum speed of 1,800 revolutions per minute, a minimum speed of 900, and a mean speed of 1,150 at 110 volts E. M. F., while the $\frac{1}{8}$ H. P. motors have a maximum speed of 1,800 revolutions, a minimum speed of 900, and a mean speed of 1,000 revolutions per minute.

The novelty of the design alone commends the motor at once, not only to electricians but to laymen as well.

SERIES ELECTRIC TRACTION.*

BY NELSON W. PERRY, E.M.

PART II.

(*Continued from page* 361.)

The upper pair of wires, which it will be seen are merely the parallel extensions of the other possible path for the current, are in multiple with the path through the mercury cups. One of each of these pairs of wires, which will hereafter be denominated sections, is connected to the feeder wire on one side of the mercury cups, and the other has a similar connection on the other side. The two wires of each section normally without electrical connection with each other, constitute what has been termed the "series of breaks normally open." If, however, these two wires be connected electrically through the terminals of a motor, the latter will be in multiple with the mercury cups and momentarily receive only the

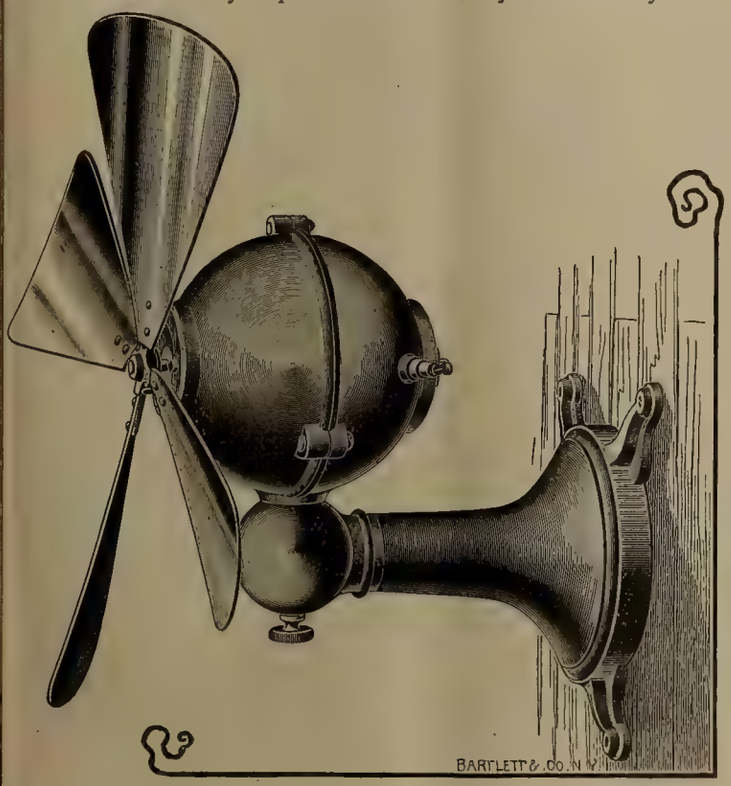


FIG. 4.—⅛ H. P. LUNDELL BRACKET FAN-MOTOR.

current due to the relative conductivity of the path thus offered. By the arrangement shown in Fig. 5 the electro-magnet which opens the mercury-cup switch is in series with the motor circuit, and the latter no sooner receives current than the former is actuated, the switch is opened, and the whole of the current, which was momentarily divided between the two branches, is diverted to the motor.

If the corresponding wires of the succeeding sections be caused to overlap without making electrical connection with each other, and these laps be staggered as shown, a means is provided whereby the motor prepares the succeeding section for occupancy before wholly passing out of the one it is about to leave, and accomplishes this without interruption to the current. Figs. 6 and 7 show how this is done, and the arrows show the paths taken by the current as the transition takes place. When the motor is in the position represented in Fig. 5, there is but one path for the current, viz., around the open switch in the feeder and through the electro magnet by which it is kept open, back again to the feeder.

As the motor proceeds to the right, one of the terminals first embraces the lower lap, thus offering two paths for the current, one passing through the switching arrangement that controls the section the car is about to leave, and the other through that controlling the section it is about to enter. (See Fig. 6.) As it progresses still further this terminal passes beyond this lap at about the same time that the other terminal embraces the other lap. This leaves the first switch without current, and the succeeding switch is automatically opened. There is no break in the circuit, however, even during the short interval occupied by the two switches in acting, for while the further terminal embraces the further lap, both of the switches concerned are short-circuited, as shown in Fig 7. Before the further terminal has passed beyond the lapping portion of the two succeeding wires, the first switch will have closed and the succeeding switch will have been opened, thus diverting all of the current to the section upon which the motor has now entered.



FIG. 5.—CEILING FAN-MOTOR.

Fig 8 shows another arrangement by which a motor is enabled to pass from one section to another without interrupting the circuit. In this arrangement the ends of the sections, while mechanically continuous, are electrically disconnected, but do not lap as before. The break in the wires connected with the switch-actuating device is longer than that between the other two wires. The larger gap, however, is lapped by a subsidiary conductor, which short-circuits the switch actuating the section the motor is about to enter, as shown. As the car proceeds from left to right, before both its trolleys have passed off the section, one of its trolleys has embraced the subsidiary conductor, and the electro magnet controlling that section is cut out of circuit and the switch drops. While the switch is dropping, however, the current continues to flow through the companion wire, through the motor to the subsidiary wire and *around* the switch actuating the section it is entering. Fig. 8 represents a branched or forked road operated by a single dynamo. In the arrange-

* A paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 7 and 8, 1892.

ment shown in Fig. 8, where the branch road is operated by the return circuit, a car turning to the left would really skip from the first section of the road to the very last, if we count them in the order in which they receive current; whereas in going straight ahead it would pass from section 1 to section 2, etc., counting them in the same order. In Fig. 9, however, which represents a similar road operated by the loop system, a car taking the left-hand branch would pass from section 1 to sections 2 and 3, whereas if it went straight ahead it would pass from section 1 to sections 4 and 5. It will be apparent from what has preceded that in neither of these cases does the skipping of one or many sections involve an opening of the circuit.

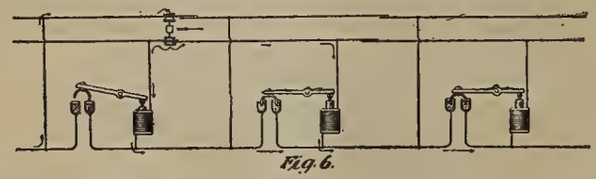


Fig. 6.

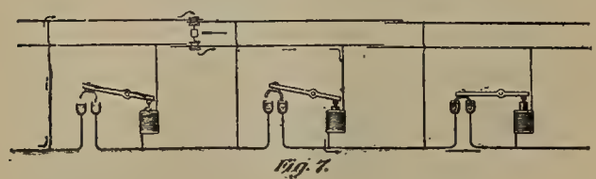


Fig. 7.

But, returning to Fig. 8, and following the car still further in its progress from left to right. We left it standing with one trolley on the further wire and the other on the subsidiary or short-circuiting conductor. In this position the current will continue to pass through the motor only so long as the switch actuating that section requires to fall into the mercury cups. Immediately that has occurred, which will be accomplished before the further trolley has passed from its wire, the motor will have been short-circuited and the car will, by its acquired momentum, pass from the system without sparking or other disturbance of the circuit. If the acquired momentum should carry the car to another section of the same system, or to a section connected with an entirely separate system, all that is necessary to enable it to proceed would be some arrangement by which the switch controlling the section upon which it was entering, could be opened by the entrance of the car itself. It will be evident from Fig. 10,

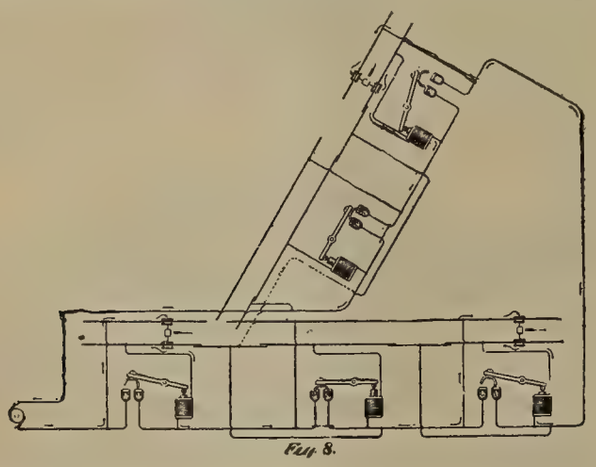


Fig. 8.

which represents two connecting roads operated by separate dynamos, that it matters not as far as the integrity of either circuit is concerned, whether the car goes to the left or to the right; in either case the circuit is closed before it leaves a section, and as it enters the succeeding section it does so before opening the switch which actuates that section, and it is entirely immaterial whether that section belongs to the same system as the one just left or to one entirely foreign to it. If only the proper switch can be opened the car may proceed on its way on either system of roads. In order to accomplish this automatically, each car may be provided with some such an arrangement as is shown in Figs. 11 and 12. M is a solenoid magnet in series with the motor D; L is a lever pivoted at P and playing between two stops, but when not actuated by the plungers of M, kept in contact with the lower stop by the spring S; B is a local battery; W, W' are the trolley wires; and C is the mercury switch connecting adjacent sections of the feeder wire. As long as the motor is receiving current from the feeder, as is the case in Fig. 11, the current must pass through M, which, by its pull on the plungers, maintains the lever L

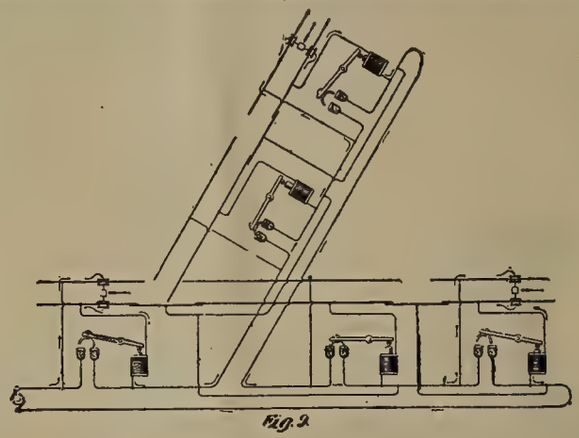


Fig. 9.

against the upper contact. As the trolleys pass off from a given section and the motor loses its current as before described, the spring S causes the lever to make the lower contact (Fig. 12), thus throwing the battery B into the circuit W, F, C, F', W'. The moment the trolleys enter upon a new section this circuit is closed, the local current passes through the feeder-switch magnet and opens the switch C, and diverts the current from the feeder to the section just entered. This stronger current actuates the lever L, again bringing it against the upper contact and cutting the battery B again out of circuit. Since the battery B is only momentarily in circuit, the cost of maintenance will be insignificant.

On single-track roads where turnouts are required, the turnout constitutes merely an additional section to one side of the main line, which is skipped by the car keeping the main track, and taken by the other car in passing. It, like every other section, has its own individual con-

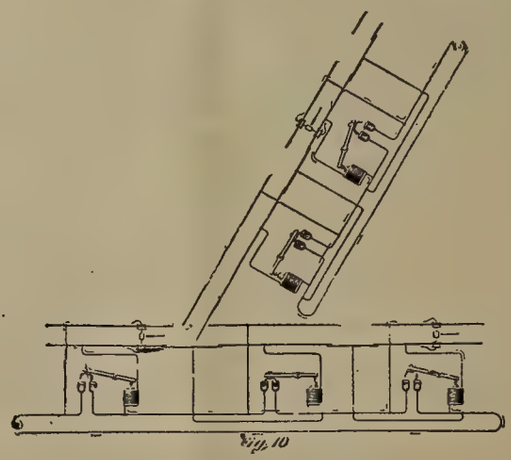


Fig. 10

trolling switch, and when both the main track and siding are occupied by cars, their motors are arranged in series with each other as represented in Fig. 13. By following the arrows the course of the current can readily be understood.

But both of the plans thus far discussed possess serious faults. In both we have provided a means by which a car may leave one section on a given road and enter an-

other one on the same or another road without breaking the main circuit, *provided the car is always going in the same direction.* In all of the cuts thus far, the car is supposed to be going from left to right, and the switches are arranged accordingly; but if we examine the drawings again it will be found that in the plan suggested in Figs. 5, 6 and 7, if the car were going in the opposite direction, the circuit would be momentarily broken as it left one section and would fail to divert the current to the

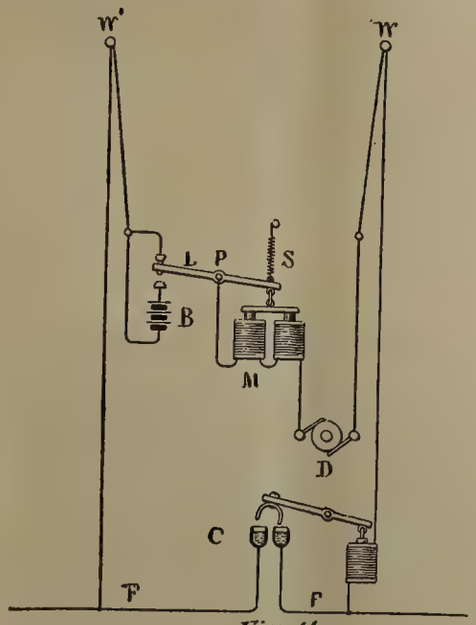


Fig. 11

section it was entering. In the second plan, outlined in Figs. 8, 9, 10 and 13, the car is momentarily without current whenever it passes from one section to another.

By combining the two plans, however, all of the difficulties seem to be removed. Figs. 14 and 15 show how this combination is effected, and the courses of the current when the motor terminals are in different positions on the wire. It will be noticed that, as in the first plan

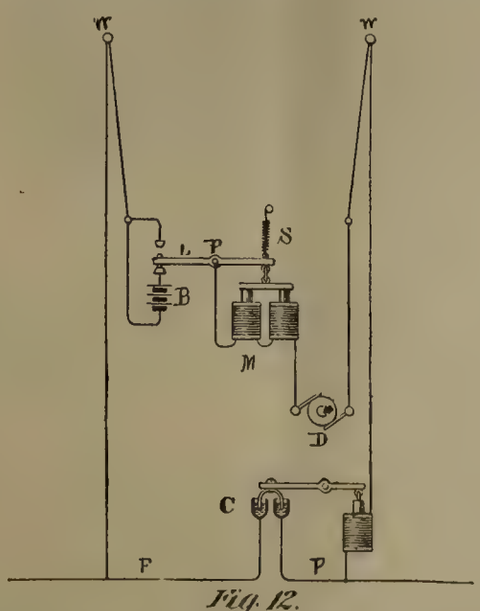
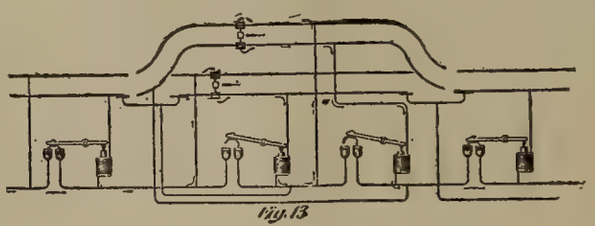


Fig. 12.

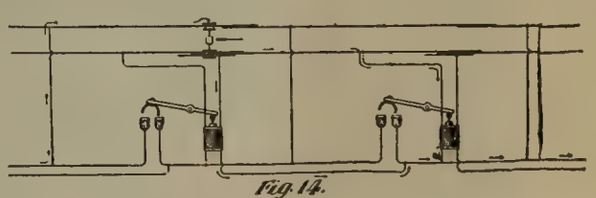
described, the trolley wires of adjacent sections are lapped, and that these laps are staggered; that parallel to but insulated from the nearer laps is placed the subsidiary wire which short-circuits the switch to the right. The switch-controlling magnet, as is shown, has two coils wound cumulatively, and may be operated either by the current passing through the subsidiary wire, by that passing through the nearer trolley wire, or by both when it takes both paths.

The supplemental conductors and the laps in the trolley wires are so arranged relatively to each other that when a car is travelling in the direction of the main current, as the trolleys approach a lap, the trolley travelling upon the wire connected with the switch will contact with the supplemental conductor before reaching the lapping portion of the trolley wires, and the companion trolley will reach its lap after the first trolley has reached its lap and before it has passed beyond the supplemental conductor; while with a car travelling in the opposite direction the order will be reversed, the trolley upon the wire *not* connected with the switch first reaching its lap, after


Fig. 13

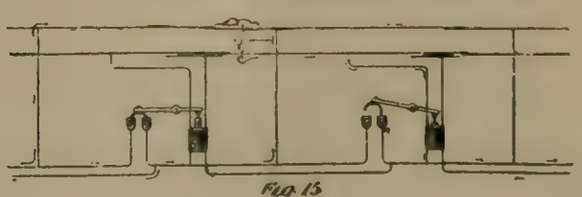
which its companion trolley reaches first its lap and afterward the supplemental conductor. By this arrangement, in whichever direction the car may be going, in passing from one section to another, it first short-circuits the switch controlling the section it is about to enter, next diverts a portion of that current to that switch, and finally all of it, cutting the switch controlling the section it has just left entirely out of circuit. In this manner the transition is accomplished in either direction from one section to another, either of the same or another connecting road without spark or interruption of circuit.

Should either one or both trolleys leave the wires, or the circuit through the motor in any other way become broken, the magnet controlling the switch to that section would be left without current and the forks would


Fig. 14.

immediately drop into the mercury cups, renewing the circuit through the feeder wire almost instantaneously. There would, however, be an interruption of the current while the fork was dropping. Even this slight interruption may readily be avoided by connecting with the switch any of the devices so sucessfully employed to obviate the same difficulty in arc-light circuits.

Should a second car run upon a section already occupied, the two would be thrown in parallel and both would stop. This arrangement therefore constitutes a most perfect automatic block system, not dependent upon frail human nature, but sure and positive in its action. On interurban electric roads, where it is even now pro-


Fig. 15

posed to reach greater speeds than are customary or attainable with steam locomotives, the importance of this feature cannot be overestimated. Not only will collisions be rendered practically impossible, but by putting semaphores or other signalling devices in the wires connecting the main feeder with the two trolley wires, each car as it enters a section will automatically set a signal at each end of that section showing that the section is occupied, and when it has left the section, set another,

indicating that the way is clear. These signals cannot fail to act, for being in series with the motor, they *must* receive current when the motor does, and lose it when the latter has passed out of the block. This seems to be the solution of the block system, as it eliminates all the uncertainties inseparable from a dependence upon human intelligence and watchfulness.

This system will no doubt be criticised first, on the score that it is a double trolley system which many are opposed to on general principles, and second, on the score of the high potentials necessarily involved in series distribution to long distances. Anticipating these, I will say in regard to the first, that however valid the objections may be to the double trolley on multiple-arc roads, they have but little force as applied to series circuits. In the latter, since both the wires on all sections not occupied by cars are of the same potential, the difficulties of insulation of the one from the other disappear entirely. Then, again, I am satisfied, with an intimate knowledge of the electric roads in Cincinnati, where with one exception they are double-trolley multiple-arc roads, that most of the objections raised against them are greatly magnified. They certainly have the decided advantage over the single trolley—of being independent, in their operation, of the condition of the track. Their chief objection being the difficulty of insulating the positive and negative wires from each other (which we have seen does not hold in series roads) and the multiplication of wires, crossings and switches where many lines converge and cross. In suburban districts where these complications do not occur (and this system is particularly adapted to such) the double-trolley multiple-arc system is in many respects superior to the single trolley. Mr. John Kilgour, president of the Cincinnati Street Railway Company, is justly proud of the Avondale double-trolley road (a suburban line), and I doubt if there is a more successful road in the country than this.

In regard to the other objection to the series method, viz.: the high potentials, the method outlined in this paper permits the use of any number of feeders, each of which may be used to supply a different portion of the road, thus reducing the potential, which in series distribution is the variable quantity, in the same manner exactly that the "drop" is obviated in parallel systems.

It is perfectly clear to the members of the Institute that this question of potential on series circuits is very much misunderstood by the laity. In the parallel system of distribution the high potential impressed upon the circuit at the dynamo is carried to every translating device on the circuit, even to that at the extreme end of the line, whereas in a series circuit the high potential spoken of exists only at the dynamo terminals, and is the sum of the electro-motive forces consumed by all the resistances on the line.

As an illustration in point, supposing we have two circuits—one parallel and the other series, the differences of potential between the terminals of the two generators being exactly the same—let us say 2,000 volts. On the multiple-arc circuit, no matter how insignificant the translating device may be or where it is located, one cannot handle its terminals without subjecting himself to a shock due to 2,000 volts. If the motor be generating one H. P. or 100, the danger is exactly the same. On the other hand, in the series system, if we are using a current of say 40 ampères, which is a convenient one for street-car purposes, if the motor be generating one H. P., the difference of potential between its terminals will be a little less than 19 volts. If it be generating 100 H. P. it would be but 1,865 volts, and before it would be as dangerous to handle as a motor on the multiple-arc circuit, it would have to be doing work equivalent to 107 H. P.

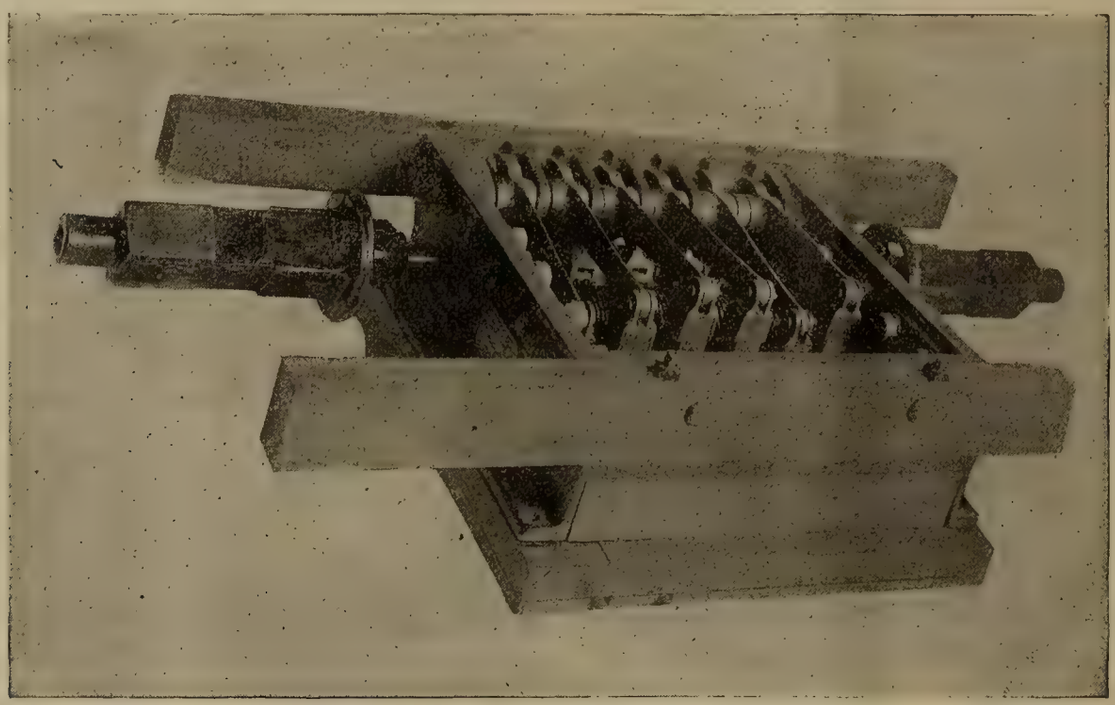


FIG. 1.—TOP VIEW OF CONTROLLER.

CONTROLLER FOR STREET-RAILWAY MOTORS.

The Thomson-Houston Electric Company has for a long time been engaged in experiments, having in view the development of a controller for railway motors that would be an improvement on those now generally used. It is well known that the regulation of motors by means of a resistance only is decidedly wasteful as well as troublesome. It in fact involves the consumption of nearly as much energy when the motor is running at slow speed as when running at high speed, although the work given out by the motor in the two cases is very

different. It simply means that the energy which, in the one case, drives the motor at a high speed, is, in the other, partly expended upon the resistance, and the remainder only is used to drive the motor. It has been customary to modify this method of regulation in well-designed plants by providing, in addition, a device for changing the field-magnets of the motor so that the counter electromotive force for a given speed will be greater, and permit, in consequence, the use of a smaller amount of resistance. In some cases these two methods of regulation—by means of resistance and alteration in field-magnet strength—have been combined in a system of commuting sections of the field magnet coils, by which the coils themselves offer a greater or less resistance to the passage of the current, and at the same time have a variable effect on the field-magnet strength. In other cases the combination of the two methods has been effected by having a separate resistance external to the motor, and then, in addition, providing a switch to cut out a section of the field-magnet coils or "loops," as it is often called, or to shunt a portion of the current around them for highest speed.

These methods have served a most excellent purpose, but it has long been the belief of Thomson-Houston engineers that a new method of motor control would be eventually developed which would secure as nearly absolute economy as possible, and at the same time be free from the troubles inherent in the use of resistances and commutated field circuits, with the sparking at the commutator which ensues where such commutation is carried to an excessive degree. After a long series of experiments the Thomson-Houston Company is now placing on the market a controller which, it has satisfied itself, is thoroughly practical, and which at the same time realizes almost a perfect theoretical economy in regulation. In a number of instances where this regulator has been used for some time, a saving of 30 per cent. in consumption of current has been effected, and when it is realized that this means a saving at the central station of over three hundred horse-power out of a thousand, the great importance of this new device cannot be doubted.

The principle upon which the new controller is based is the shifting of the connections of two motors from series to multiple, so that for slow speed the two motors will be in series, giving in consequence a high counter electromotive force (that of each motor being in series with that of the other) at a low rate of speed, while for higher speed they are connected in multiple, in which condition highest speed and power are obtainable with equal economy.

In the accompanying illustrations the general form of the apparatus which the company has adopted for effecting these changes is disclosed. Figure 1 shows a top and Figure 2 a bottom view of the new controller. As will be readily understood from an inspection of the illustrations, the apparatus consists of a longitudinal shaft acting upon a series of switch-levers to produce the various connections necessary to place the motors in series or parallel. This controller is to be placed at any point beneath the car and operated by a mechanical connection from either end of the vehicle. In this apparatus the mechanical and electrical details have been worked out with the greatest care, and it was permitted to go on the market only after satisfactory tests had been made, proving the efficiency and reliability of the device. The Thomson-Houston Company has for some time owned controlling patents of this type of controller, the most important being No. 385,055, dated June 26, 1888, and No. 393,322, dated November 20, 1888.

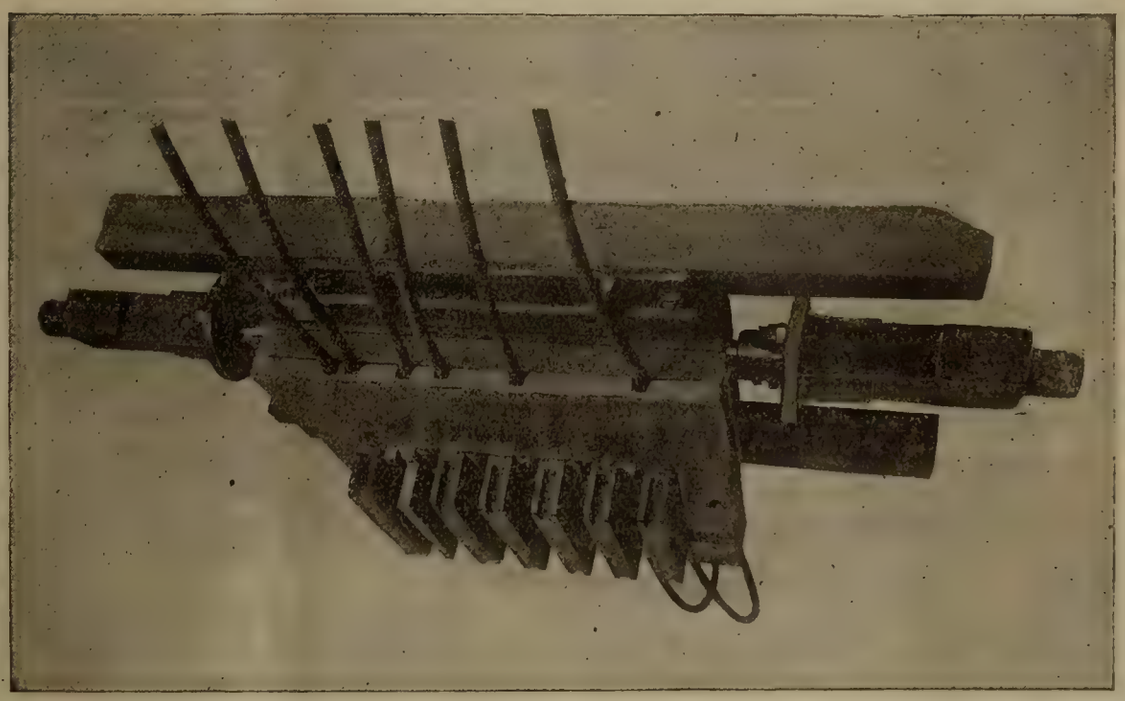


FIG. 2.—BOTTOM VIEW OF CONTROLLER.

QUICKEST TIME ON RECORD.

The quickest time for making the largest belt on record was recently accomplished by the Bodifield Belting Company, of Cleveland, Ohio. At 10.30 A.M., June 2, the company received an order from the American Wire Company, Cleveland, Ohio, for a 143 feet 60-inch three-ply belt. At 5 A.M., June 6, the belt was on the pulleys running. This is certainly marvellous, especially as every inch of it had to be made. The belt contained 2,145 square feet of leather, 300 steer-hides being used to make it; the belt when completed weighed 2,263 pounds. This speaks well for the company's ability to accept and promptly fill all orders entrusted to it.

CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

The annual convention of the Association of Railway Telegraph Superintendents of America was called to order at 10 A.M., Wednesday, June 15, by President C. S. Jones, at "The Albany," Denver, Col. There was a large number of delegates present from all parts of the United States. Ten new members were elected and the following-named gentlemen were elected honorary members: Thomas A. Edison, Orange, N. J.; J. J. Dickey, Supt. W. U. Telegraph Company, Omaha, Neb.; Thomas D. Lockwood, of the Bell Telephone Company, Boston; Ralph W. Pope, Editor *Electric Power*, New York; Prof. Wm. F. Gardner, U. S. Naval Observatory, Washington, D. C., and Thomas R. Taltavall, Editor ELECTRICAL AGE, New York.

Announcement was made by the secretary that the Western Union Telegraph Company, through Superintendent Dickey, and the Colorado Telephone Co. extended to the members the free use of their wires during the convention, and that the Remington typewriter people had placed a typewriter and a stenographer in the meeting-room for the convenience of the members of the association free of charge.

The election of officers for the ensuing year was next taken up, and the following-named gentlemen were chosen: President, L. H. Korty; vice-president, U. J. Fry; secretary and treasurer, P. W. Drew.

Milwaukee was chosen as the place for the next annual meeting and June 20, 1893, the date.

After the election of officers Mr. J. W. Lattig read a paper by S. S. Bogart, entitled, "A Few Words About Batteries."

Mr. Bogart referred to the virtues and weak points of some of the batteries now in use, and continued as follows:

"I was forcibly reminded while reading the very able remarks of Mr. G. L. Lang, from the cultured New England, the pioneer of the railroad signals [at last year's meeting], that a leading cause of the difficulties encountered was the sulphating of zincs, causing a high internal resistance and consequent change in the output of current, and it occurred to me that I might give you a few personal observations without being accused of having wearied you thus far only to spring on you an old form of advertisement in a new guise. Some of you doubtless know that I am above guile. I know a battery I do not believe it will be possible to sulphate, giving an average internal resistance of about one-tenth of an ohm, whose constancy is maintained from the point of starting until the end. I have used the type 'G' of the Edison-Lalande for different purposes during the year past. While at our Cincinnati meeting from the cells used on the phonoplex, four relays, transmitters, locks, sounders, bells, signals and answers back were tapped from the same cells, twenty-four circuits in all. Whenever the locks had completed their phase and vitalized the answer backs the cell on that particular set had no resistance interposed, yet there was no interference. I saw a battery of this type in April that had worked daily on a phonoplex circuit over 200 miles, and had not been renewed nor had any attention in twenty-six weeks. I am now using the same type of battery in preference to others for a block-signal system, four cells in series, closed circuit, in which there is an average resistance interposed of ten ohms. It has been working since April 4. There is tapped from it a sounder alarm bell and annunciator, the last two on the same cell, which shows conclusively that the 300 ampères, by interposing a proper resistance, can be called upon to give out their E. M. F. as required. I know of no other type of battery capable of such a showing. Another feature which contributes to the value of this battery for use in connection with railway signals and all work requiring the installation of cells at points where heat is unavailable, is found in the exceedingly low temperatures which the solution will stand without solidifying. It has been tested to 50° (Fahr.) below zero, with no sign of freezing. The solution in a Callaud or gravity cell will solidify at a temperature a few degrees below the freezing-point of water.

"There are gentlemen here who have experienced the same trouble in their quadruplex batteries as that described by Mr. Lang in his paper to which I have already referred, and in which he states that nine-tenths of the trouble on block signals is attributable to the battery. In this I fully agree with him. Why not abandon the old reformed Daniells and use one of a higher efficiency, good from start to finish, whose strength, like this convention's, is continuous? Eminent chemists say there is nothing injurious in *potasse fusa*; certainly no more than sulphuric and other acids. It burns no quicker. One cannot help according a tribute to the foresight of Edison.

"I regret my inability to write an interesting paper filled with historical facts and profusely illustrated, and feel confident that you will never call on me again."

At the conclusion of the reading of the paper letters of regret were read from several members at not being able to be present at the meeting, including one from Mr. E. T. Jeffrey, President of the Denver and Rio Grande R. R., who had expected to address the convention, but was unavoidably absent from the city.

Invitations were read from the Pueblo Board of Trade to the members to visit that city, and from the Denver and Rio Grande, the Union Pacific and the Colorado Midland railroads, extending the courtesies of free transportation over these lines.

Governor Routt, of Colorado, was then introduced and made a few well-chosen remarks. His many official duties, he said, prevented his preparing a speech. He referred to the responsibilities of railroad telegraphers, and stated that many lives constantly depended upon them. He paid them a high compliment, and when he concluded his remarks three rousing cheers were given him.

A recess was then taken till afternoon, and in the meantime the members in a body visited the room in which the exhibits of the various electrical and railway devices were shown, all of which were fully described by attendants. An account of these exhibits will be found elsewhere in this issue.

At the afternoon session the first business was the reading by Mr. M. B. Leonard of an extremely interesting and valuable paper on "Insulation," written by Mr. Thomas A. Edison. This paper in full is given elsewhere in this issue.

Some remarks on the subject of the paper were made by Mr. T. D. Lockwood and T. J. Smith.

Mr. Lockwood thought the paper was one of great value, and he agreed with what Mr. Edison had said.

Mr. Smith spoke of oil insulators, stating that as yet they were made and used to but little extent in this country.

Mr. C. A. Darlton then read a paper by Prof. Wm. F. Gardner, entitled "The Government Time System in Its Relations, Practically, to Railroad Matters."

Prof. Gardner referred to the advantages incident to a single central standard of time; gave a history of the government time service, and pointed out the advantages incident to the government system which qualify it to be a standard of authority.

In conclusion, he recommended that as far as possible hand work should be avoided in the transmission of time signals on railroad wires, and that automatic receiving and distributing should be employed even at the most distant points. He further recommended that the ob-

servatory signals be received direct throughout the whole system of each railroad at least once daily, instead of receiving the observatory signals only at some central station, and at another hour retransmitting them from there. The simplest instruments should always be used, and the use of duplex and quadruplex instruments avoided. Simple instruments are more sure of operation and easier of adjustment.

At the conclusion of the reading of the paper Mr. T. D. Lockwood, on invitation, made some extremely interesting remarks on galvanometers and their uses.

In introducing his subject he spoke of the high regard he entertained for associations of the character of this one. "We obtain advantage," he said, "by association with our fellow-craftsmen." He thought that it would have been better if the railroads and the telegraph had always been associated as they are now; there would have been fewer collisions.

Coming to his subject he said it was the fashion among telegraph men—for it was a fashion—to believe that the galvanometer was a mysterious instrument, but there was really nothing mysterious about it. In the study of electricity no higher mathematics were necessary; arithmetic, he said, sufficed for all needs.

He then briefly described ammeters, voltmeters and ohmmeters, used in measuring electric light currents, and said that the galvanometer if rightly handled could be used as all three instruments. By it we can measure current, voltage and resistance, although it takes a little more time.

He next referred to the early discoveries as to the relations between electricity and magnetism, and explained how, by increasing the number of turns of wire around a magnetic needle the effect of the current upon the needle was augmented. This fact, he said, was taken advantage of by Crooke & Wheatstone in their telegraph system, which was invented three years prior to that invented by Morse.

The tangent galvanometer was next fully and clearly described, and with the aid of a blackboard, he explained a tangent and how it was used in connection with the measurement of electric currents by the deflections of the needle. Tangent galvanometers, he continued, were used in measuring resistances of instruments, batteries, ground wires, etc.

Rheostats and the substitution method of measurement were next explained, and he then told how the galvanometer could be used to determine how much battery is needed for a given amount of work.

Mr. Lockwood then, in a very clear and able manner, described the Wheatstone bridge it all its details, and with diagrams on the blackboard made the subject easy of comprehension.

In conclusion, he stated that all electrical appliances which a railroad uses should be placed in the charge of the telegraph superintendent.

Votes of thanks were tendered to Mr. Lockwood and also to Prof. Gardner for his able paper, after which the meeting adjourned until Thursday morning.

SECOND DAY, THURSDAY.

The meeting was called to order at 9:45 A.M., and the first thing done was the reading of a telegram from the Train Despatchers' Association, in convention at New Orleans, in which greetings were conveyed, with the wish that the superintendent's convention would be a prosperous one.

The secretary was authorized to return an appropriate answer to the telegram.

Mr. Charles Selden then read a very interesting paper on "Electricity and its Relation to Transportation," a full abstract of which was printed in our last issue. Well-deserved applause followed the reading of the paper, after which a paper was read by Mr. J. B. Stewart, on "The Block Signals of the Present and What Is Required for the Future."

Mr. Stewart described the English, or Sykes system, the one now in general use, and asked if it met the requirements and gave the necessary security.

It is claimed for the Sykes system, he said, two persons must make a mistake before a wrong signal can be given, but he gave a supposititious case where a collision was possible under the ordinary conditions. Such a condition would be present if a train from some cause stopped after entering a block 1,000 feet. To meet such a contingency, the Hall Signal Company, of New York, had, he said, made an improvement on the Sykes system. It consisted of a track instrument which was depressed by a train in passing out of the block. The instrument is connected electrically with the unlocking device, so that it is necessary for at least a part of the train to pass out before the lever can be unlocked.

Another great chance for an error in the Sykes system, as well as in all other non-automatic systems, he said, was the possibility of the operator failing to notice the absence of "markers" (in case a train should break in two) and report "train clear." The following train would, under such circumstances, be admitted into the block under a clear signal, to find the detached portion of the preceding train unprotected by a flag.

These points seemed to be covered by the pneumatic system, he thought, but he believed the same protection is afforded by another system which is operated by a track circuit and with much less mechanism.

He thought that the electro-pneumatic would be the system of the future. With such a system the operator controls the line of signals for a certain distance in the blocks each side of his station. He believed that, in any event, electricity would play an important part in the block signal of the future. His own experience and observations had led him to believe that a combination automatic and manual system would meet the requirements, and he suggested that blocks be not less than three-quarters of a mile ; the home signal operated by a lever, and signals operated by electricity and gravity, placed 1,000 or 1,500 feet apart throughout the block, the circuit connecting these signals to be also connected with the lever at the home station, so that in moving the lever to place the home signal at danger, the circuit would be opened and the signals go to danger by gravity, or weight. These signals, he said, will give ample notice of the position of the home signals and protect a train stopping just beyond a block station. It also admits of giving notice to the train, should the block ahead become clear, that schedule speed might be resumed before the train reaches the home station.

To eliminate the chance of an operator unlocking the lever while any part of the train is in the block, he would add to the above the connecting, and insulating of one line of rails throughout each block, running taps from this rail circuit to one side of the metallic line circuit which is used to unlock the lever. A train passing over the block will ground the side of the circuit connected by taps to rail and close the relay, and the local of this relay will lock the lever which operates the home signal and open the circuit of the block in the rear, remaining so until the last pair of wheels connected by a metal axle passes out of the block. With this arrangement it will not be essential that the operator shall see the markers.

In conclusion, Mr. Stewart referred to the trouble caused by improper attention to batteries. He claimed that with systematic attention to batteries and apparatus, there would be no failures of the electrical parts.

Mr. Stewart's paper was followed by one on "Individual Selection of Electrical Objects," prepared by Mr. S. S. Bogart and read by Mr. J. W. Lattig. A very full abstract of this paper will appear in our next issue.

At the conclusion of the reading of Mr. Bogart's paper

a short discussion took place, during which Mr. T. D. Lockwood referred to the use of electric motive-power in the Baltimore tunnels, which enterprise was spoken of by Mr. Selden in his paper. Mr. Lockwood stated that it was not an experiment, but a success already. He then, in a very clear manner, gave a sketch of the beginnings of the dynamo, stating that Moses G. Farmer was really the inventor of it; although he was twenty years ahead of his time. He thought that great developments would be made in the next five years in electric railways for surburban traffic.

In Mr. Selden's paper that gentleman referred to a new system of electric railway invented by Mr. E. E. Reis, of Baltimore. Mr. Selden, after Mr. Lockwood's remarks last noted, showed a working model of the railway.

Underneath the car, running its entire length, was the secondary coil of a transformer. The primary coil or coils consisted of a series of coils laid end to end under the surface, but parallel to and between the rails. The passage of an alternating current through these primary coils induced in the secondary coil (on the car) sufficient current to operate a small alternating-current motor placed on the car, and this motor imparted motion to the car-wheels in the usual way. The model worked well, and it attracted the very earnest attention of the members.

A recess till afternoon was then taken.

When the meeting was called to order in the afternoon, Mr. J. W. Lattig, of the Electric Secret Service Co., New York, in answer to a question from a member during the morning session, read a letter from Mr. George Payson, of the Western Railroad Association, in which the legal status of the company's system of individual calls, etc., was defined. It appeared from this communication that the only existing controversy between the Electric Secret Service Co. and the Gill-Alexander Co., of Kansas City, in no way affected the right of either company to install and sell its own instruments. Mr. Lattig said his company would guarantee to protect all purchasers of its apparatus against legal complications.

The following committees were then appointed by the president, to report at the next annual meeting:

To revise the constitution.—Messrs. Selden, Greene and Gemmell.

To devise a new form of service-card.—Messrs. Swift, Ford and Sholes.

On arrangements for the next annual meeting.—Messrs. Reed, Fry and Ford.

On topics for papers for the next meeting.—Messrs. J. B. Stewart, Gemmell and Adams.

All business having been concluded, President Jones, in a neat little speech, in which he expressed great satisfaction at the success of this convention, surrendered the chair and gavel to the president-elect, Mr. L. H. Korty. Mr. Korty assumed the chair and thanked the members for the honor conferred upon him. The meeting then adjourned.

The following is a list of those in attendance at the Convention:

C. S. Jones, Ill. Cent. R. R., Chicago; A. R. Swift, C. R. I. & P. R. R., Chicago; C. Selden, B. & O. R. R., Baltimore; O. C. Greene, N. Pac. R. R., St. Paul; G. M. Dugan, Ill. Cent. R. R., Jackson, Tenn.; P. W. Drew, Wis. Cent. R. R., Chicago; M. Magiff, Cent. Vt. R. R., St. Albans, Vt.; H. C. Hope, C. St. P. M. & O. R. R., St. Paul; G. L. Lang, N. Y. & N. E. R. R., Boston; M. B. Leonard, C. & O. R. R., Richmond, Va.; C. A. Darlton, R. & D. R. R., Atlanta, Ga.; J. L. Orbison, C. H. & D. R. R., Cincinnati, O.; J. C. Ford, C. St. P. & K. C. R. R., St. Paul; G. R. Kimball, B. & O. R. R., Newark, O.; G. T. Williams, N. Y. C. & St. L. R. R., Cleveland, O.; L. B. Foley, D. L. & W. R. R., New York; J. T. Gibbons, D. L. & W. R. R., New York; K. McKenzie, M. & O. R. R., Jackson, Tenn.; H. C. Reed, M. L. S. & W. R. R., Milwaukee; J. B. Stewart, West Shore R. R., New York; W. W. Jackson, N. Y. & N. E. R. R., Providence, R. I.; R. J. M. Danley, C. H. & S. R. R., Columbus, O.; W. B. Ward, B. C. R. & N. R. R., Cedar Rapids, Ia.; W. D. Vincent, B. & O. R. R., Pittsburg, Pa.; S. K. Bullard, M. K. & T. R. R., Sedalia, Mo.; U. J. Fry, C. M. & St. P. R. R., Milwaukee; W. J. Holton, C. & W. I. R. R., Chicago; D. H. Caldwell, N. Y. C. & St. L. R. R., Ft. Wayne. Ind.; G. C. Kinsman, Wabash R. R., Decatur, Ill.; H. C. Sprague, K. C. Ft. S. & M. R. R.. Kansas City, Mo.; L. H. Korty, U. P. R. R., Omaha, Neb.; C. G. Sholes, A. T. & S. F. R. R., Topeka, Kan.; A. R. Lingafelt, C. R. I. & P. R. R., Topeka, Kan.; W. P. McFarland, F. E. & M. V. R. R., Omaha, Neb.; C. S. Rhoads, C. C. C. & St. L. R. R., Indianapolis, Ind.; F. M. Duncan, D. & R. G. R. R., Denver; W. W. Ryder, C. B. & Q. R. R., Chicago; Geo. B. McCoy, Ill. Cent. R. R., Memphis, Tenn.; C. P. Mackie, Electric Secret Service Co., New York; J. W. Lattig, Electric Secret Service Co., New York; S. S. Bogart, Electric Secret Service Co., New York; W. S. Logue, Edison Mfg. Co., New York; H. F. Houghton, Wabash, R. R., Decatur, Ill.; J. B. Shaw, Jamestown, N. Y.; Ralph W. Pope, *Electric Power*, New York; T. D. Lockwood, Bell Telephone Co., Boston; T. J. Smith, The E. S. Greeley & Co., New York; H. R. Wilson, Chicago; D. C. Matheson, C. & G. T. R. R., Flint, Mich.; T. R. Taltavall, ELECTRICAL AGE, New York; C. M. Crook, Du Laney Clock Co., Chicago; R. B. Gemmell, A. T. & S. F. R. R., Topeka, Kan.; A. P. Willoughby, Standard Battery Co., Chicago; E. R. Adams, P. & R. R. R., Reading, Pa.; J. J. Burns, D. & R. G. R. R., Pueblo, Col.; C. W. Hammond, Mo. Pac. R. R., St. Louis, Mo.

LADIES.

Mrs. J. L Orbison, Mrs. W. F. Taylor, Mrs. A. R. Swift, Mrs. O. C. Greene, Mrs. G. M. Dugan, Mrs. C. Selden, Mrs. P. W. Drew, Mrs. M. Magiff, Mrs. G. L. Lang, Mrs. C. A. Darlton, Mrs. G. T. Williams, Mrs. T. D. Lockwood, Mrs. L. B. Foley, Mrs. K. McKenzie, Mrs. J. B. Stewart, Mrs. J. B. Shaw, Mrs. R. J. M. Danley, Mrs. W. P. Ward, Mrs. S. K. Bullard, Mrs. G. H. Scott, Mrs. U. J. Fry, Mrs. W. J. Holton, Mrs. H. F. Houghton, Mrs. T. J. Smith, Mrs. C. P. Mackie. Misses Greene, L. Selden, Bessie Stork, E. McCoy, Nellie A. Hope, Nellie B. Hope, M. Stewart, Frankie Magiff.

EXHIBITS.

Distance had no terrors for enterprising concerns who had something worth exhibiting on this occasion.

The Electric Secret Service Company, of 45 Broadway New York, had an extensive display of its various apparatus in practical operation. These included the Leonard Interlocking Block Signal system, the Leonard Automatic Train Order Signal, the Individual Continuous Telegraph Call with automatic answer back, and the Individual Arc Light and Motor Cut-Out. The company was represented by C. P. Mackie, general manager, S. S. Bogart, general agent, and J. W. Lattig, general superintendent.

Mr. M. B. Leonard showed a couple of samples of Miller's Excessive Current Protector, invented and patented by J. N. Miller, of Cincinnati, O. This instrument is designed to protect all classes of electrical apparatus from stray excessive currents.

The Edison Manufacturing Company, 42 Broad street New York, was ably represented by Mr. W. S. Logue, and had quite an extensive exhibition of Edison-Lalande batteries of all types, from 15 ampère-hours to 900 ampère-hours capacity; also two Faradic batteries in highly-finished wooden boxes. The phonoplex in practical operation was also shown. A circuit from Denver to Colorado Springs, a distance of 75 miles, was used,

and the apparatus worked with complete success. The condensers used in connection with the operation of the phonoplex were made by Mr. Wm. Marshall, University Building, New York, which instruments are justly celebrated for their high efficiency, excellence of construction, etc.

The Du Laney Clock Company, 79 Dearborn street, Chicago, was represented by Mr. C. M. Crook, who exhibited a sample of the self-winding and synchronizing clocks made by this company. These clocks are remarkable for simplicity of construction and ease and accuracy of operation. They are made for railroad time service. The clock is wound every two minutes by the operation of a pair of magnets instead of an electric motor. This frequent winding keeps the main spring wound at a nearly definite tension all the time. The synchronizing is accomplished by another pair of magnets which are energized by the electric time signal, and the operation is performed independently of the motion of the clock-work. Two cells of Samson battery will keep the clock wound for one year.

The Gill-Alexander Individual Telegraph Call-Bell system was shown in practical operation. This system is in use on many Western railroads, and the testimonials received by the company show that it gives satisfactory results. Mr. M. C. Gillham, the treasurer of the company, was present.

The Standard Battery Co., 324 Dearborn street, Chicago, was represented by Mr. A. P. Willoughby, the general manager. Mr. Willoughby showed some cells of the Iron Gravity Battery made by his company. In place of zinc an iron electrode is provided, and there is no corrosion whatever. The other electrode is copper. It is claimed that this battery has very excellent merits.

Mr. G. E. Lang showed some samples of the goods of the Laminar Fibre Goods Co., 180 Summer street, Boston. Laminar fibre is used for general insulating purposes and is similar to vulcanized fibre, but much cheaper. All the roads running out of Boston using electrical track signals use it for track insulation. It can be made in any form, and when it is dry it is one of the very best of insulators. It is made of cotton or linen pulp, and finds many uses in railway work.

An exhibit of historical interest was inclosed in a frame. It consisted of old train orders issued by the Camden and Amboy, and Philadelphia and Trenton Railroads, dated December 15, 1846; October 2, 1847, and February 8, 1849, and an old time-card issued December 21, 1858. These were loaned by Mr. Wm. Ettinger, of the Pennsylvania R. R., Jersey City. Mr. Magiff, of the Vermont Central road, showed in the same frame a time-card issued by that road bearing date October 10, 1853.

CONVENTION NOTES.

A party of delegates to the convention, to the number of 75, some accompanied by their wives, left Chicago for Denver at 6 P.M. Sunday, June 12, on two special Pullman cars provided by the Chicago, Rock Island and Pacific R. R. Co. Mr. A. R. Swift, superintendent of telegraph of that company, and his wife, had charge of the arrangements, and did all in their power to make all hands comfortable. The ride to Denver was a most enjoyable one and will be always remembered with pleasure by those who comprised the party. The train arrived at Denver at 8 A.M., Tuesday, June 14, and the day was spent in sight-seeing.

After the convention, which lasted two days, Wednesday and Thursday, several excursions were given to the delegates by the various railroad companies to many of the points of interest for which Colorado is celebrated.

On Friday the Union Pacific Railroad Co. ran a special train to Silver Flume over the celebrated "Loop." The train stopped at Silver Flume, where lunch was served on board. After lunch the party visited the silver mines which abound in that vicinity.

On Saturday morning the delegates went to Manitou on a special train provided by the Denver and Rio Grande R. R. Co., and in the afternoon ascended Pike's Peak in a special furnished by the Manitou and Pike's Peak Railroad Co., popularly known as the "Cog-Wheel Line."

A point about 3000 feet from the summit was reached, whence a magnificent view of the surrounding country was obtained; as the road-bed had not yet been entirely overhauled after the severe snows of winter, it was not considered advisable to proceed further than the point named. After returning from the Peak a special train on the Colorado Midland R. R. conveyed the party to Woodland Park, through the beautiful Ute pass.

The party stayed over night at Manitou, and on Sunday in a special train provided by the Denver and Rio Grande R. R. Co. took a trip to Pueblo and the Grand Cañon, visiting the world-famed Mineral Palace *en route.*

As a token of their appreciation of the many courtesies and the attention received at the hands of Mr. and Mrs. A. R. Swift during the trip from Chicago to Denver, the members presented to that gentleman and lady an elegant solid silver salad service appropriately inscribed. The presentation speech was made by Mr. Charles Selden.

The various railroads treated the members of the association and their wives and friends with the utmost liberality. Nothing was too good for the visitors, and everything possible was done to make their stay as enjoyable as possible.

A resolution of hearty thanks was tendered by the association to the Chicago, Rock Island and Pacific, Atchison, Topeka, and Santa Fe, Union Pacific, Denver and Rio Grande, Colorado Midland, and Manitou and Pike's Peak Railroad Companies, Superintendent J. J. Dickey, of the Western Union Telegraph Company, the Colorado Telephone Co. and the Remington Typewriter Co. for courtesies received. The railroad companies provided free transportation; the telegraph and telephone companies free use of their wires, and the Remington Typewriter Co. placed one of their indispensable machines, and a stenographer, at the disposal of the members during the convention. The committee of arrangements was also tendered the appreciative thanks of the association for the able manner in which it arranged and carried out the programme of the meeting.

Mr. T. D. Lockwood's talk on the Galvanometer was greatly enjoyed by the members, and they all agreed that the association was highly honored when that gentlemen was elected an honorary member.

On the other hand, Mr. Lockwood himself expressed great pleasure at being thus honored. The association no doubt will receive a great deal of benefit from the advice and help Mr. Lockwood will bestow at the meetings.

The members of the association feel proud of their organization, for the reason that it has the unique honor of being the first body before which a paper from Mr. Thomas A. Edison was read.

The programme of next year's meeting of the association, which will be held at Milwaukee, will include a visit, in a body, to the World's Fair.

CROOK, HORNER & Co., Baltimore representatives of the Ball Engine Co., Erie, Pa., have recently furnished two 150 H. P. engines of this manufacture to the North Avenue Street Railway Co., Baltimore, and two 150 H. P. Tandem Compound Condensing engines and complete steam plant to the Chesapeake Light and Power Co., Hampton, Va.

INSULATION.*

BY THOMAS A. EDISON.

To telegraphy the insulation of its circuits is so vital a matter that, at the risk of making history repeat itself and of recounting an oft-told tale, a short paper on the subject may be tolerated.

As a class, gases are the best insulators ; next liquids, and solids last of all. The insulation of gases is so good that no determination appears yet to have been made of any leakage through them. If it were possible to make an experiment at or near the centre of the earth, so as to be beyond the reach of gravitational force, an electrified body might be left for hours in a gas without any visible means of support, and observations then made to determine whether any loss of charge took place through surrounding gases. Under existing circumstances the loss of charge which always does take place on electrified bodies cannot readily be traced beyond that through the suspension or support that holds them. Even in moist air the loss of charge has not yet been brought home to the aqueous vapor. Professor Boys exhibited before the Physical Society of London, in April, 1889, a pair of electrified gold leaves, suspended in moist air by a short hook of quartz. The loss of charge appeared to be about 25% in five hours. A glass hook under the same conditions would have allowed the charge to disappear, it was said, within one minute.

If any perfectly insulating solid could be found, telegraphists would soon discover any surface leakage from their wires through the air, for the surface of a No. 8 B & S wire in 224 square feet or 20.8 square meters per mile.

The loss of charge which takes place convectively into the air over any sharp point in an electrified body is a phenomenon of a different nature. There the layer of atmosphere over the point is continually being torn by the magnitude of the forces brought locally to bear upon it, and the particles of moving air carry away the charge. Some liquids have also a very high insulation, notably most mineral oils. Animal and vegetable oils are by no means so good, or at least there is greater difficulty in obtaining them in a highly insulating condition. Water, contrary to prevailing notions, is quite an insulator. In the purest distilled water resistance as high as 7 megohms per c. c. has been recorded ; that is to say, a block one centimeter cube of water pressed between two opposite conducting planes as electrodes would offer a resistance of 7 megohms ; but the least trace of impurity brings the resistance down.

Ice at 12° C. has been measured at 2,240 megohms per cubic centimeter. There are two conditions of surface upon which bare wires, miles in length, laid on the ground have been worked telegraphically—one over the dry desert sands of Africa, the other over dry ice in the far north. Sea-water has a resistance of about 30 ohms per c. c. at 5° C.

It would appear probable that liquids cannot conduct without electrolytic decomposition. A microscope will show that one microampère decomposes the drop of water it traverses.

One of the most important and promising modern theories of chemistry is based upon the assumption, in accordance with a considerable array of facts, that solutions only conduct by the transfer of atoms or ions to the electrodes, each carrying an electric charge, and the conductivity of a liquid measures on this hypothesis the number of uncombined or dissociated ions permeating its mass. These free ions are the porters carrying the charge, and the conductivity of the liquid depends upon the number available and the speed with which they can migrate.

Liquids, too, have, as a class, the quality of elastic insulation to high tensions, which is an important feature to the electrical engineer. Air for the first few centimeters will break and allow a spark discharge to occur when the pressure reaches from 10,000 to 50,000 volts per centimeter (25,400 to 127,000 volts per inch) according to the shape and condition of the electrodes, but rosin oil is said to stand about 75 times the pressure of air per cm. without disrupting.

The following is a list of actually observed resistance in commercial samples of well-known insulating substances. The results are given in megohms per cubic centimeter at or near 18° C.:

Paraffine wax	110,000,000	megohms
Heavy paraffine oil	8,000,000	"
Olive oil	1,000,000	"
Lard oil	350,000	"
Creosote	5.4	"
Stearic acid	350,000,000	"
Sperm oil	0.077	"
Benzine	14,400,000	"
Balsam copaiba	211,000	"
Benzole	1,320	"
Oil of wood tar	1,670,000,000	"
Crude ozokerite	450,000,000	"

All transparent solids are insulators, but, of course, the opposite statement is not true that all opaque solids are good conductors. There is now good evidence for believing that the process by which light is propagated, the mechanism by which it is transmitted through space, is purely electromagnetic, and the magnetic vibrations passing through a conductor would generate electrical currents and be absorbed in the substance as heat ; that is to say, it would be opaque to the light, failing to transmit the energy.

The difficulty with solids is not so much to find insulators, for the great majority of solid substances freed from moisture are poor conductors, but to find an insulation of suitable mechanical qualities. Glass, porcelain and mica seem to be almost the only practically available insulators that will support considerable stresses, and these for many structural purposes are far weaker than is desired. In American telegraphy, glass is almost the universal insulator, but in Europe, particularly in the south and west, the atmosphere is so much more humid, and glass so hygroscopic, that no circuit of any length could be operated with glass insulators except in dry weather. Porcelain or vitrified stoneware insulators are used instead, and in quite a variety of forms. Practically speaking, the insulation of a line is never that of the material forming the insulators, but always that of their surfaces, and the films of dust and moisture that may have become encrusted thereon. The most perfect insulators are those which have underneath the hood a cup filled with oil, in such a manner that the current leaking from the wire to the ground has to pass over the oil, or else through the substance of the insulator itself. These insulators are certainly more expensive, and require to be refilled with oil at intervals, but they will defy weather and keep the insulation nearly as high in fog as in sunshine.

When a long leaky wire is opened at the distant end, and tested for insulation, the insulation per mile always appears to be somewhat more than it is for any actual mile, since the more distant portions of the line are tested with a reduced pressure, owing to the leakage over the nearer portion. When the wire is grounded at the far end and its conductor resistance measured, the leakage will on the other hand make the apparent resistance per mile too low. But if the conductor resistance is reduced in a given ratio, say as 100 to 95, the insulation will be overindicated in the exact inverse ratio of 95 to 100, provided that the insulation of the line is uniform. So that if a wire's conductor resistance at its temperature of observation is known to be 10 ohms per mile, but appears

* Paper read at the Convention of Railway Telegraph Superintendents held at Denver, Col., June 15 and 16, 1892.

by leakage over the whole length to be 9 ohms, then if the insulation per mile apparently measures 400,000 ohms, it will be really 360,000, and each mile taken separately might be expected to measure 360,000. As is well known, telegraph lines work better up to a certain point if the insulation is rather low. A wire has to be emptied of its charge between the impulses of the key sufficiently far to keep the relays from sticking. If the insulation is perfect this quantity has to be cleared through the ends to ground, but if the line leaks it can escape more readily at all points.

The longer the line, the more essential good insulation necessarily becomes. The insulators are perhaps never more carefully tested than those intended for the long circuits on the Asiatic plains. It was at one time customary to test each insulator before it went out, by taste. The insulator was immersed nearly to the rim, head downwards in water, and a battery of 100 cells was connected with one pole to the water and the other to the insulator stalk through a particular kind of key. The operator first rested his moistened finger on this key and then applied his tongue to it. If he tasted no current, the insulator was passed out as satisfactory. The test was sensitive and expeditious, and saved the care and handling of a galvanometer.

The insulation of a wire is a definite term and stands for a definite property so long as it is not necessary to measure it very accurately. There is usually no difficulty in finding the insulation of any overhead wire within 5 % at any one time, and two observers measuring the line from the same end with different instruments would generally agree in their results to that limit, but as higher degrees of accuracy are attempted (a condition that fortunately does not practically occur), the difficulty of obtaining concordant results may increase rapidly. A resistance coil of wire at a uniform temperature can have its resistance measured to within one-fiftieth of one per cent., if necessary, but a leakage resistance is essentially liable to variation. The atmospheric conditions may be altering, or there may be polarization, or inductive disturbances from neighboring wires, or a combination of conditions that may set close measurement at defiance. It is generally advisable to employ galvanometers for this purpose, that even if sensitive are slow of movement and deadbeat. The only instances in which accurate measurements of insulation are possible and necessary are in connection with subterranean or subaqueous wires. Jute and paper, dry or saturated with compound, are rapidly coming into use for subterranean wires sheathed in lead, while for long cables under water, india-rubber and guttapercha are invariably employed. With conductors highly insulated by these methods, the insulation can be measured much more closely, and is definite for a given temperature of the core, but even in this case the current that will flow from a battery into the wire freed at the distant end is not all leakage. A considerable portion may be stored up in the insulating substance, and be returned from the wire to ground after the battery has been removed. This "polarization" is particularly noticeable with guttapercha and india-rubber covered wires, and their insulation may be apparently 50 % greater after three minutes of charging than at the end of the first minute. In specifications it is usual to call for a certain insulation per mile at 75° C., and after a definite interval of charge.

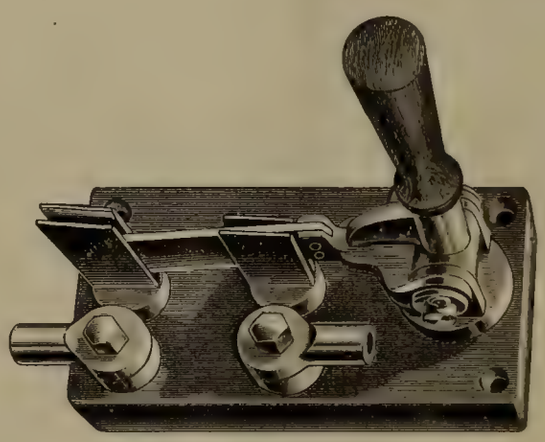
The insulation obtained from a given thickness of covering depends on the diameter of the wire as well as on the quality of the cover, for a large wire supplies a larger leaking surface. Also if an insulating coating of a certain thickness produces an insulation of 100 megohms per mile, doubling that thickness will not double the insulation, because the leakage will take place with greater relative facility through the greater surface of the second coat. The exact increase of insulation will depend upon the diameters of first coating and wire.

When a wire is well and homogeneously insulated, its insulation resistance at a given duration of charge or period of electrification will appear to be the same with different battery powers or voltages applied, but if, on the contrary, it contains any small faults or defects, it will generally show less insulation with increasing testing pressures. This often forms a criterion as to the reliable insulation of a long cable. The insulation in an ocean cable under the pressure of great depth and near the temperature of melting ice that deep oceans approach might be 15,000 megohms per nautical mile at the fifth minute. With a small incipient fault the insulation might still reach 3,000 megohms per mile and seem excellent, but it is probable that when tested with 5 cells and with 50 cells, the insulation resistance in the latter case would not appear so high. It would also probably be different with the zinc or copper pole to line.

The only value that can attach to a high measured insulation is the assurance it conveys that no flaws exist in its covering or supports, and will therefore remain in good signalling order unless disturbed. In fact, a very high insulation, as we have seen, actually tends to retard signalling. Mechanical security from the loss of insulation is the great desideratum rather than a very high degree of insulation itself.

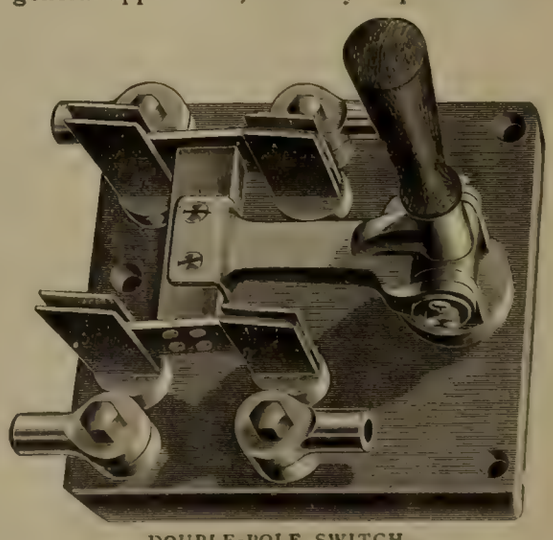
SNAP SWITCHES.

The accompanying cuts represent the single-pole and double-pole snap switches recently placed upon the market by the C. & C. Electric Motor Co., of New York.



SINGLE-POLE SWITCH.

The plain switches designed by this company have the same general appearance, the only important difference



DOUBLE-POLE SWITCH.

being the omission of the snap spring in the plain switch, while the handle-lever and knife-lever are replaced by a single casting.

Almost all specifications for electric-lighting plants now call for marble or slate switch-boards, instead of the wood board, which was formerly considered satisfactory. The switches that were designed for the wood boards have been made to do service on the marble, but owing to their construction they do not make a handsome appearance. The switches here illustrated were designed specially for this class of work, and have been provided with ample contact-surface and quick brake, and the metal parts are so solidly constructed as to obviate any possible danger of breaking.

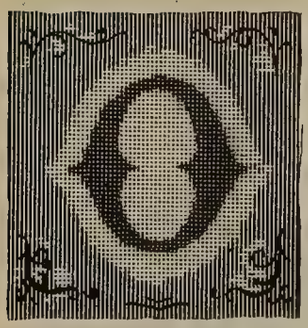
The connections are made from the back of the switch-board to these switches, but the contact binding-posts are made extra long, so that when wanted the switches may be supplied to be fitted to a switch-board of any thickness.

On switches provided with fuse blocks and mounted on slate bases the distance between the fuse terminals is made ample enough to render the fuses perfectly reliable and to prevent any danger of arcing across. This feature is specially desirable when the switches are used on 500 volt circuits.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electroplating.



ONE of the most interesting applications of electricity is that of electroplating, and as a great deal of experimental work of this character is carried on, as well as in a commercial sense, a few words concerning the requirements for successful results will not be amiss.

Electroplating, defined, means the plating of one metal with another metal by means of the electric current passing through liquid solutions of the proper metals, in which the articles to be plated are suspended.

The power of an electric current to decompose liquid chemical compounds and effect other combinations is called *electrolysis*. Electrolysis was the subject of the article of this series in the ELECTRICAL AGE of May 14 last, to which the reader is referred for careful study in connection with this one.

As far as history teaches us, Wollaston conducted experiments in electroplating in 1801, but it was not introduced as an art until 1840. This was in England, by Richard Elkington.

The metals generally used in electroplating are gold, silver, nickel and copper, although others are deposited in this way—tin and platinum, for instance. It is interesting to note that it is estimated that over 125 tons of silver are used annually in electroplating.

In large establishments the plating solutions are held in vats made of pine lined with lead or gutta-percha. For small work and for experimental work vessels of glass, china or earthenware answer every purpose.

The electric current may be supplied by a dynamo or a battery, but for amateur or experimental work batteries are the usual sources of current. The direction of the current should under no circumstances ever be reversed with respect to the circuit.

The solutions used in plating consist of some salt of the metal to be deposited, the solvent usually being distilled rain water. The anode usually consists of plates of the same metal with which the articles are to be plated, while the articles themselves constitute the cathode. The anode of a plating cell is connected with the positive pole of the source of current, while the cathode is connected with the negative pole. The anode and cathode are both suspended in the solution from copper bars which rest on copper strips laid along the edge of the vessel containing the solution, but insulated therefrom.

The proper area of the anode is a matter of some importance; there is such a thing as getting it too large or too small. For nickel plating the area of the nickel anodes, or plates, should at least equal the cathode surface; that is, the surface of the articles to be plated, and each cathode surface should be exposed to an anode surface. The anodes should be submerged to about two-thirds the depth of the solution.

In gold plating a less surface of the anode is required, and the exposure of the cathode surfaces to the anode is a matter of less importance as compared with nickel plating. The reason for this is that the anode in the gold bath is more soluble than the nickel anode, and the gold solution itself is more readily decomposed by the current than the nickel solution, consequently it parts with its metal with greater facility.

What is true of gold plating is equally true of silver.

To do this subject complete justice, we will be compelled, on account of the press of other matter, to divide it into two parts, and will therefore continue it in our next article.

PORTABLE TESTING KEYS.

Every one who has occasion to make insulation tests away from a laboratory knows how essential it is to have apparatus that is reliable and at the same time adapted to surrounding circumstances; that is, accuracy must be combined with portability.

A short-circuit key or a contact key that can be thrust



PORTABLE TESTING KEY.

into one's pocket will commend itself for convenience to those engaged in outside work, and we are informed by Queen & Co., of Philadelphia, that they can "fill the bill" with their new key, illustrated herewith. The keys are made of hard rubber, polished, with brass connections and platinum contacts, and the desired effect is produced by simple pressure of the hand.

Three forms are now made, viz., single-contact, double-contact and short-circuit.

QUICK WORK.

The advantages which a purchaser derives by dealing with a bulk contractor are clearly illustrated by a remarkable installation recently made at White Plains.

A very handsome new church was presented to the parish by Mrs. M. C. Reynal, and the architect, Mr. T. H. Poole, of New York city, contracted with one of the large electrical manufacturing companies to put in wiring and fixtures for electric lights, and made arrangements with the local lighting company to install a special dynamo and supply current.

It was intended to use the lighting plant at the consecration exercises, but as that day drew near it was evident that neither company would be ready.

The day before the exercises the architect concluded that he must have electric lights if it were at all possible. Having had satisfactory experience with a well-known bulk electric contractor of New York city, the architect called upon the concern at 4:30 one afternoon and asked

if it would be possible to install the plant and have it running in time for the exercises which would come off at 10:30 the next morning.

It was necessary to secure, deliver at White Plains, and install the dynamo, complete the wiring of the church, run the line to the central-station plant, alter the speed of the engine, supply belting, foundation, etc.

The contract was promptly accepted by H. Ward Leonard & Co., whom Mr. Poole applied to at 4:30 in the afternoon, and at 10:15 the next morning the entire plant was operating perfectly.

Architects and the public generally are beginning to appreciate that electric plants can be installed by bulk electric contractors with a rapidity and satisfaction which can never be obtained by dealing with various large manufacturing concerns, no one of whom shoulders the entire responsibility.

PACKARD LAMPS.

The long experience of the Messrs. Packard in the incandescent lamp business led them to stamp the name



PACKARD RAILROAD LAMP.

"High Grade" on the lamps now being made by the New York and Ohio Co., Warren, Ohio.

The ordinary type is manufactured in 8, 10, 16, 25, 32 and 50 C. P. for all bases. The illustration represents the supported filament or railroad lamp, which allows the supporting of the filament during violent vibrations and the non-support of the filament when the conditions are normal.

The Packard High Grade lamps are receiving endorsement from some of the largest consumers, and they are especially satisfactory to meter customers where the "most light for the money" is wanted.

The record made by the Packard Lamp is a good one and is due to an appreciation of the necessary careful inspection of details of manufacture, coupled with a thorough understanding of the business by the makers.

The Eastern agent, Mr. Charles E. Chapin, 136 Liberty street, New York city, reports a good business being done in the East with entire satisfaction to the trade.

SPECIAL NOTICE.

The New York office of the Consolidated Electric Storage Company, 120 Broadway, is the sole agency for the sale of storage batteries for New York and vicinity. Purchasers desiring to secure the best terms should apply at that office to E. J. Moore, manager.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, June 25, 1892.

THE ABENDROTH & ROOT MANUFACTURING COMPANY, 28 Cliff street, New York, has just sold a 300 H. P. Root's Improved Water Tube Safety Boiler to the New York Steam Company, foot of East 116th street, New York.

MR. H. C. RICHARDSON, of Curtis & Dean, reports the sale of Thomson-Houston equipment for two 20-ton electric cranes to the Wright Steam Engine Works, Newburg, N. Y. Three Standard T.-H. railway motors will be used on each crane. When fully equipped the new shops of the Wright Co. will have the finest facilities for rapid assembling of their engines.

PROF. F. B. CROCKER, vice-president of the Crocker-Wheeler Electric Company, New York, sailed on Saturday in the steamer *Etruria* for Europe. While abroad he will meet all the prominent English and Continental engineers, to get, if possible, the results of their latest experiences in central station and power transmission work, and to compare notes on electrical matters in general, making a special study of improvements in electric motors, with a view of introducing anything of value into the Crocker-Wheeler machines.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, incorporated under the laws of the state of New Jersey, with an authorized capital full-paid of $20,000, has purchased the good-will, business, patents, trade marks and stock of the Manhattan Electrical Supply Company, incorporated under the New York state laws, and will continue in the electrical supply business at 36 Cortlandt street, New York. With better facilities for manufacturing electrical goods, and the enlarging of its salesroom at 36 Cortlandt street, the company is prepared to fill orders promptly and at moderate prices. The officers are: J. J. Gorman, president; Edgar Whitmore, vice-president; James Pembroke, secretary, and H. T. Johnson, treasurer.

THE firm of F. Holman & Co. has been reorganized under the name of F. Holman Electric Company. The new concern will continue at the old address, 128 Pearl street, New York, Mr. Holman giving his personal attention to the manufacture and sale of the "Paradox" reflector shades for incandescent lights which have attained considerable popularity. These shades contain many valuable features, and are so constructed as to permit of a variety of designs and artistic effects. The

company guarantees these reflectors to retain their reflective power for three years, failing which they will be renewed. The reflector shade was first brought out by Mr. Holman, while connected with the Edison General Electric Company. He subsequently withdrew from that concern and organized the firm of F. Holman & Co., which has been reorganized, as above stated.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, asquoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	85 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	206 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	157 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill., N. Y.	5,400,000	100 00	85 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	84 00
Edison General	15,000,000	100 00	103 50
Edison General Receipts		100 00	108 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	44 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	107 75
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	18 50
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 25
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	64 75
Thomson-Houston pref.	4,000,000	25 00	29 75
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	93 75
Westinghouse Elec. & Manf. Co.	7,000.000	50 00	28 75
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	45 00
Westinghouse Ass. Rects.		50 00	18 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

SPECIAL CORRESPONDENCE.

The following letter speaks for itself:

NEW YORK, June 18, 1892.

To the Editor of ELECTRICAL AGE:

Several of the technical journals have recently published notices, emanating evidently from the Magnetic Separator Company, of New York, stating that a suit had been entered in the United States Court for the District of New Jersey against the International Ore Separating Company, of No. 1 Broadway, New York, for infringement of patents. We will be greatly favored if you will publish in your columns the following true statement of the matter:

We wish to say on behalf of the International Ore Separating Company that this statement, that suit has been brought against it by the Magnetic Separator Company, or by any other person, firm or corporation, is unqualifiedly false.

The International Ore Separating Company operates under patents assigned to it, which infringe no other patents whatsoever, while eminent counsel have repeatedly advised that the claims of the patents of the Magnetic Separator Company are invalid, and this the International Ore Separating Company stands ready to prove before any court of law or equity. By the actual practical results of separation, as well as by the opinion of those best qualified to judge, the separators built by the International Ore Separating Company are superior by reason of their simplicity, cheapness, durability and efficiency to all others now on the market.

The especial features of these separators are absolutely new—the spirally-wound drums of small diameter, the special forms of magnet with consequent poles, the method of transference from drum to magnets, the combination with these of a belt and rollers, together with the method of operation under the surface of water, are all completely protected by United States and foreign patents, and any infringement of these will be promptly prosecuted.

INTERNATIONAL ORE SEPARATING COMPANY,
by Harvey S. Chase, Treasurer.

A CARD TO THE STEAM-USING PUBLIC.

It having been brought to my attention within a day or two that printed matter is being circulated wherein my name appears as general manager of the "Hussey Re-Heater and Steam Plant Improvement Company," I would state that I have not been connected with that company for over two years.

For your further information I would advise you as follows: In 1883 Mr. Hussey patented two reheaters for reheating exhaust steam. These reheaters were manufactured and sold by Mr. Donaldson and Mr. Hussey conjointly, afterwards by Mr. Donaldson, and in 1884 by the Donaldson Heater Company, of which I was secretary. Within a few months I, individually, secured the exclusive right to manufacture and sell them.

In 1888, on the strength of certain promises, I organized, with others, the Hussey Re-Heater and Steam

Plant Improvement Company, of which I was general manager. But after two years with that company I resigned as its general manager, at the same time withdrawing such interests as I had, and since then I have had no further connection with it.

I intended at the time to open an office for the continuation of my business, but while making the necessary arrangements I concluded to spend a short time in the electrical business, since I knew very little about electricity, and realized that it was to play an important part in the steam business. I entered the Edison Company and only recently left it.

How long my name has been used in the manner mentioned I do not know, but I wish, even perhaps at this late day, to state that I am not interested, either directly or indirectly, in any business except my own.

Very truly yours,

S. D. BREWER,

Hussey Reheater System, 50 *Broadway*, *New York*.

JUNE 18, 1892.

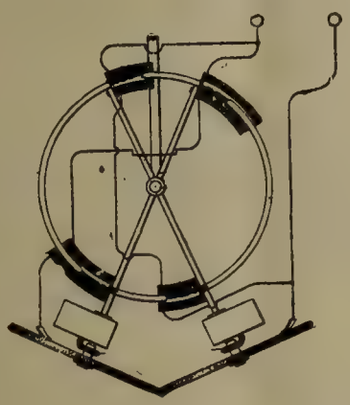
The Electrical Age's Illustrated Patent Record.

Issued June 21, 1892.

477,206. Electric Alarm-Clock. Benjamin Franklin, Chicago, Ill., assignor of three-fourths to David H. Fletcher, Calvin R. Beach and George H. Merriell, same place. Filed Sept. 12, 1891.

477,214. Electric-Controlling Apparatus for Fire Alarms. George Knowles, Jr., Milwaukee, Wis. Filed Dec. 3, 1889.

477,218. Cable Junction-Box. John D. McLeod, Milwaukee, Wis. Filed Dec. 15, 1891.



477,273. ELECTRIC-ARC LAMP.

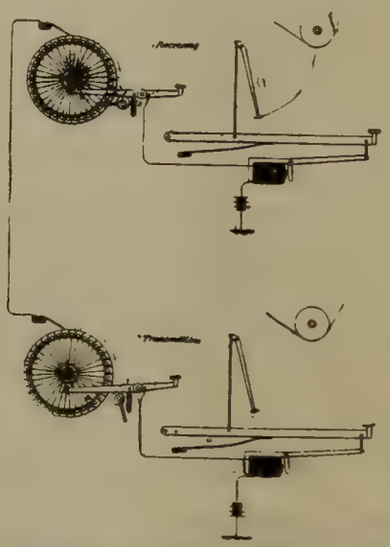
477,219. Carbon-Rod Contact for Arc Lamps. Charles McNellis, Chicago, Ill. Filed Jan. 26, 1892.

477,221. Electric-Arc Lamp. Lemon Parker, St. Louis, Mo. Filed July 13, 1891.

477,223. Means for Operating Ammeters and Other Electrical Apparatus. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y. Filed Sept. 24, 1891.

477,247. Rheostat. George K. Cummings, Chicago, Ill. Filed Dec. 11, 1891.

477,250. Distribution of Rotary Electric Currents. Alard E. Du Bois-Reymond, Berlin, Germany, assignor to Siemens & Halske, same place. Filed April 30, 1891.



477,383. PRINTING-TELEGRAPH.

477,273. Electric-Arc Lamp. Norman F. Rutherford, Bathurst, New South Wales. Filed Aug. 13, 1891.

477,301. Electric Jail. Perley Hale, Chicago, Ill., and Charles H. Sparks, St. Louis, Mo., assignors, by direct and mesne assignments, of part interest to William S. Hull, Sheffield, Ala. Filed Sept. 7, 1891.

THE

"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

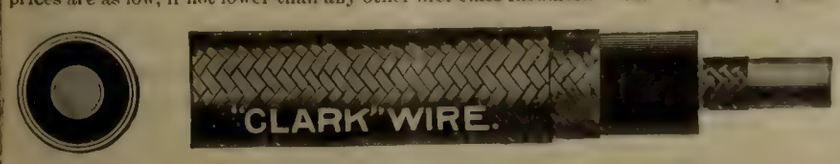
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.

HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

477,315. Thermotic Circuit Closer. Walter H. Tapley, Chicago, Ill., assignor to the Ware Automatic Heat Generator and Regulator Company, same place. Filed Aug. 14. 1889. Renewed Oct, 24, 1891.

477,374. Electrical Switch. Charles J. Klein, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed May 28, 1891.

477,383. Printing-Telegraph. Charles J. Reed, Orange, N. J. Filed May 27, 1891.

477,384. Printing-Telegraph. Charles J. Reed, Orange, N. J. Filed July 6, 1891.

477,407. Incandescent Electric-Lamp Socket. Jacob S. Gibbs, Hartford, Conn., assignor to the Perkins Electric Switch and Manufacturing Company, same place. Filed Feb. 27, 1892.

477,409. Electric Switch. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Dec. 16, 1891.

477,427. Electric-Arc Lamp. Frederic V. Maquare, Paris, France. Filed Aug. 13, 1890. Patented in France, in Belgium, in England, in Germany, in Spain, in Italy and in Austria-Hungary.

477,483. Electric Motor. Frederick Yeiser, Tampa, Fla. Filed Sept. 22. 1891.

477,579. Test-Circuit for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 12, 1885.

477,595. Electric Switch. Jesse L. Hinds, Syracuse, N. Y., assignor to the Electric Engineering and Supply Company, same place. Filed July 23, 1891.

477,612. Electric Switch. Eugene A. Snow, Syracuse, N. Y., assignor to the Electric Engineering and Supply Company, same place. Filed July 23, 1881.

477,613. Combined Weighing, Lifting, Measuring and Electric Machine. August Sundh, Yonkers, N. Y. Filed Nov. 4, 1890.

477,616. Electric-Annunciator Drop. James C. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 17, 1889.

477,627. Electric Embossing-Stamp. Charles E. Carpenter, Minneapolis, Minn., assignor to the Carpenter-Nevens Electric Heating Company, same place. Filed June 21, 1890.

477,628. Electric Heater. Charles E. Carpenter, Minneapolis, Minn. Filed Nov. 29, 1890.

LEONARD'S 3-WIRE SYSTEM.

Indentical in Cost and Efficiency

WITH EDISON SYSTEM.

SIMPLER TO OPERATE.

Copper required guaranteed to be not over 30% of that required for 2-wire system, under same conditions.

Royalty, 1 cent per lb. of Copper Installed.

PATENTED JUNE 7, 1892, No. 476,544.

CHARLESTOWN, W. VA., June 18, 1892.

MESSRS. H. WARD LEONARD & CO.,
136 LEONARD STREET, NEW YORK.

GENTLEMEN: The central station plant, which you installed for us here, under your new patented system, has given entire satisfaction ever since is started, which was about six months ago.

The operation of the plant is quite simple and economical, and as a result the plant is making very satisfactory earnings, although our town is rather small, having only about 3,000 inhabitants.

Yours very truly,
(Signed) CITY ELECTRIC LIGHT CO.,
WM. CAMPBELL, *Sec'y*.

For bids for complete plants, or conductors only, address

H. Ward Leonard & Co., 136 Liberty St., New York City.

VULCANIZED FIBRE COMPANY,

Established 1873.

Sole Manufacturers of HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

FACTORY: WILMINGTON, DEL. **The Standard Electrical Insulating Material of the World.** OFFICE: 14 DEY ST., N. Y.

McLEOD, WARD & CO.,

Electrical and Mechanical Eng'rs,

91 LIBERTY STREET, NEW YORK.

ELECTRIC MOTORS, FAN OUTFITS.

Brushes for Sprague Motors, Hoods for Arc Lamps. Write for Prices.

PLATINUM FOR ALL PURPOSES. SCRAP and NATIVE PLATINUM PURCHASED. BAKER & CO., 408-414 New Jersey Railroad Ave., Newark, N. J.

ELECTRIC ELEVATORS

Also HYDRAULIC AND ELECTRIC DOCK HOISTS and STEAM.

In practical and successful operation.

SEND FOR PAMPHLET H.

THE AMERICAN ELECTRIC ELEVATOR Co., 15 Cortlandt St., New York.

Manufacturers of OCTAGONAL AND CEDAR TELEPHONE & ELECTRICAL RAILWAY POLES & CROSS ARMS

THE H. M. LOUD & SONS LUMBER CO.

OSCODA, MICH.

BATTERY ZINCS

RODS AND PLATES FOR BATTERIES.

CROW FOOT ZINCS.

H. LAMARCHE'S SONS, 83 JOHN ST., N. Y.

ELECTRICAL AGE

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T. R. TALTAVALL, SEC'Y AND EDITOR.
J. H. GLOVER, ASSOCIATE EDITOR.

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A. E. KORNFELD, N. D. WEBSTER, G. B. ELLERY.

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NEW YORK, JULY 9, 1892.

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VAST POSSIBILITIES.

No one can read electrical literature of the day without being forcibly impressed with the vast possibilities of electric power for railway-car propulsion. Gradually the steam-railway problem is being solved, and it may not be many years, or perhaps months, before we may see the dream of electric railway enthusiasts realized.

ALTERNATING CURRENTS.

In the paper on the physiological effects of alternating currents of high frequency read by Prof. E. J. Houston before the electrical section of the Franklin Institute, May 24 last, some interesting passages occur. He refers to the experiments of Mr. Nikola Tesla with alternating currents of very high frequency, and points out the reason why such currents are less dangerous to the human body than currents of less frequent alternations. Currents of enormously high frequencies traverse only the superficial portions of the body, while those of less frequency penetrate the surfaces to greater extent. From these considerations he infers that when the frequency of alternations becomes as great as that of the ether waves, which cause sunlight, the body would probably experience on the surface the same genial effects as are produced by the light and heat of the sun.

Prof. Houston is considerable of a philosopher, and has a power of penetrating the mysteries of nature that few men possess. On the 1st of March last he read a paper before the same institution on "Cerebral Radiation," which was full of scientific interest, and in which he ventured some explanations of the operations of the mind. Although such a subject is one extremely difficult to treat in a popular manner, Prof. Houston succeeded in expressing his views so clearly, that any one with intelligence, after reading his paper, could not help feeling that there was a near approach to fundamental truth in what he said.

THE TELEPHONE INDUSTRY.

The census bureau at Washington has just issued an interesting report on operating telephone companies for the year ended December 31, 1890, prepared by Mr. Allen R. Foote, expert special agent for the collection of statistics of the electrical industries.

The figures of 1890 are compared with corresponding ones of 1880, and show the marvellous development of the telephone industry.

At the beginning of 1879 the telephone was an insignificant affair, and the business was little or none, but at the end of that year it had developed into one of the most important industries in the country.

The report for 1890 is accompanied by several tables which show in detail the enormous strides the business has made during the decade 1880–1890, financially and physically.

There were 148 companies in the field in 1880, while in 1890 there were but 53, showing the results of combination.

The total amount invested in telephone property in 1890 was $72,341,736, against $14,605,787 in 1880, and the net earnings show an increase of $4,536,334. In 1880 there were in use 108,638 telephones and transmitters, and in 1890, 467,356, while the number of miles of wire at the same dates was 34,305 and 240,412.

Among other interesting figures we find an increase in the net earnings per mile of wire of 3.60 per cent., and an increase in net earnings per subscriber of 54.68 per cent. There was an increase of 5.30 per cent. in the interest-bearing and profit-showing investment per subscriber.

The report, which is published in full elsewhere in this issue, is exceedingly interesting, and may be studied with much profit. It tells a story that is unequalled in the history of the industrial world.

ELECTRIC LIGHT PLANT IN AN HOSPITAL.

In the installation of isolated electric-lighting plants it is frequently necessary and important to attain some special end other than that of the production of current for the lights. In hospitals, for instance, any jarring or vibration from machinery would be decidedly objectionable; in such a place a smoothly-running plant, free from such unwholesome features, is an absolute neccessity.

A plant of this character is that of the New York Hospital, on 16th street, between 5th and 6th avenues, New York City.

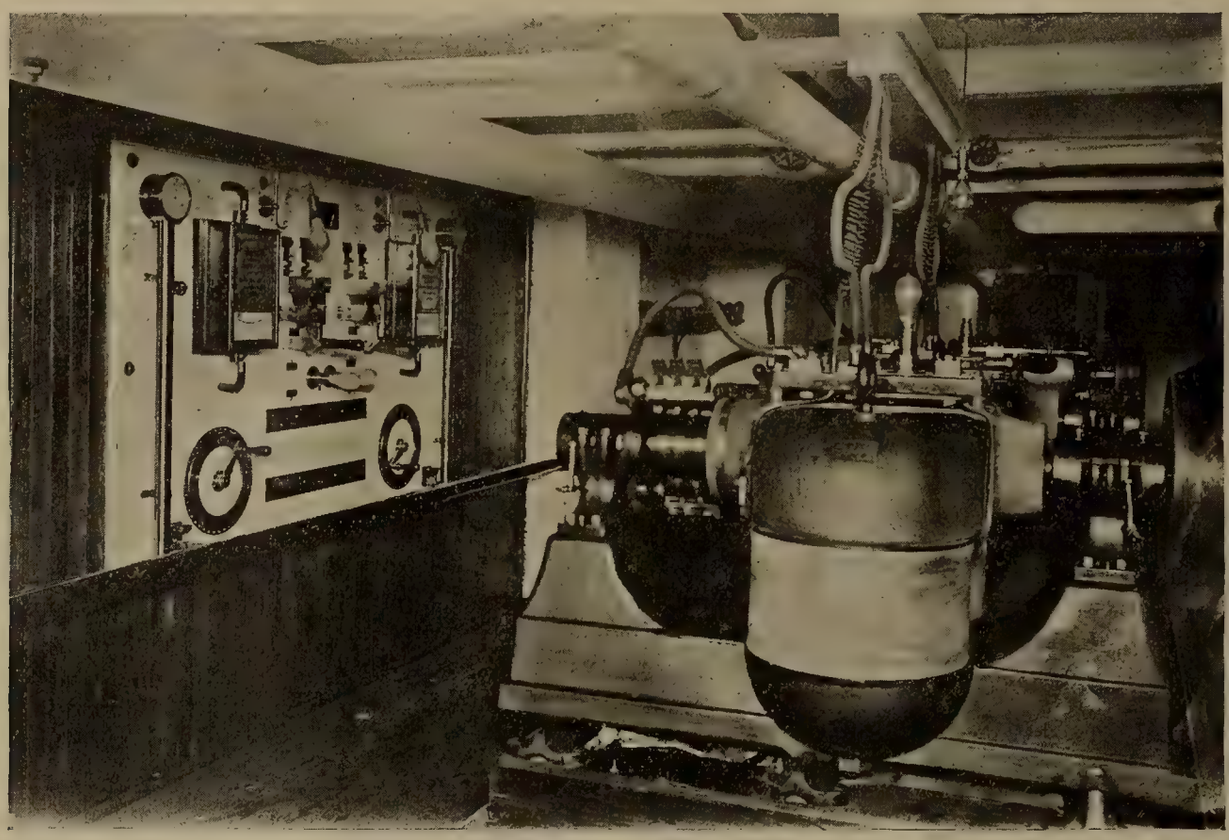
This plant which is described and illustrated herewith, is remarkable for its quiet running and efficiency. The electrical portion of it consists of two 40 kilowatt shunt-wound Detroit generators, manufactured by the Detroit Motor Co., of Detroit, Mich. They run with exceptional smoothness, and are free from sparking at all loads. No leaving ample capacity in the generating plant for future extensions of the buildings.

The buildings are wired on the three-wire system with Bishop "White Core" rubber-covered wire throughout, and all the wiring is on the surface encased in neat mouldings. The connections are so arranged that by simply throwing two-way switches one way or the other, the current supply may be obtained from the isolated plant or the street mains of the Edison Electric Illuminating Co.

Sawyer-Man 117 volt lamps are used, and answer equally well on either system.

The power for driving the dynamo is developed by two Straight-Line Engines of 75 H. P. each, running at 270 revolutions a minute.

The boiler-house is a spacious one, and contains a battery of 7 40 H. P. boilers, each built by Haywood & Bartlett, Baltimore, Md. They were installed by Baker, Smith & Co., of New York, who also did all the piping. The piping is all covered with patent air-space and magnesia covering.



ELECTRIC LIGHT PLANT IN NEW YORK HOSPITAL.

change is necessary in the adjustment of the brushes to meet the altered conditions of change of load. The machines have self-oiling bearings of large surface.

The switchboard is a very compactly built one, and is made of Italian marble. It is 6 feet 6 inches in length and 4 feet high. Mounted directly on the board are Cardew voltmeters, ammeters, a ground-detector, and Van Nuis Ajax switches for the various circuits. One feature of the board is that the switches and the switch-faces of the rheostats are mounted directly on the board, dispensing with the use of separate bases. At the back of the switch is a connection-closet where all necessary connections with the bus-bars and other parts are made with great facility. The switchboard was furnished by T. J. Murphy, the well-known switchboard maker, 136 Liberty street, New York city.

The present buildings are wired for 900 16 C. P. lamps, Underwood cotton-leather belting is used, and it runs noiselessly.

The plant, taken as a whole, is a model one in every particular, and reflects great credit upon the gentlemen who installed it, Messrs. Hatzel & Buehler, of 114 Fifth avenue, New York city. This firm is the new agent in New York for the Detroit Motor Co., of Detroit, Mich.

The accompanying illustration was made from a photograph of this plant taken by our special artist.

PERSONAL.

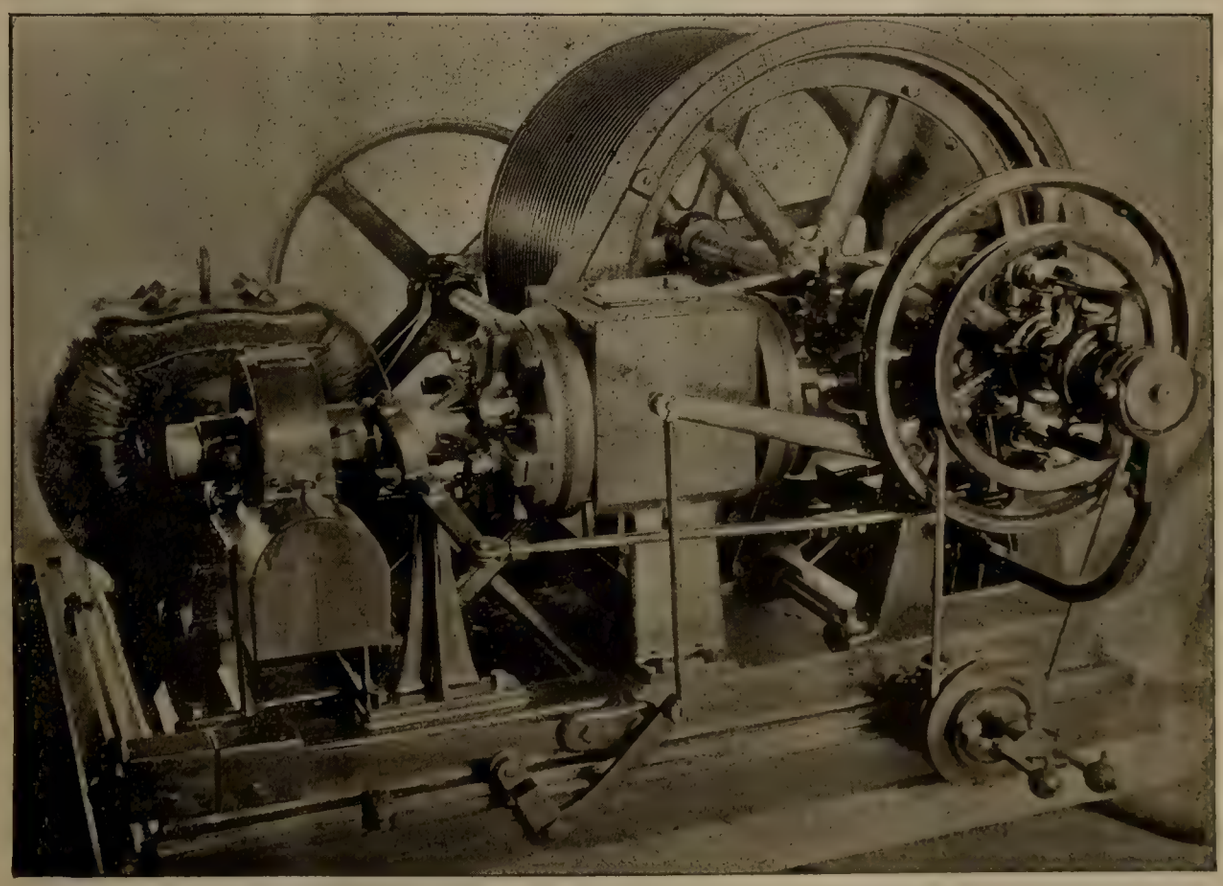
Mr. Carl Hering was married on June 30 to Miss Harriet B. Truesdell, of Philadelphia, the ceremony being performed in New York City. The couple will spend their honeymoon in Europe.

FRISBIE ELECTRIC ELEVATOR.

The accompanying cut represents one of the new Frisbie Direct Electric Elevators. The motor is run continuously during the hours of work, thus having its full power to start the load when thrown on by means of the friction clutches. The motor is connected to a screw shaft and runs into a worm gear that is keyed to the shaft that has the friction clutches, one being used to hoist and one to lower. The reverse motion is gained by a set of mitre gears, to which is connected the spur pinion that drives the drum gear. These gears are all cut by machinery and run smoothly and quietly.

The machine has an automatic stop motion that allows the car to be run at full speed and stopped at the extreme travel of the run independently of the operator. A slack cable-stop also stops the machine in the event of the descent of the car becoming impaired, and prevents the cables from leaving the drum. A speed governor also stops the machine if for any reason the speed of the car becomes greater than usual. The machine has, in fact, all the safety appliances that are required for all contingencies.

There are a large number of the machines running and all giving good satisfaction. The D. Frisbie Company has an office in the Mail and Express Building, New York city, and the main office and works are located in New Haven, Conn. This company has made many improvements in elevators within the last year, and will no doubt bring out many improvements in the near future.



ELECTRIC ELEVATOR MADE BY THE D. FRISBIE COMPANY.

SPECIAL NOTICE.

The New York office of the Consolidated Electric Storage Company, 120 Broadway, is the sole agency for the sale of storage batteries for New York and vicinity. Purchasers desiring to secure the best terms should apply at that office to E. J. Moore, manager.

ELECTRIC STORM VAGARIES.

BY WILLIAM FINN.

In a recent communication to the ELECTRICAL AGE on the subject of earth-currents the writer presented some details regarding the derangement of the telegraph service from the series of electric storms which began February 13 last, and continued with more or less frequency and intensity up to April 26.

Several recurrences of the phenomena have since been noted, and some curious and anomalous results observed.

On Monday, May 16, for instance, the entire quadruplex service between New York and Chicago over the Western Union lines was quite seriously interrupted all day by the prevalence of earth-currents, which, strange as it may appear, failed to sensibly disturb the more delicate apparatus of the automatic system until after 3 P.M., though that system is usually the first to indicate the fact of their existence in the wires.

The following day was a comparatively quiet one, only a few instances being recorded of interruptions from that cause; but early on Wednesday, May 18, an electric storm of considerable proportion put in an appearance, and continued to rage with varying degrees of violence all day and during a greater portion of the succeeding night.

At first the western wires alone felt the disquieting forces, but towards the afternoon the area of disturbance became greatly extended, and after 3 P.M. circuits in nearly every direction became influenced.

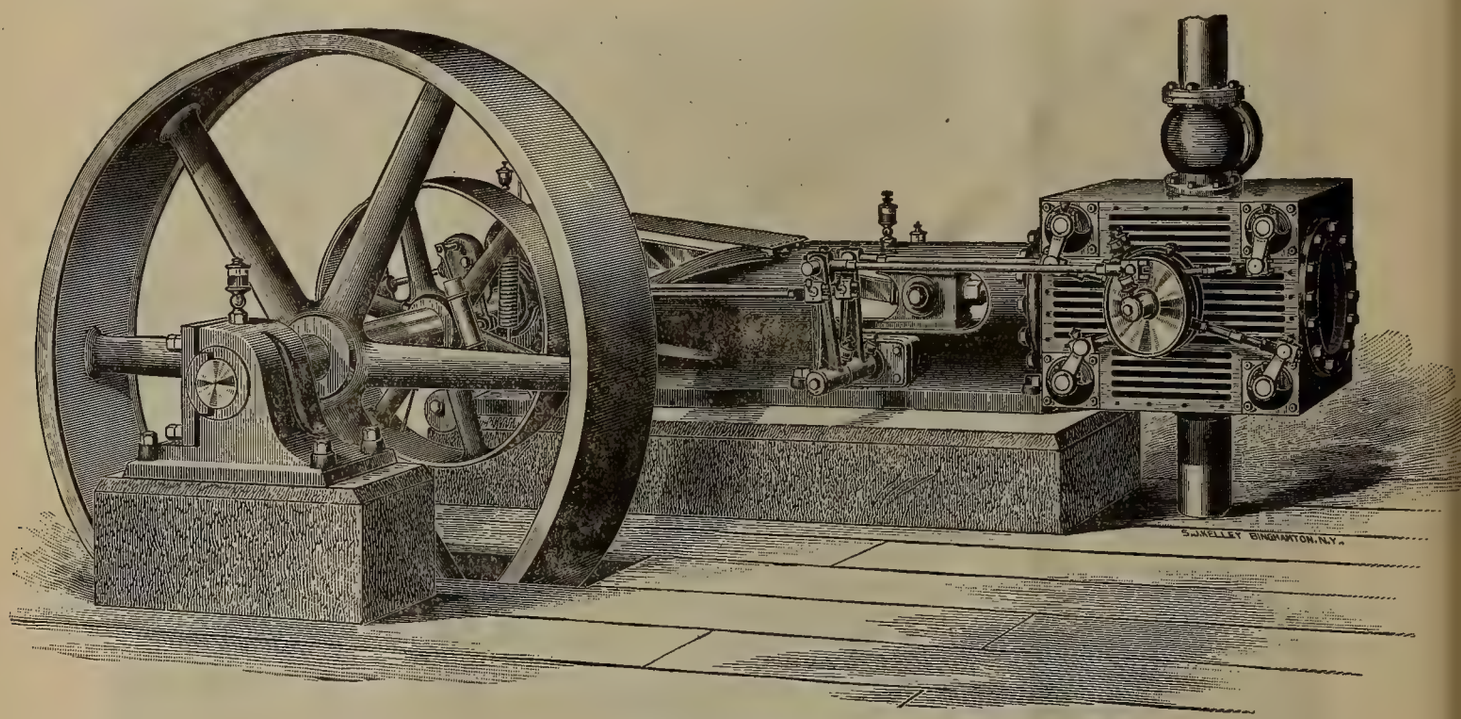
The maximum intensity was reached about 4 o'clock, at which time an earth-current in a wire between Buffalo and Chicago developed a strength of 35 milliampéres,

(Continued on page 395.)

THE PAYNE-CORLISS.

BY C. E. MANNING, M.E.

The age of iron, so rapidly merging into the age of electricity, is particularly marked by the rapid strides in machinery for the production of electrical power. In all practical electrical apparatus of any considerable size the real basis of production is the coal; so the next step is the water, thence the steam, thence the electricity. The first movement toward the mechanical production of electricity was to produce the machinery at any cost to produce required results. The next problem—the one which now confronts us—is to produce the machinery that will yield the same required results at a minimum cost. A step in this direction is the Payne-Corliss engine, which although on first investigation seems a compromise, is proving to be an advantageous one from an economical standpoint.



PAYNE-CORLISS ENGINE.

As will be seen from the engraving, the Payne-Corliss combines two universally-approved devices—the Corliss type of valves and the shaft-governor. Two wrist-plates have been substituted for the one in the Corliss engine proper; one wrist-plate actuates the steam valves, operating under control of the shaft-governor through a variable eccentric. The other wrist-plate actuates the exhaust valves only, and is operated by a fixed eccentric on the shaft, thus obtaining a constant free exhaust. The advantage thus gained gives a cut-off dependent directly upon the speed, and an exhaust unaffected by the variable point of cut-off. It also allows the close regulation of the standard shaft-governor.

It has been the aim of manufacturers of the modern high-speed engines to attain the economy of action of the long-stroke Corliss engine; and several approximations have resulted.

B. W. Payne & Sons, 41 Dey street, New York city, whose works are in Elmira, N. Y., have accomplished the desired result by using a double ported valve of the Corliss type, in which for any given angular motion of the wrist-plate the valve opening is twice that of the standard Corliss valve. This operates so satisfactorily that they are enabled to do away with the slow-working dash-pots and to obtain a positive valve motion that equals the best results of the Corliss disengaging valve-gear. The records of the indicator cards taken at several plants containing the Payne-Corliss, show a large gain in economy over the single-valve engine—results which compare very favorably with the longer stroke engines. These data, which were reported by the owners of the engines, show an economy of from 2.6 to 2.8 lbs of coal per H. P. per hour, on a basis of nine lbs. of boiler evaporation; engines non-condensing.

The Payne Company is installing a Payne-Corliss in the Haverstraw, N. Y. electric-light station, under written guarantee to save twenty per cent. in fuel over a single-valve engine which has been in operation for some time. If feasible, without interference with the working capacity of the engine, extensive tests will be made to determine how high a speed can be economically obtained.

As a step towards economy the Payne-Corliss is certainly in the right direction; it most assuredly merits the attention of electrical engineers as well as the owners of electrical or other plants who are not stockholders in coal property.

DIED FROM TASTING ELECTRICITY.

The death of Arthur James Yeo, a practical electrician, who recently died in New York, was said by his physician to have been due to too much electricity taken internally, and causing nervous apoplexy.

For some two years past, Yeo, who had been employed in the electrical works of Ostrander & Co., New York, had been in the habit of testing fine wire, such as is used for burglar alarms, etc., by touching them to his tongue. Then it began to affect him; his nervous system was undermined, and he grew weaker and weaker, and finally died. Previous to his employment in this city he had been working on the Panama canal, and caught the fever, from the effects of which he had never fully recovered; this may have aggravated his trouble. It is said that electricians throughout the city have been dismayed at Yeo's death, although many of them profess not to believe in the cause attributed by the attending physician.

OPERATING TELEPHONE COMPANIES.*

BY ALLEN R. FOOTE.

The report on telephones for the tenth census (1880) is presented in volume iv., commencing on page 787. Preceding the tables the following statement is made under the heading of "Remarks":

It is of the first importance to remember that the census year 1879–1880 was the year in which the telephone business passed through the stages of an unprecedented development. At the beginning of that year this business amounted to little or nothing. At the end of the year it represented one of the greatest interests of the country. Neither the census nor any other statistical agency can deal in a wholly satisfactory manner with anything which is subject to rapid and violent changes.

The tables exhibit 148 companies and private concerns, which aggregate 34,305 miles of wire, 54,319 receiving telephones, and 3,338 employés.

The collection of these statistics has been with a view to exhibit the telephone business in 1880 as completely as circumstances allowed, and for the purpose of establishing a basis for the future taking of such statistics.

The inquiry into this subject for the eleventh census is assigned to the Division of Manufactures, to place it properly in the group of electrical industries in said division. The form of publication adopted for the tenth census disclosed the detailed statistics for each reporting company. The form of publication adopted for the eleventh census is particularly designed to avoid disclosing the individual statistics of any reporting company, firm or person. For this reason, in presenting the statistics of operating telephone companies, a consolidated report is given, in which is grouped the statistics of all reporting companies, and comparison made with corresponding statistics for the year 1880, so far as the same are exhibited in the tenth census report.

Examination of the report now presented will show that many items are reported for the eleventh census that do not occur in the report for 1880, thus broadening the basis of comparison for future reports.

The percentages of increase and decrease from 1880 to 1890, in those items of essential interest to the public, are shown in the following summary:

sation. While these data possess considerable statistical value, it is impossible by such methods to convey a proper representation of the actual changes that have occurred in the business of operating telephone companies during the decade from 1880 to 1890. Improvements in instruments and exchange switchboards, changing from grounded to metallic circuits, placing wires underground, extension of lines to extra-territoral districts, and, finally, the introduction of long-distance service, combined to make the service rendered in 1890 more valuable and satisfactory to subscribers than the service rendered in 1880.

The presence in the statistics for 1890 for the first time of the items "5,029,438 feet of cables" and "54,690 miles of wire underground," requires a few words of explanation and comment. The rapidly increasing number of subscribers rendered it imperative to employ a very large number of wires for the service. This led to bunching of wires in cables. The average number of wires so bunched in present practice is about fifty pairs. The increasing number of wires and cables for various electrical purposes led to an urgent demand that the wires be placed underground in the congested districts of large cities.

A comparison of the cost of the two systems will be found in the subjoined table:

Cost of Telephone Line Construction.	Per mile of wire.	Per mile of productive wire. (*a.*)
Aërial lines, individual wires	$35.00	$35.00
Aërial lines, cabled wires	*b* 89.76	179.52
Underground lines, cabled wires	*c* 121.44	242.88

a. The cost per mile of productive wire is calculated on the basis of existing conditions, as follows: In aërial lines of individual wires, all wires placed are productive. In aërial lines of cabled wires the productive wires average one-half of all wires placed. In underground construction the productive ducts and wires average one-half of all ducts and wires placed. In the cities of Washington, D. C., and Baltimore, Md., there are 6,061 miles of wire underground. Of these wires 2 980 miles are productive and 3,081 miles are nonproductive at the present time (1892).

b. At this rate per mile of wire, the 5,029.438 feet of cables reported in 1890, containing 50 wires to the cable, cost $4 275,022 placed.

SUMMARY SHOWING PERCENTAGES OF INCREASE OR DECREASE FROM 1880 TO 1890.

Items.	Increase. (Per cent.)	Decrease. (Per cent.)
Number of companies, firms and persons reporting	.....	64.19
Interest-bearing and profit-sharing investment	395.30	.....
Interest bearing and profit-sharing investment per mile of wire	.....	29.34
Interest-bearing and profit-sharing investment per subscriber	5.30	.....
Net earnings per mile of wire	3.60	.....
Net earnings per subscriber	54.68	.....
Number of exchanges	183.98	.....
Miles of wire per exchange	145.57	.....
Number of subscribers per exchange	64.86	.....
Number of employés per exchange	.....	12.50
Miles of wire	600.81	.....
Miles of wire per subscriber	49.30	.....
Number of subscribers	369.61	.....
Number of employés	158.99	.....

The above summary shows that the number of subscribers has increased during the decade 369.61 per cent.; the number of persons brought into communication per exchange has increased 64.86 per cent.; the mileage of wire per subscriber has increased 49.30 per cent.; while the interest-bearing and profit-sharing investment has increased but 5.30 per cent. per subscriber.

Unfortunately, the census report for 1880 affords no basis of comparison for cost to subscribers per conver-

c. At this rate the 54,690 miles of underground wires reported in 1890 cost $6,641,553 placed. The feet of cables and mileage of wire underground is a duplication to the extent in which cables are placed underground.

The report for 1880 included the statistics of the American Bell Telephone Company, as at that time this company operated one exchange. The report for 1890 excludes the statistics of the American Bell Telephone Company, since it is not now an operating company.

The following tables show the number of operating

* Census Bulletin, No 196.

telephone companies, the amount and character of investments, revenues and expenses, the facilities furnished for public and private use, as well as the use made by the general public of such facilities for 1890 in comparison with similar data for 1880, so far as the same is possible, considering the enlarged scope of the inquiry for 1890.

Table 1 shows for 1880 and 1890 the number of operating telephone companies, the amount and character of investments, revenues and expenses :

TABLE 1.—COMPARATIVE STATEMENT, 1880–1890, OF OPERATING TELEPHONE COMPANIES' INVESTMENTS, REVENUES AND EXPENSES.

ITEMS.	1880	1890	INCREASE.		DECREASE.	
			Amount.	Per cent.	Number or Amount.	Per cent.
Number of companies, firms and persons reporting	148	53	.....	.....	95	64.19
Investments :						
Share investments	$13,358,720.00	$67,349,171.00	$53,990,451.00	404.16	.....	.....
Bond investments	1,247,067.00	4,992,565.00	3,745 498.00	300 34	.....	.....
Total interest-bearing and profit-sharing investments	14,605,787.00	72,341,736.00	57,735,949.00	395.30	.....	.....
Investment per mile of wire	426.00	301.00	.....	.....	$125 00	29.34
Investment per subscriber	302.00	318.00	16 00	5.30	.....	.....
Revenues and expenses :						
Gross earnings	$3,098,081.00	$16,404.583.00	$13,306,502.00	429.51	.....	.....
Gross expenses	2,373.703.00	11,143,871.00	8,770,168.00	369.47	.....	.....
Net earnings	724,378.00	5,260,712.00	4,536,334.00	626 24	.....	.....
Aggregate dividends	302,730.00	3,168,208.00	2,865,478.00	946.55	.....	.....
Surplus	421,648.00	2,092,504.00	1,670,856.00	396.27	.....	.....
Per cent. of net earnings on total investment	4.96	7.27	2.31	46.57	.....	.....
Per cent. of aggregate dividends on share investment	2.27	4.70	2 43	107.05	.....	.....
Gross earnings per mile of wire	$90.31	$68.24	.....	.....	$22.07	24.44
Gross expense per mile of wire	69.19	46.36	.....	.....	22.83	33.00
Net earnings per mile of wire	21.12	21.88	$0.76	3.60	.....	.....
Aggregate dividends per mile of wire	8.83	13.18	4.35	49.26	.....	.....
Surplus per mile of wire	12.29	8.70	.....	.....	3.59	29.21
Gross earnings per subscriber	$63.99	$72.15	$8.16	12.75	.....	.....
Gross expense per subscriber	49.03	49.01	.....	.....	$0.02	0.04
Net earnings per subscriber	14.96	23.14	8.18	54.68	.....	.....
Aggregate dividends per subscriber	6.25	13.94	7.69	123.04	.....	.....
Surplus per subscriber	8.71	9.20	0.49	5.63	.....	.....

Table 2 shows for 1890 the facilities furnished for public and private use by operating telephone companies in comparison with similar data for 1880 :

TABLE 2.—COMPARATIVE STATEMENT, 1880–1890, OF OPERATING TELEPHONE COMPANIES' FACILITIES FURNISHED FOR PUBLIC AND PRIVATE USE.

FACILITIES FURNISHED FOR PUBLIC AND PRIVATE USE.	1880	1890	INCREASE.		DECREASE.	
			Number.	Per cent.	Number.	Per cent.
Number of central exchanges	.....	774	.....	.....	.....	.....
Number of branch exchanges	.....	467	.....	.....	.....	.....
Total number of exchanges	437	1,241	804	183 98	.....	.....
Number of employés per exchange	8	7	....	.....	1	12.50
Number of telephones and transmitters (*a*)	108,638	467,356	358,718	330.20	.....	.....
Length of cables in feet	.....	5,029,438	.....	.....	.....	.....
Miles of extra-territorial wire	.....	50,921	.....	.....	.....	.....
Miles of long-distance wire	.....	40,309	.....	.....	.....	.....
Total mileage of extra-territorial and long-distance wire	.....	91,230	.....	.....	.....	.....
Miles of wire on poles	.....	171,498	.....	.....	.....	.....
Miles of wire on buildings	.....	13,445	....	.....	.....	.....
Miles of wire underground	.....	54,690	.....	.....	.....	.....
Miles of wire submarine	.....	779	.....	.....	.....	.....
Total miles of wire	34,305	240,412	206,107	600.81	.....	.....
Miles of wire per subscriber	0.71	1.06	0.35	49.30	.....	.....
Miles of wire per exchange	79	194	115	145.57	.....	.....
Number of day operators	.....	3,761	.....	.....	.....	.....
Number of night operators	.....	1,008	.....	.....	.....	.....
Number of other employés	.....	3,876	.....	.....	.....	.....
Total number of employés	3,338	8,645	5,307	158.99	.....	.....

a. The report of 1880 gives "Number of receiving telephones in use, 54,319." To make comparison with 1890, a transmitter is added for each telephone.

Table 3 shows for 1890 the use made of the facilities furnished by operating telephone companies in comparison with the data obtained for 1880 :

TABLE 3.—COMPARATIVE STATEMENT, 1880–1890, OF USE MADE OF OPERATING TELEPHONE FACILITIES.

USE MADE OF FACILITIES.	1880	1890	INCREASE.		DECREASE.	
			Number.	Per cent.	Number.	Per cent.
Exchange and toll stations		203,060				
Extra exchange toll stations		1,037				
Private lines and other stations		23,260				
Total number of subscribers	48,414	227,357	178,943	369.61		
Number of subscribers per exchange	111	183	72	64.86		
Number of exchange conversations		450,000,000				
Number of extra-territorial conversations		3,200,000				
Total number of conversations		453,200,000				
Average daily calls per subscriber :						
Exchanges with 100 or less subscribers		4.80				
Exchanges with 100 to 200 subscribers		6.25				
Exchanges with 200 to 500 subscribers		7.43				
Exchanges with 500 to 1,000 subscribers		8.00				
Exchanges with 1,000 to 1,500 subscribers		8.67				
Exchanges with 1,500 subscribers and over		8.86				
Average price paid per subscriber per call :						
Exchanges with 100 or less subscribers		3.25 cents.				
Exchanges with 100 to 200 subscribers		2.33 "				
Exchanges with 200 to 500 subscribers		2.40 "				
Exchanges with 500 to 1,000 subscribers		2.37 "				
Exchanges with 1,000 to 1,500 subscribers		2.14 "				
Exchanges with 1,500 subscribers and over		3.50 "				

ELECTRIC STORM VAGARIES.

(Continued from page 391.)

representing a potential difference between the two grounds of nearly 90 volts.

Conversation was subsequently carried on between New York and Buffalo, and signals exchanged over wires to Albany, Boston and Bangor by means of these natural currents.

It is a singular fact that at a time when circuits to Philadelphia, Washington and other comparatively short lines to southern points were almost entirely free from interruption, the longer southern circuits, such as those to Richmond, New Orleans, etc., could only manage to be operated with considerable difficulty and delay.

The most peculiar characteristics of the storm consisted in the variety of its vagaries and the suddenness of its changes.

At one moment the signals on the circuits affected would be rendered entirely unintelligible, while immediately afterwards the storm would so far subside as to admit of the ordinary signalling currents passing without any interference whatever.

These alternations of maxima and minima continued with more or less irregularity all day, the phase and period of one wave differing apparently from those of every other wave.

There have been electric storms in the past of much greater severity and longer duration, but none within the experience of the writer that presented so many anomalies, or exhibited such odd eccentricities as the one referred to.

The only effective remedy against earth-current disturbances on land lines appears to be in the use of the metallic circuit. It is possible to entirely exclude them by means of condensers interposed in the line, as is customary on long submarine circuits, but where neighboring wires are more numerous, and operated with currents of much greater intensity, the condenser introduces a fresh source of trouble from inductive action, which renders it practically useless in the ordinary transmission of the signalling currents.

ATMOSPHERIC ELECTRICITY.

In 1752 Lemonnier observed that the atmosphere usually was in an electrical condition. Cavallo, Beccaria, Ceca and others, added to our knowledge of the subject, and more recently Quetelet and Sir W. Thomson have generalized from more careful observations. The main result is that the air above the surface of the earth is usually, during fine weather, positively electrified, or at least that it is positive with respect to the earth's surface, the earth's surface being relatively negative. The so-called measurements of "atmospheric electricity" are really measurements of difference of potential between a point of the earth's surface and a point somewhere in the air above it. In the upper regions of the atmosphere the air is highly rarefied, and conducts electricity as do the rarefied gases in Geissler's tubes. The lower air is, when dry, a non-conductor. The upper stratum is believed to be charged with + electricity, while the earth's surface is itself negatively charged, the stratum of denser air between acting like the glass of a Leyden jar in keeping the opposite charges separate. If we could measure the electric potential at different points within the thickness of the glass of a Leyden jar, we should find that the values of the potential changed in regular order from a + value at one side to a — value at the other, there being a point of zero potential about half way between the two Now, the air in fine weather always gives + indications, and the potential of it is higher the higher we go to measure it. Cavallo found more electricity in the air just outside the cupola of St. Paul's Cathedral in London, than at a lower point of the building. Sir W. Thomson found the potential in the island of Arran to increase from 23 to 46 volts for a rise of one foot in level; but the difference of potential was sometimes eight or ten times as much for the same difference of level, and changed rapidly as the east wind blew masses of cloud charged with + or — electricity across the sky. Joule and Thomson, at Aberdeen, found the rise of potential to be equal to 40 volts per foot, or 1.3 volts per centimetre rise of level.

During fine weather a negative electrification of the air is extremely rare.

INDIVIDUAL SELECTION OF ELECTRICAL OBJECTS.*

BY S. S. BOGART.

Individual selection, as applied to electrical objects, has some interesting features. It is strikingly singular that it has not received more attention at the hands of the eminent persons here present. The application of a selector to any circuit to reach any of the objects desired and the necessity for such a device is doubtless as apparent to all as is the application of the current to telegraph, lighting and power. In the individual call-bell circuit we have a combination of electrical impulses on a transmitter (or sent by an ordinary Morse key) and selector-shaft that correspond with each other. Any other than the combination for that instrument throws in a false combination, upsets the pawls and restores the selector's sector to zero. This principle applied to all the other selectors on the circuit acts in a like manner. The call-bell set consists of a key, transmitter, relay, sounder, answer-back and bell. When the combination has properly completed its phase, the answer-back is vitalized, and it automatically transmits the assurance back over the wire that the object has been reached and the bell is ringing. The sounder is always in circuit, except when the bell is ringing, then all of the battery is transferred to the bell. But three cells of ordinary Callaud or gravity battery are necessary for the entire circuit. There are no short circuits ; always a magnet's resistance interposed, consequently the battery is in a normal condition. Does not waste under local action or wear out through short circuiting. The advantages of this system in saving time in calling offices has been carefully gone over, and as it is an undisputed fact that upwards of one-third of the time is spent in calling, the fact is apparent that the general managers will bless us all for not asking them to build additional expensive wires on which we are to spend one-third of the time calling the offices. The greater the number of wires the more difficult the problem of raising the one or two operators at some points. As we increase the number of wires on the poles, we increase the cross-fire or induction and escape. When the relay adjustments change to such an extent as to affect the sounder, the selector will work so long as the armature of the relay moves to its contacts. Other arguments too exhaustive to advance here could be offered in favor of the adoption of such a system. Fearing that they might smack too strongly of bias in favor of my own, I prefer to have my associates get the bias from another direction.

FOR ELECTRIC LIGHT AND POWER USES.

In connection with the use of arc lights, the selector system affords a simple and effectual means of starting and extinguishing lights at various hours upon the same circuit. Arc service, as is well known, is usually run on "day," "nine o'clock," "midnight," "all-night," and other circuits, and frequently all these may be found on one block or street. This multiplicity of circuits and variety of uses lead inevitably to greater expense, increased risk and difficulty of operation. The application of the "combination" device permits the several classes of lights to be operated on one circuit, and the central offices to control each separate class, or each group in that class, as desired. Incandescent circuits and those used for the transmission of power are equally subject to the control of the "combination selector," and in all branches of lighting and power work the system may be applied to advantage. The automatic attachment both ensures safety of operation and announces to the transmitting point the completion of the desired work, while the economy resulting from its use on circuits or wide extent of great activity will be an important consideration to every company employing electric lights or power.

FOR FIRE-ALARM AND POLICE SERVICE.

The use of these instruments on the police and fire circuits of cities enables an alarm to be confined only to such posts or stations as are at the moment required, instead of arousing the entire department, as is generally the case. The call may be limited to a single station, or to a group of them, or to a whole district, according to the "combinations" employed. The immense saving of time, money and fatigue to men and horses by the adoption of such an individual signal will be readily appreciated by all familiar with the present system in vogue in our departments of public safety. The chief of a department can direct his summons at pleasure to the stations he wishes to reach, and by using a number of combinations can employ as many different signals as necessity requires.

FOR TELEGRAPH AND TELEPHONE PURPOSES.

In "village and town" telephone exchanges, and upon long-distance and all private lines, the application of these selectors will ensure complete privacy by the exclusion of all intermediate telephones. In circuits of minor importance the central office may be entirely dispensed with, each subscriber being supplied with his own combination and those of the others upon the same circuit. This system permits calls to pass noiselessly through intermediate telephones, thus avoiding the vexatious ringing of all bells which now occur when one subscriber sends a signal to another. The fact that no message will be audible to any subscriber other than the one immediately interested, opens what is practically a new field for the development of the telephone.

FOR NAVAL AND MILITARY PURPOSES.

While, for obvious reasons, it is not convenient to discuss in detail the use to which this system is now applied in connection with military and other government service, it may be pointed out that it (1) gives at any moment to headquarters, or other proper authority, the control of the line ; (2) allows confidential intercourse between any two points on a circuit without including intermediate stations ; (3) gives to the commander of a battery of guns or torpedoes the faculty of discharging at will any one weapon upon a circuit without danger of affecting the others, thus dispensing with the necessity of having a separate wire for each individual weapon ; (4) places in the hands of headquarters or its delegates the exclusive power of affecting any electrical circuit, by giving them the means of changing the combinations of the various stations at pleasure, by which no station can be actuated except by one familiar with the respective "combination."

A more recent connection, and one that is received with marked favor by leading railroad men, is its application to the Leonard Interlocking Block Signal and the Leonard Train Order Signal. In the former it enables us to use a wire for other than blocking trains, thus saving a duplication of wires. In the latter the train dispatcher is master of the situation, and controls as many signals as he desires from his table, and receives assurance of the fact from the return signal that the object sought has been attained.

* Abstract of paper read at Convention of the Association of American Railway Telegraph Superintendents, held at Denver, Col., June 15 and 16, 1892.

Gray European Telautograph Company, Chicago, Ill., was incorporated June 21, with a capital stock of $100,000, to manufacture, buy and sell telautographs and other electrical devices. Incorporators: Charles P. Treat James W. Chisholm, Frederick W. Cushing.

THE PHYSIOLOGICAL EFFECTS OF ALTERNATING CURRENTS OF HIGH FREQUENCY.*

BY PROF. EDWIN J. HOUSTON.

GENTLEMEN: I have concluded to place on record a brief statement of the substance of some remarks made by me at the last meeting of the section, concerning the physiological effects on the human body of alternating currents of very high frequencies.

As is well known, the physiological effects of alternating discharges of but moderate frequencies are more severe than are those of steady currents of the same current strength. As, however, the rapidity of alternation increases, the severity of the physiological effects decreases, until at extraordinarily high frequencies all harmful physiological effects practically disappear.

Three varieties of electric discharges or currents are employed in electrotherapy for the treatment of diseased conditions of the body.

(1) The steady, continuous currents produced by voltaic batteries, and called, in electrotherapeutics, galvanic currents.

(2) The alternating currents produced by induction coils, and called, in electrotherapeutics, faradic currents.

(3) The electrostatic discharges obtained from frictional or influence machines, and called, in electrotherapeutics, franklinic currents.

As is well known, the physiological effects produced by galvanic currents differ markedly from those produced by faradic currents. The former, unless very powerful, produce on the opening or closing of the circuit a contraction that is of very short duration—in fact, almost but momentary; the latter produce a contraction that continues as long as the current is passing. This is generally believed to be due to the fact that the contractions attending the opening and closing of the circuit follow one another so rapidly that the muscles fail to assume the condition of rest, and so present the appearance of continuous contraction.

Franklinic currents produce, in general, effects somewhat similar to those of faradic currents.

When alternating currents are sent through the human body the physiological effects increase in severity with an increase in the current strength. With current strengths greatly in excess of those employed in electrotherapy additional effects are produced, and a tonic contraction of the muscles follow. Moreover, in such cases the severity of the physiological effects is increased by the high potential of the break-induced discharge.

As, however, the rapidity of alternation increases, the severity of the physiological effects decreases until, when enormously high frequencies are reached, the discharges become harmless. These facts have been demonstrated by Dr. Tatum for comparatively high frequencies, and by Nikola Tesla for enormously high frequencies.

In a lecture delivered before the American Institute of Electrical Engineers, at Columbia College, New York, on May 20, 1891, Tesla, speaking of these effects, says:

"I have found that by using the ordinary low frequencies, the physiological effects of the current required to maintain, at a certain degree of brightness, a tube four feet long, provided at the ends with outside and inside condenser coatings, is so powerful that I think it might produce serious injury to those not accustomed to such shocks; whereas, with 20,000 alternations per second, the tube may be maintained at the same degree of brightness without any effect being felt.

"This is due principally to the fact that a much smaller potential is required to produce the same light effect and also to the higher efficiency in the light production. It is evident that the efficiency in such cases is the greater the higher the frequency, for the quicker the process of charging and discharging the molecules, the less energy will be lost in the form of dark radiation."

The severity of the physiological effects attending any electric discharge through the body, must necessarily depend to a considerable extent not only on the quantity of energy present in the discharge, but also on the time in which it is acting.

It has occurred to me that in another circumstance is to be found, perhaps, the principal cause why discharges of enormously high frequency of alternation should be so comparatively harmless. This fact, I think, is to be found in the manner in which, according to our modern ideas, an electric discharge is believed to pass through a conducting path or circuit, viz.: that the electric energy is not propagated through the mass of the conductor itself, but rather through the dielectric or other medium lying outside the conductor; that the electric energy is rained down on the surface of the conductor from the space outside it, and sinks down into the mass of the conductor, the conductor forming a sink or place where the energy can be dissipated.

In the case of a steady, continuous current, the energy sinks or soaks rapidly through the mass of the conductor, so that the electric current, in the language of the old ideas, passes through all portions of the mass of the conductor.

In the case of alternating currents, however, the energy received from a single impulse or electrical movement, by sinking or soaking, moves, (say) from the conductor towards the centre, only while such impulse continues; and, when the direction of the impulse changes moves in the opposite direction, or towards the surface. In conductors through which alternating currents are passing, the current density is therefore greatest near the surface portions, and, in the case of alternations of very high frequency, the central portions of the conductor are entirely free from electric currents, the current being limited to portions near the surface.

In the case of the enormously high frequencies employed by Tesla, this action was so pronounced that conductors failed completely to conduct.

When, therefore, the human body is subjected to the effects of discharges of alternating currents of enormously high frequencies, the superficial portions only are traversed by the discharges. The more deeply seated vital organs, being thus free from current, such discharges are necessarily harmless.

As the frequency of alternation increases, the body becomes more and more protected, until, when the frequency becomes as great as that of the ether waves, which cause sunlight, they would probably produce on the surface of the body the same genial effects as are produced by the light and heat of the sun, with which they are probably identical.

If these views are correct, it would appear that when the human body is exposed to rapidly-alternating discharges, it is subjected at one moment to a discharge that might produce instant death, were it not for the fact that the bolt is practically no sooner hurled at the body than it is hurled away from it.

* Read before the Electrical Section of the Franklin Institute, Philadelphia, May 24, 1892.

The Village Electric Light Company, Greenbush, N. Y., was incorporated June 14, with a capital stock of $25,000. Incorporators: James Pidgeon, James Murphy, Henry A. Conway, all of Troy, N. Y.

The Electric Railway and Power Company, Tiffin, Ohio, was incorporated June 16, with a capital stock of $50,000. Incorporators: J. M. Naylor, George D. Loomis, B. W. Crobaugh, C. J. Yingling, Joseph P. Myers.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electroplating (*concluded*).

THE precipitation of metal upon articles to be plated is affected by the distance between the anodes and cathodes. By increasing the distance metal is more evenly deposited on rough surfaces, but for plane surfaces less distance is advantageous. If the distance between the plates be increased too much the resistance in the cell is correspondingly increased; it is therefore necessary to keep within certain limits. These have been well established by long experience. Thus, for nickel plating on plane, even surfaces, the distance between the anode and cathode should be about three inches; but for surfaces having prominences or cavities, the distance can, with decided advantage, be increased to from five to ten inches, according to the unevenness of the surface to be plated.

In suspending nickel anodes it is customary to use nickel hooks, but copper wire may be used, providing the wire is not allowed to come in contact with the solution.

The method of hanging silver anodes is somewhat different. They may be suspended by iron wires, or lead ribbons, but care must be taken to keep the plates entirely submerged, otherwise corrosion would take place on the anode at the surface of the solution.

The purity of the metal in the anode is a matter of great importance, and upon it depends the quality of the plating. The metal of the anode replaces that abstracted from the solution in plating, and should be as pure as possible. This refers to anodes of the same metal as that deposited.

Insoluble anodes of a different metal are used with advantage sometimes. Platinum, for instance, on account of its indissolubility, is recommended for nickel plating. There is an objection, however, to using indissoluble anodes, in that the electrolytic resistance is greater when such are used, requiring greater electrical energy to overcome it. Another objection is that the metallic density of the bath is being constantly weakened as the work of plating goes on, requiring constant attention and additions of fresh liquid in order to maintain the proper degree of saturation. This latter difficulty is, however, overcome by making the anodes partially of nickel. About one-third nickel is used in such plates, and the effect of an anode of a composite character is to maintain the constancy or strength of the plating solution, and keep the resistance of the bath down. But platinum is an expensive metal, and for this reason is not available to the experimenter or amateur.

The law of compensation, however, comes to our rescue here, and we have in carbon a good substitute, if platinum cannot be had. Carbon anodes, while they answer the purpose well, are liable to disintegration, pieces dropping off until the plates become useless. This happens when the best of carbon is used, and the only way to avoid the difficulties and annoyances consequent upon such disintegration is to renew the carbon plates from time to time. The breaking up of the carbon anodes is a weak point in their extensive use.

As much care, of course, must be given to the composition of the plating liquid as to any other part of the outfit, to obtain satisfactory results. In nickel plating the solution generally used consists of a double salt of nickel and ammonium. This is obtained by mixing either nickel chloride with ammonium chloride, or nickel sulphate with ammonium sulphate, distilled water being used for the purpose. The solution should be as near neutral as possible; that is, it should be neither acid nor alkaline. The condition of the solution can be tested with blue litmus paper. When the liquid is too acid the addition of ammonium will restore it to the desired condition, and *vice versa*, in case it be too alkaline. Solutions for silver plating are of greater variety. Silvernitrate, cyanides of silver and potassium, chlorides of silver and of soda, etc., are variously used for the purpose.

In gold plating the solution that is generally used consists of gold chloride combined with cyanide of potassium. The gold chloride is obtained by dissolving the pure metal (gold) in a mixture of two parts hydrochloric and one part nitric acid.

In this article space will not permit of our going into the practical details of the composition of the various solations, but for the benefit of those who desire to carry on experimental work in this line we would recommend a work which is replete with valuable information. We refer to "Electroplating," * by Urquhart. "Electroplating," † by Trevert is another good little book, although it is much smaller and necessarily more condensed than the former.

The preparation of the articles for the plating bath is one of the most important parts of the process, and one in which too much care cannot be exercised. The articles to be plated must be thoroughly cleansed to remove all traces of oxide and other deleterious substances which may adhere to the surface. This is done by immersion in liquid specially prepared, which are referred to in detail in the books above mentioned.

After the articles are carefully cleansed they are put into the plating bath. Great care must be taken in handling previous to putting them in the bath, as a touch of the finger on the surface to be plated would leave a grease spot that would resist the action of the current, and the result would be a blemish.

The energy of current required to plate successfully is a matter of importance. Three Bunsen cells constitute a good plating battery, but any bichromate battery will answer the purpose very well. The amount of current required of course depends upon the size and the number of articles to be plated, and on the size of the bath. Too little or too much current affects the character of the resuling work; the proper amount should therefore be properly determined. For amateur work, however, three cells of Bunsen battery, or its equivalent, will give good results.

All things being equal, it takes a longer time to plate with silver than with either gold or nickel. For silver it requires from 8 to 12 hours with a battery current; for nickel from 2 to 5 hours, and for gold a few minutes' immersion is sufficient, as gold is deposited very rapidly. To insure evenness of deposit and homogeneousness it is necessary to frequently agitate the solution.

CATALOGUE.

The E. W. Bliss Company, Ltd., and the Stiles and Parker Press Company, 17 Adams Street. Brooklyn, catalogue for 1892 is just out. It is a veritable encylopædia of what has been accomplished in the construction of presses, dies and special sheet-metal machinery; is gotten up in book form bound in cloth, profusely illustrated, and contains full description and prices for the great variety of presses, dies and machinery manufactured by the company.

Gray International Telautograph Company, Chicago, Ill., was incorporated June 29, with a capital stock of $1,000,000, to buy, sell and operate electrical appliances, and patents and privileges for same in foreign countries. Incorporators: Frederick W. Cushing, Horace A. Cushing, James W. Chisholm.

* Price $2.00.
† Price 50 cents. Both for sale by the Electrical Age Publishing Co., New York.

COMING DEVELOPMENT OF ELECTRIC RAILWAYS.*

BY FRANK J. SPRAGUE.

Impressed by the great development of this industry, and brought face to face with the changes it has wrought, the query is continually made: Will the electric motor replace the steam locomotive? It is similar to the older questions: Will the telephone replace the telegraph? Will the electric light annihilate the gas system? And, in all soberness, a like answer can be made: It will not; but it will, as the electric light and as the telephone have done, create a field of its own, and will replace a portion of the service now done by steam.

It seems to me that the growth of electric railways will proceed something in this order: First, the street systems in the various towns, then connecting lines between adjacent towns following the lines of highways; then longer connecting lines, either on the tracks of existing steam lines, or, growing bolder, on exclusive rights of way on the same order. Then will come suburban traffic on a larger scale, and freight transfer systems, and finally the more ambitious projects of trunk line service under limiting conditions.

It has been very properly said that a man will make the first long rides on electric railway by transferring from one town system to another through connecting links, rather than on individual roads. This is precisely the process by which great steam systems have been built up, although of course starting on a larger scale, and it is but natural that this shall be one step in the development of electric railways.

No one will question the capacity of a motor to do the necessary work required, or to make a speed superior to that of the steam locomotive, provided sufficient energy be delivered to its terminals, but we must deal with existing or probable methods of supply. It is true that the speed at which a train is propelled by steam has only increased about 50 per cent. in sixty years, for in 1832 the "Matthew Baldwin" often made a speed of a mile in a minute. But we must not confound speed with power, for while the maximum speed has not been so materially increased, the endurance, the perfection of the mechanism, the economy of performance have made great strides; the increased speed, which is by no means the maximum possible of a locomotive *per se*, has been attained at much higher powers, and the schedule time has been shortened principally by cutting down grades, strengthening curves, filling up ravines, abolishing trestle works, replacing wooden bridges by permanent ones of iron or stone, by the use of heavier and stiffer rails, better switches, improved methods of automatic signalling, the interlocking switch and signal system and the abolition of grade crossings; in short, by improvements in details and management which permit of higher speeds on more extended sections of road because of greater safety, lower traction coefficients, and a greater degree of confidence possessed in the engine.

All these things are necessary for high-speed electric railways, and any general improvements that will be of benefit to the latter must necessarily be of service to the former.

Almost every one is familiar with the remarkable run recently made by a Schenectady locomotive hauling a special train on the New York Central railroad, when the distance of 439½ miles from New York to Buffalo was made at an average speed of nearly sixty miles per hour, and which was the precursor of the Empire State express, which makes the regular run at an average speed of over fifty-two miles.

* * * * * *

On the New Jersey Central road one schedule time is 36¼ miles in 39 minutes, which is made where there are a number of necessary slackings in the speed. On the 13th of May the time was taken of the speed of a Baldwin compound locomotive for a considerable period of time on one of the regular runs. Ten continuous miles were made in 452½ seconds, and five were made in 222 seconds The fastest time taken was 44 seconds, and the slowest noted was 47.

In making these very high-speed runs there is not much attempt at maximum economy of coal consumption, the necessity being to generate steam as fast as required by the cylinders; but on taking an average of five trips I find that there was evaporated 7.19 pounds of water per pound of coal used. The total weight of train varied from 213 to 241 tons.

I recently inspected a number of engine sheets, one of which gave the duty of 25 engines. The average total cost per engine mile was 10.85 cents, of which 2.66 was for fuel. The total cost varied from 6.8 to 19.24 cents, and the fuel (wood) from 1.96 to 4.77 cents. On another sheet, giving the performance of 22 engines, the total cost per engine mile was 14.70 cents, of which the fuel cost 4.61. The total cost varied from 8.82 to 27.98 cents, and the fuel cost from 2.04 to 7.48. In still another, that of the performance of 18 engines, the total cost per engine mile was 14.73 cents, of which the fuel (coal) cost 6.62 cents. The total cost varied from 10.04 to 22.52 cents, and the fuel cost from 3.82 to 13.84 cents.

In discussing the electric system there is often a confusion of statements with reference to economy. Despite the undoubted fact that the electric motor can probably be run at variable high speeds with less variation of economy than can the steam locomotive, we must not forget that in the latter we are considering the economy of the unit as a whole, not merely of the steam cylinders, but also of the boiler and the furnace. In electric propulsion a similar comparison of economies must take into account the variable duty of the central station and the losses on the line as well as those in the motor, and where single units are used the variation in economy of the whole system would be much greater than in the steam locomotive. There will be only a reasonably fixed efficiency of the central station and the line when the number of units is large enough to make the load on the central stations nearly constant.

Some time ago I made a very careful analysis of the work done on the elevated roads in New York city, with a view of determining the coal consumption and the duty performed by the locomotives. At the time this investigation was made, now nearly seven years ago, there were in use on the Third avenue division 63 trains at one time, running at very close intervals. The weight of the trains was from 80 to 90 tons; the speed was often as high as 20 to 25 miles an hour; stops were made every third of a mile; in short, the duty demanded of the engines was exceedingly severe. The maximum indicated horse-power of the locomotives was found to average about 163 H. P., although on occasions these locomotives have been worked up to 185 H. P. Work was divided approximately as follows: Acceleration in starting, 59 per cent.; lifting, 24.3 per cent., and traction, 16.7 per cent. The average horse-power exerted was 70.3 H. P., considerably less than one-half of the maximum.

The work on the line was so distributed that there was an almost constant local duty of about 4,500 H. P. The locomotives were on duty 20 hours, but used steam only six hours, and including all losses when standing still and the amount of steam used in braking, there was a horse-power developed for about 6.2 pounds of coal per hour.

* Abstract of paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, June 6–8, 1892.

I believe that these figures are entirely reliable, and they show a remarkable performance when we consider the class of duty.

An analysis of the coal expenditures showed that, with an efficiency of 60 per cent. and without any of the energy of the train being returned to the line, the relative coal expenditures between steam and electricity would be about in a ratio of two to one; but if the energy of the train was returned to the line to the extent which I believe it is possible, then the relative expenditures of fuel would be in the proportion of seven to two. Since the coal charge on the four divisions was at that time about $550,000, it can easily be seen that, independent of any question of saving in the care of the structure, and any reduction or depreciation of the motor equipment, the fuel saving would be sufficient to pay a good interest on the cost of an electric equipment.

* * * * * *

Such a shape can be given to the front of an electric locomotive as will make the air resistance not over one-half that presented by a plain surface of equal cross section and perpendicular to the line of motion, but even this fact does not alter the other, that the resistance per ton must be higher for small trains than for large ones.

Speed, capacity and coal economy are, however, not the only questions to be considered in railroad operation, and in discussing the general subject it will be found that the signalling and braking questions at high speed are serious ones. Undoubtedly an electric train with distributed motors, making the weight of the train available for traction, could by using the motors as dynamos to return the energy of the train to the line from the highest to mean speeds, and then on a local circuit be more quickly and effectually slowed down and stopped than where shoe brakes are used, and both methods of course would be available. But if using a motor ahead of a train there will be comparatively little difference in the stopping power.

When riding at 60 or 70 miles an hour it is a very quick stop to bring a train at rest in less than 2,000 feet. This is often as far as any signal can be made out, especially when the weather is at all thick. Hence we may expect to find on electric railroads, if high speeds are to be attained, and quite possibly also on steam railroads, an extension of automatic signalling, so that trains indicate on more than two sets of signals. At present the practice is to divide the line into sections, and when a train passes a certain point it sets a danger and a cautionary signal, dropping the danger signal on the section just preceding, and the cautionary signal on the one beyond.

Turning now to the greater powers, we must not confuse the terms "large-powered" and "trunk-line" work. There are two statements which I think will need no corroboration. If we had a continuous train movement completely occupying a track system, there can be no question but that its operation from a central source by electricity would be more economical than if operated by steam locomotives. So, too, if a large number of units in reasonable proximity are moved, and the stopping and starting so regulated that the total demand upon the central stations is fairly continuous and equal, then there is no question as to the economy of electric propulsion as compared with steam. On the other hand, the operation of a single or very few units over a long distance would be so uneconomical and afford so small a return on the investment required as to make it prohibitory.

Between these two lies the condition of operation where steam and electricity meet on planes of equality. As the number of trains decreases, steam operation is the more economical; as the number increases, electricity must be preferred.

In discussing the use of electricity instead of steam, a well-known steam engineer recently stated that in his judgment it must be conceded that electromotive force for the propulsion of cars will not be economical except for suburban traffic and upon certain sections of important trunk lines like the New York Central, between New York and Albany, the Pennsylvania system, between New York and Philadelphia, the other lines of like character where it is necessary to dispatch a large number of comparatively light trains every day, and at short intervals. The principal field for a power of this kind would be in suburban service long enough to make the ordinary street electric cars unpopular because of the time required; and also in such cases as these mentioned above, for moving freight trains in cities; that is, for the performance of transfer service.

This is precisely in line with the arguments which I have advanced from time to time, and which I illustrated in a paper before the National Electric Light Association and its convention in Kansas City, where I outlined the possible service between New York and Philadelphia, which I believed to be practicable.

I must repeat that it narrows itself down to the one question as to the number of trains operated between two terminal points. Make that number of trains sufficiently large, and the electric motor is the best means of propulsion, whether for high or low speed, whether for large or for small cars. Decrease this number and we must rely on steam propulsion.

Of course I do not in this general reply consider those special cases where advantages are to be gained for which there is a return for capital in another direction. Such a case is that of the Baltimore tunnel, where the investment and cost of operation will be greater than that for steam propulsion; in fact, there will practically be no economy in power because the steam locomotives are not done away with, but are simply unused for a period of little over a mile. There is in this specific case, however, the incidental advantage of doing away with the necessity of a ventilating plant, and yet getting rid of the annoynces incidental to tunnel service.

Every system has its limitation. The electric is not exempt from this law, and hence it will be well to set forth what are well known limiting laws concerning the transmission of energy. They have been stated time and again, but somehow or another people often lose sight of them in discussing the question of investments in large electric railways, so that I think it would be well perhaps to restate and emphasize them:

"The weight of copper necessary to transmit a given amount of power with a fixed loss will vary inversely as the square of the electromotive force used.

"The distances to which it can be transmitted with a given weight of conductor will vary directly as the pressure.

"The distance to which it can be transmitted over a conductor with a given cross section will vary directly as the pressure.

"The weight of copper necessary where the supply station is in the centre of a system is only one-quarter that required if the station is at one end.

"The weight of copper will vary inversely as the square of the number of supplying stations properly placed.

"The electromotive force required will vary inversely as the number of stations."

Lack of knowledge of these simple and unalterable laws has led to much misconception of electrical possibilities, and these have not been confined to the electrical engineers.

Leaving out of present consideration trunk-line work, there are three problems requiring solution in the application of electricity to propulsion on a large scale under conditions existing, for example, in Chicago, or in any other place where there is a movement of a large number

of trains or more or less complicated tracks, as will be found at almost all terminal railway stations. They are :

First, the development of an electric locomotive of ample power which shall be as readily controlled as the steam locomotive, shall be reliable in operation, and shall show a high economy. Of course such a machine must have all the adjuncts which are necessary for train movement.

Second, a system of conductor and methods of supporting the same which can be relied upon for ample supply of current and absolute certainty of continuous contact at all speeds on curves, switches, cross-overs and the multitudinous combinations which exist on yard-tracks.

Third, a system of automatic block-signalling, which, while effective for steam traffic, will not be thrown out of operation by the use of tracks as conductors of electricity for a general supply. This is a more serious question than it is at first considered, for this use will materially interfere with, if not absolutely destroy, the utility of what is known as the rail-circuit system. This third problem is one which must necessarily follow the development of the other two, as the automatic signalling systems now existing have followed the development of steam practice.

It will probably be found necessary to erect a variety of conductors. From the most careful consideration which I have been able to give to the subject, I believe there is one way and only one way in which the current can properly be supplied in any complicated system, and that is from the overhead conductor, practically rigid in character, following very nearly the centre line of all tracks and switches, with no movable overhead parts, and with return through the rail. The locomotive would then practically be moving between two electric planes, the lower being the guiding one.

I know there has been a great deal of talk about other possible systems of supply. We have heard much of the charged rail using low potential currents supplied at frequent intervals by motor-generators driven from a central station. Since we have discovered no conductors devoid of resistance, and the art of welding is not particularly applicable for railway service where moving contacts are a necessity, little credence need be given to any scheme of this character.

Intimately connected with the question of conductors and one of the most serious ones which has to be met by the electrician, is that of potential.

For the present, and I think for a long time to come, we must confine ourselves to the consideration of railroad problems where continuous currents are used, and where the traffic between two points is sufficiently large to justify the investment in central stations and conductors which would be required for the operation of such a system.

THE "WORLD'S CHOICE."

The Westinghouse Electric and Mfg. Co., in accepting the contract for the entire incandescent lighting of the World's Columbian Exposition, promised the directory the finest electrical installation the world has ever seen. To make this entirely possible the company has decided, it is said, to use exclusively Grimshaw White-Core wire, cables, tape and compound. Doubtless many of the buildings will also be tubed with Vulca ducts. The current for every incandescent lamp used in the grounds and buildings of the World's Fair will therefore go through Grimshaw White-Core wire. Many of the arc lights, motors, etc., will also get their current from this well-known wire.

The New York Insulated Wire Co., the manufacturer of the Grimshaw White-Core Insulated wire, it would seem is justified in amplifying the scope of its assertion that Grimshaw White-Core is the "nation's choice," setting it up now as the "world's choice."

Grimshaw White-Core wire will, it appears, be exclusively used in supplying about 150,000 16 C. P. incandescent lamps with current, and the company has good reason to feel elated.

The contract for the World's Fair wire calls for over 15,000,000 feet, yet this order, immense as it is, will not disturb the regular business of the company in the slightest degree. It will continue to carry ample stock on hand to fill all orders on the same day they are received.

PATRIOTISM.

The American Electrical Works, of Providence, R. I., never lets a holiday go by without sending its greetings and a souvenir of some sort to its many friends. Its Fourth of July souvenir this year was one worthy of particular mention. It consisted of a neat card folded double, on the front of which was pasted a beautiful tiny silk American flag with the words "4th of July, 1892, American Electrical Works, Providence, R. I." underneath. On the inside was painted a verse from the "Star Spangled Banner" and seasonable greetings.

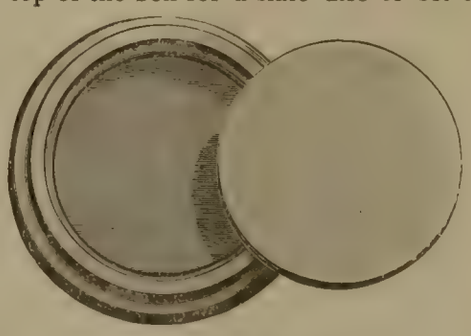
The whole thing was extremely neat in conception and execution, and the American Electrical Works are to be commended for their enterprise and patriotism.

"There is but one American flag, and but one American Electrical Works," and we may add; "and but one Eugene F. Phillips."

TURNED SLATE.

It is not generally known that slate is capable of being turned and fashioned, as well as wood.

The accompanying illustration represents a circular switch box of slate, 8 inches in diameter, one inch thick, with the centre turned out to a depth of three-quarters of an inch and a groove three-eighths of an inch deep, leaving the balance of the space between the groove and the top of the box for a slate disc to set in. The



SLATE SWITCH BOX.

thickness of the disc is just sufficient to make it flush with the top of the box.

The screws in the space below the disc are perfectly insulated, since all metal is completely surrounded by slate.

The box is manufactured by Mr. T. J. Murphy, Electrical Exchange Building, New York city.

Anything that can be turned out of wood can now be turned out of slate. Among the things turned from slate may be mentioned washers, spools, etc.

F. R. Dravo & Co., the Pittsburg representatives of the Ball Engine Co., Erie, Pa., manufacturers of the Ball Automatic Cut-off engine, recently furnished one 50 and one 100 H. P. engine to the Pittsburg Iron and Steel Engineering Co., Pittsburg; one 130 H. P. engine to the Moundsville Electrical Co., Moundsville, W. Va.; and one 80 H. P. engine to the Oakland Light and Power Co., Oakland, Md.

The Syracuse Twist Drill Company, 936 Grape street, Syracuse, N. Y., has issued its illustrated price list for June.

A GREAT ENGINEERING ENTERPRISE IN JAPAN.

The last mail from the Orient brings a very interesting account of the completion and successful operation of a great government work in Japan. Lake Biwa, having an area of 500 square miles, is located 7 miles from the city of Kioto and at an elevation of 143 feet.

A navigable canal has been cut from this lake to Kioto, involving two miles of tunnelling and an aqueduct of considerable length. At the eastern extremity of the city, to which point the canal has been brought, there is a sharp decline of 118 feet, from the base of which the canal is continued to the sea. This difference in level is overcome by inclined-plane ways 2,100 feet in length, on which boats are raised and lowered from one canal to the other. These ways are operated by electric power furnished from a Pelton Water Wheel, connected with a Sprague motor.

The fall above named affords also a very valuable water-power, a part of which has already been utilized for various mechanical purposes by means of electric transmission. The power-station is located at the foot of the incline and consists of three 8-feet and two 6-feet Pelton wheels, aggregating about 600 H. P., which are supplied with water from the high level canal by 3 lines of 36-inch pipe 1,300 feet in length, delivering water to the wheels under a head of about 100 feet.

These wheels are at present operating 3 Edison dynamos of 80 kilowatts each, the power from which is distributed about the city within a radius of 2 miles, running rice mills, spinning mills, a watch factory and various other machinery. One Thomson-Houston alternating-current dynamo of 2,000 volts supplies the city with 1,300 incandescent lights as well as many arc lights.

The above works, involving an expenditure of $1,500,000, were planned by and executed under the direct supervision of Mr. S. Tenabe, an eminent Japanese engineer, and their operation is said to be a great success both from a mechanical and financial point of view.

A NEW INCANDESCENT LAMP.

An incandescent lamp recently invented by E. W. Applegate, a telegrapher, was tested in the Western Union building, Chicago, Friday, June 24, and is said to have been a success in every respect, the light being much brighter than that given by the lamps in present use. A company is being formed to introduce this lamp, and it is proposed to sell the lamp for 25 cents, and guarantee it to have longer life than any other lamp in the market. Mr. Applegate said: "We will also guarantee that the bulb will not become black and discolored from filament. It is a lamp in which iron wire is used instead of platinum. The lamp has a lava head through which an iron wire passes, thus preventing the heat from reaching the point of seal. Lava is the poorest known conductor for heat. The bulbs and head of lava may be used a number of times, and it is the intention of the company to buy these bulbs from customers when exhausted. The filament or carbon is composed of a substance that will burn for a period of two hours in the open air. The period of life within the vacuum will exceed two years. The discoloration of the globe is prevented by the filament being transparent. It prevents the accumulation of any black sediment."

The new company will be known as the Applegate Incandescent Manufacturing Company.

A VALUABLE DIRECTORY.

About as complete a thing in the way of a directory that we have seen is the second edition of "The Architects and Builders' Guide and Contractors' Reference Directory," just issued by Samuel E. Hendricks & Co., New York. According to the publishers' statement, it contains the names of all who are engaged in construction work of any kind, and the industries that are kindred to it; including a very good list of those engaged in electrical pursuits, car builders, railroad purchasing officials, supply men, etc., all nicely arranged for ready reference. It makes a valuable office assistant and is an authority to be followed in addressing circulars, being arranged with a view to economy in that respect. Although the first edition of this work was the most complete publication of its kind ever issued, the second edition far surpasses it in every way. It is handsomely bound in cloth and sells for five dollars.

NEW INCORPORATIONS.

Neenah and Menasha Electric Railway Company, Menasha, Wis., incorporated June 15, with a capital stock of $150,000. Incorporators: Curtis Reed, W. R. Reed, S. Bullard.

The Passaic and Newark Electric Railway Company, Passaic, N. J., incorporated June 13, with a capital stock of $100,000. Incorporators: B. W. Spencer, B. Morrell, J. Kennell, W. R. Brown, F. M. Moore, Passaic, N. J.

The Cadiz Electric Light and Power Company, Cadiz, Ohio, incorporated June 14, with a capital stock of $15,000, to furnish electricity for illuminating and mechanical purposes. Incorporators: W. W. Wright, C. S. Scott, C. A. Holmes, James M. Sheriff, James B. Rogers, C. F. Brown, W. L. Sharp, W. T. Wood, C. Brown, Fred. D. Perry, L. B. Lamb, A. B. Sheriff, E. H. Atkinson, Charles S. McCoy, M. J. McCoy.

The Bayard Building, Loan and Improvement Company, Bayard, W. Va., incorporated June 15, with a capital stock of $25,000. Among other things it will operate an electric-light plant. Incorporators: W. McBrown, R. F. Whitmer, R. Workman, Bayard, W. Va.

Schlichting and Smith Company, Brooklyn, N. Y., incorporated June 24, with a capital stock of $75,000. Among other things it will manufacture electrical appliances. Incorporators: Albert T. Schlichting and Julius Smith, Brooklyn, N. Y.

The American Electric Rock Drill Company, Jersey City, N. J., incorporated June 23, with a capital stock of $250,000. Incorporators: R. G. Hollaman, C. E. Burke, Brooklyn, N. Y.; R. J. Horner, New York; A. B. Archibold, Jersey City, N. J.

The Bacon-Tyler Company, Berwick, Me., incorporated June 23, with a capital stock of $250,000, to manufacture and deal in mechanical, electrical and other devices. Incorporators: Charles N. Rogers, Henry S. Bason, William H. Tyler, Eben F. Thompson, Worcester, Mass.; H. V. Moore, Berwick, Me.

The North Kankakee Electric Light and Railway Company, Kankakee, Ill., incorporated June 25, with a capital stock of $30,000. Incorporators: J. H. Hardeback, Walter W. Hatch, August D. Ehrich.

San Francisco Electric Storage Company, San Francisco, Cal., incorporated June 24, with a capital stock of $1,000,000, to deal in and manufacture electrical machinery and generate and deal in electric light and power. Incorporators: D. Gilbert, Dexter C. B. Sessions, S. C. Mills, H. W. Spalding, San Francisco, Cal.; E. J. McCutchen.

The Tiffin Electric Street Railway Company, Tiffin, O., incorporated June 27, with a capital stock of $50,000. Incorporators: Meshech Frost, Frank Bloom, W. F. Noble, Ralph D. Sneoth, John L. Lott.

Security Insulator Company, Elizabeth, N. J., incorporated June 22, with a capital stock of $10,000, to manufacture and sell electrical supplies. Incorporators: F. L. Pope, G. C., Brown, A. S. Brown, Elizabeth, N. J.

Compound Electric Motor and Dynamo Company,

Chicago, Ill., incorporated June 25, with a capital stock of $500,000. Incorporators: Charles Turner Brown, Archibald J. Robertson, Frederick E. Turner.

Marlin Oil Company, Marlin, Texas, incorporated June 18, with a capital stock of $100,000. Among other things it it will supply electric power. Incorporators: N. Levy, T. E. Bante, T. A. Cheeves, J. W. Robinson.

The People's Light and Power Company, Aspen, Col., incorporated June 20, with a capital stock of $200,000, to supply electric light and power. Incorporators: George S. Newman, Moses L. Stern, Charles I. Thomson.

Central Light and Power Company, Peoria, Ill., incorporated June 22, with a capital stock of $200,000 to furnish electric light, heat and power, and steam power and heating. Incorporators: Walter Barker, J. Newell Ward, Walter S. Horton.

Normal Electric Light and Power Company, Normal, Ill., incorporated June 22, with a capital stock of $25,000. Incorporators: John W. Cook, A. S. Hotfield, E. B. Hillman.

The Marietta Electric Light, Heat and Power Company, Marietta, Pa., incorporated June 21, with a capital stock of $1,000. Incorporators: Henry S. Rich, D. B. Case, Albert D. Wike, all of Marietta, Pa.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 2, 1892.

HAVE you seen those unique pocket match-boxes the Okonite Company is getting out? If not, send for one. They are very neat and burglar-proof.

MR. ALBERT E. RICH on July 1 resigned his position as general manager of the Hunt Engineering Company, 126 Liberty street, this city.

T. Z. LATSHAW, general manager of the National Electric Light Manufacturing and Construction Company, is installing 2,500 incandescent and 100 arc lamps in Westchester, N. Y. The plant includes 4 dynamos. Mr. Latshaw had not completed arrangements for the engines when your representative saw him.

A VERY interesting work on researches in electro-allotropic physiology and the application of different qualities of electricity to cure disease, is published by the Jerome Kidder Mfg. Co., 820 Broadway, and sold for the small sum of 25 cents. The medical battery manufactured by this firm has had a phenomenal success, as is attested by the numerous testimonials received, some covering a period of twenty-five years and over.

SOME time ago in mentioning the progress being made by this firm of Hatzel & Buehler, we gave by mistake their old address, 29 West 26th street. Ever since May 1 they have been located in handsome quarters in the elegant new building, 114 5th avenue, where they have on exhibition a beautiful collection of pictures of residences, public buildings, hospitals, etc., in which they have installed complete electric light plants, etc., since which they have added several more.

MESSRS. J. G. WILLIAMS & CO., 9 Richards street, Brooklyn, N. Y., are extensive manufacturers of drop forgings in iron, copper and other metals, for dynamos, motors, and electrical apparatus generally. Their business has grown to such large proportions as to necessitate the building of an additional factory. When it is completed they will add more machinery, doubling their capacity. An examination of their catalogue will give some idea of their work.

OIL WELL SUPPLY CO., of Pittsburg, Pa., has opened a branch store at 32 Cortlandt street, this city, with Mr. C. F. Collins as manager. A full supply of artesian well supplies and stationary and drilling engines will be kept constantly on hand. The company will shortly have at the above branch store a new stationary boiler the cost of which, Mr. Collins claims, will be 40 % less than that of the ordinary stationary boilers. No doubt under the management of Mr. Collins, who is a very wide-awake and affable gentleman, the business of the Oil Well Supply Co. will prosper.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	200 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	154 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill., N. Y.	5,400,000	100 00	85 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	84 00
Edison General	15,000,000	100 00	103 00
Edison General Receipts		100 00	108 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	44 00
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	108 00
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 25
Laclede Gas pref.	2,500,000	100 00	58 50
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co.	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 75
Postal Telegraph	10,000,000	100 00	55 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s, Ark.	50,000		*97
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00

Names of Companies.	Capital.	Par.	Price.
The Ongley Electric Co., N. Y.....	250,000	100 00	85 00
The Siemens & Halske Co., Ill.....	500,000	100 00	par
The Washington Wat. Pow., Wash.....	1,500 000	100 00	90
The Wells & French Co., Ill.....	600,000	100 00	par
Thomson-Houston Electric Co.....	6,000,000	25 00	64 75
Thomson-Houston pref.....	4,000,000	25 00	29 50
T.-H. Electric Co. 5s, Boston.....	500,000		*99
United States Elec. Co.....	1.500,000	100 00	25 00
United States Illuminating, N.Y.....	1,250,000	100 00	26 00
Western Union.....	86,188,852	100 00	95 75
Westinghouse Elec. & Manf. Co.....	7,000,000	50 00	28 50
Westinghouse Elec. Co. pref. 7s.....	4,000,000	50 00	45 50
Westinghouse Ass. Rects.....		50 00	18 00
West Point W. Lt. & P. Co., Va.....	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

On June 22 last another and most satisfactory stage was reached in electrical finances by the listing on the New York Stock Exchange of $4,024,400, preference shares, and $29,847,100 common stock of the General Electric Company, of New York. The Stock Exchange committee is empowered to add as desired $227,600 preferred, and $612,900 common stock. On the 23d the stock appeared among the regular quotations, fifty shares having been sold at 107½, and closing for the day with 108 asked. It was very noticeable that when the Edison General was fluctuating between 90 and 102, that 50 shares was often the average clear up and down the limit. I hope to see the General Electric before fall a leader on the floor. The New York Guaranty and Indemnity Company at once notified the holders of trust receipts issued by that corporation for stock of the Edison General, and the common stock of the Thomson-Houston Company, which had been deposited with them, as per the agreement of February 9, 1892, that on and after June 23, they would be prepared to deliver as against those receipts the new stock. The books for the transfer of trust receipts will permanently close on August 1, prox. The terms of exchange are as follows: One share of the common stock of the General Electric Company for each share of the Edison General Company represented by such trust receipts, and three shares of the common stock of the General Electric Company for every five shares of the common stock of the Thomson-Houston Electric Company represented by such trust receipts. This will considerably change the names as they appear in the list quoted regularly in the Electrical Age after the 1st of August. The amalgamation has been carried out without disturbing the many contracts in which the different companies and sub-companies were engaged. The various offices, factories, plants and franchises have been turned over to the General Electric corporation, and the public at large have experienced no inconvenience. The new stock will no doubt continue the same average of dividend as has been paid by the several parts when disconnected, and the increase will not be seen by the shareholders until the whole workings have been systematized, and the greater profits ascertained. General Electric bonds may also be issued as a new security. I believe the Thomson-Houston as a parent company never issued any of its own bonds, although there are a few collateral bonds of local companies out among the financial institutions. The Edison Electric Illuminating Company, of New York, also listed on the Stock Exchange the same day an additional issue of $900,000, making a total listed of $5,400,000, and also an additional issue of five per cent. convertible bonds of $400,000, making a total amount listed of $2,650,000.

As the telephone business of the United States must learn its lesson from the United Kingdom, the financial facts as set forth in the public meetings held in London, are most desirable testimony.

The Consolidated Telephone Construction and Maintenance Company, (Limited), held its eleventh annual meeting under the presidency of Mr. C. L. W. Fitzgerald, on June 9 last. The chairman said in substance, "it was with extreme regret that the directors were obliged to present accounts which were not so favorable as on previous occasions. On the credit side, the sum of £6,665, was profit on manufacturing. Last year it was £9,619, and had averaged £8,000 or £9,000 each year since 1885. Last year the patents held by the National Telephone Company expired, and consequently the United Kingdom became free for any one to compete for telephone business. The foreigners—German, French, and Americans especially—were not slow to take advantage of this fresh market; one and all started agencies in London and elsewhere, and in addition, hosts of small English firms began making telephones. The Board had manufactured a first-class article and got a substantial price, but the foreigners and others began to offer telephones at a less price, so they had to reduce theirs also. This state of things had gone on for the past six months. Competitors offered telephones as low as 20 to 30 shillings, and of course their customers asked them to do the same; the result was that they had not sold many of their high class expensive telephones, but got orders for cheap instruments which yielded a lower profit. Foreign nations had put on export duties which injured business. This accounted for the falling off in their profits. The measure they proposed to adopt was to reduce their fixed charges and manufacture with the greatest economy; as to the sub-companies, the financial crisis in Portugal had had a detrimental effect on business of the Anglo-Portuguese Telephone Company, and the directors of that company had considered it would be unwise to pay a dividend. The Austrian government had signed a contract with the Telephone Company of Austria, for the purchase of the company's exchange business, to take effect from January 1, 1893, which would result in the repayment of a considerable sum for securities which they held in the Austrian company." I don't think comment on this report is necessary at present, it speaks for itself, and shadows the condition here early next year.

HEAVY-DUTY ENGINE FOR ELECTRIC RAILWAY SERVICE.

The extremely varying load which a steam-engine in an electric railway power-station is so often called upon to carry calls for the fulfilment of special conditions, prominent among which are great strength and prompt acting of the governing mechanism. It was through lack of one or both of these essential points that some of the engines in the early installed stations have shown themselves unfit for the task assigned them.

The Ball Engine Co., of Erie, Pa., has recently brought out an engine especially for electric-railway service which is, for its cylinder capacity, of great strength and weight—the makers claiming that the engines they build are, for the horse-power, the heaviest engines made. The connecting-rod and crank-shaft are of forged steel. The crank-shaft is eight inches diameter in the crank-pin and in the journals. The crank-pin boxes are lined with strictly genuine babbitt; the cross-head boxes are of pure copper and tin. The cross-head pin is of tool steel. The system of oiling the running parts is very simple and thorough. The valve which has been used by this company with such great success in the past in their electric-light engines is continued in the heavy-duty engine. This engine has shown in practice perfect regulation under conditions where the variation in load on the generator from zero to the full capacity has occurred during less than five seconds of time. The makers of this engine, working on the theory that the electric-railway interests demand a strictly first-class engine, are using the very best possible material and workmanship throughout, and claim to give perfect satisfaction.

TO EXTEND ITS PLANT.

Less than a year ago, owing to the great expansion in its business, the Ball Engine Co., Erie, Pa., was forced to erect a large and complete machine shop which was filled with the latest and most modern improved tools. No idea was entertained at the time that any further increase would be necessary for several years to come; but the demand for the latest improved Ball engines, built by this company, has been so great, especially for electric railway work, that already the company has been again compelled to make a further extension of the same building. This extension, which is now under way, will be built on the gallery plan, the same as the balance of the building. It will contain, among other valuable features, the most complete testing blocks and apparatus in the country, and will be capable of testing engines of very large capacity. Every engine that leaves the works of the Ball Engine Co. is thoroughly tested and guaranteed to give satisfaction under the most unfavorable circumstances.

The Electrical Age's Illustrated Patent Record.

Issued June 28, 1892.

477,635. Electrical Keyboard. William E. Blodgett, Faribault, Minn. Filed March 17, 1890.

477,637. Electric Regulating Apparatus. Julien M. Bradford, Portland, Me. Filed Sept. 29, 1890.

477,645. Battery. William A. Childs, Englewood, N. J., assignor of one-half to Frank Shaw, New York, N. Y. Filed Dec. 27, 1888.

477,652. Writing-Telegraph System. Harry Etheridge, Pittsburg, Pa., assignor to the Writing-Telegraph Company, New York, N. Y. Filed Sept. 10, 1890.

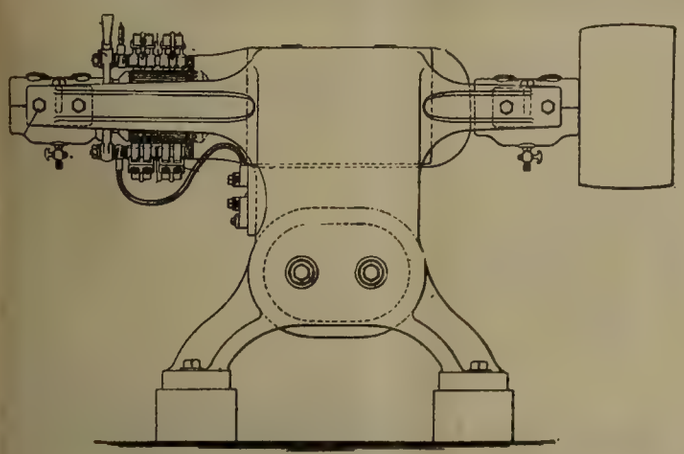
477,656. Lightning-Arrester. Frederic Haselwander, Frankfort, Germany. Filed Oct. 2, 1891. Patented in Germany.

477,665. Individualizing Cut-Out for Printing-Telegraphs. Samuel R. Linville, Philadelphia, Pa. Filed Feb. 10, 1892.

477,695. Thrust-Collar for Axles of Electrically-Propelled Vehicles. Richard P. Osgood, Methuen, Mass. Filed March 14, 1892.

477,708. Electric-Current Regulator. Charles D. Sigsbee, U. S. Navy, and Thomas S. Hayward and Frank S. Anderson, Easton, Md. Filed Sept. 11, 1891.

477,712. Automatic Test for Burglar-Alarm Systems



477,729.—DYNAMO-ELECTRIC MACHINE.

Alfred Stromberg, Chicago, Ill., assignor of one half to Mark Simons, same place. Filed March 17, 1892.

477,729. Dynamo-Electric Machine. James J. Wood, Fort Wayne, Ind. Filed Dec. 1, 1891.

477,734. Electric Railway. Joseph W. Bates, Minneapolis, Minn., assignor to the Bates & Blake Electric Railway Conduit Company, same place. Filed March 17, 1892.

477,753. Insulator. Frederick D'A. Goold, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed Oct. 24, 1891.

477,786. Socket for Incandescent Lamps. Evelyn L. Smith and George C. H. Foster, Bridgeport, Conn., assignors to the Crown Electric Manufacturing Company, same place. Filed Sept. 7, 1891.

477,787. Electric Conductor. Charles T. Snedekor, Worcester, Mass., assignor to the Washburn & Moen Manufacturing Company, same place. Filed Oct. 17, 1891.

477,810. Receptacle for Portable Electric Lamps. Herrman Molendo, New York, N. Y. Filed April 21, 1892.

477,835. Phonoporic Telegraphy. Charles Langdon-Davies, London, England, assignor to the Phonopore Syndicate, Limited, same place. Filed April 20, 1892. Patented in France.

477,853. Electric Telemeter. Cornelius T. Barrett, Brooklyn, N. Y., assignor of one-third to Harry W. Douty, Jersey City, N. J. Filed Nov. 5, 1891.

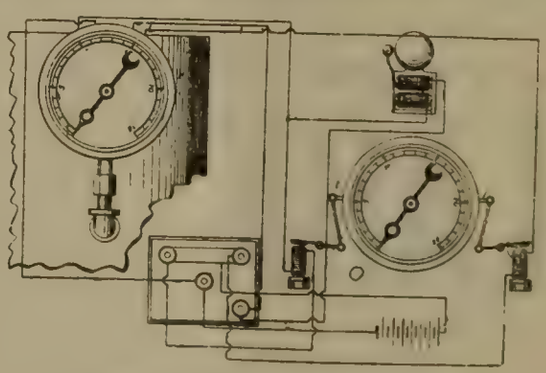
477,866. Telephony. Robert Hope-Jones, Birkenhead, England. Filed Sept. 17, 1891.

477,869. Electric Switch. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y. Filed Oct. 8, 1891.

477,879. Electric-Current Transformer. Norman T. Wilcox, Meriden, Conn. Filed Aug. 20, 1891.

477,890. Mast-Arm Electric Switch. Thomas Dillon, Indianapolis, Ind., assignor of one-half to John Caven, same place. Filed March 31, 1892.

477,897. Electric Lock. William H. Hollar, Elizabeth, N. J., and Frederick S. Holmes, Malden, Mass., assign-



477,853.—ELECTRIC TELEMETER.

ors to James W. Torrey, Merchantville, N. J. Filed Feb. 3, 1890.

477,898. Electric Lock. William H. Hollar, Elizabeth, N. J., and Frederick S. Holmes, Malden, Mass., assignors to James W. Torrey, Merchantville, N. J. Filed Feb. 3, 1890.

477,913. Voltaic Body-Battery. Wilson F. Potter, Albany, N. Y. Filed April 4, 1892.

477,914. Secondary Battery. William L. Silvey, Lima, Ohio. Filed June 15, 1891.

477,931. Telephone-Tablet. Joseph S. Gold, Columbus, Ohio, assignor to the Gold Telephone-Tablet Company, same place. Filed Jan. 25, 1892.

477,932. Telephone-Tablet Support. Joseph S. Gold and Adam H. McAlpine, Columbus, Ohio, assignors to the Gold Telephone-Tablet Company, same place. Filed March 26, 1892.

PATENTS.—Continued.

477,950. Electric Alarm. Stephen M. Mathews, Rat Portage, Ontario, Canada. Filed Nov. 16, 1891.

477,951. Composite Electric Conductor. Charles A. Mezger, Brooklyn, N. Y. Filed Oct. 30, 1891.

477,975. Electric-Bath Apparatus. Henry E. Waite, New York, N. Y. Filed May 17, 1892.

477,980. Insulator. Herbert C. Wirt, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 21, 1890.

477,984. Electric Lamp or Conductor-Support. Charles Bell, Stroudsburg, Pa. Filed March 23, 1892.

477,986. Electrical Stop-Motion for Knitting Machines. Albin Beyer, Brooklyn, N. Y., assignor to Henry Gernshym & Brother, same place. Filed Oct. 5, 1891.

478,011. Automatic Electric Change-Maker and Check-Receiver. Thomas Mangan, New Orleans, La. Filed Sept. 26, 1891.

478,018. Electrode for Secondary Batteries. Harry G. Osburn, Chicago, Ill. Filed April 7, 1891.

478,032. Electrical Organ. Richard P. Strand, St. John, Canada. Filed March 23, 1892.

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NEW YORK STREET RAILWAY ASSOCIATION.

At the tenth annual meeting of the Street Railway Association of the State of New York, which will be held at the United States Hotel, Saratoga Springs, N. Y., on Tuesday, September 20, 1892, at 10 A.M., the following papers will be read: "Recent Improvements in Cable Traction," by Mr. George W. McNulty, engineer Broadway and Seventh Avenue Railroad, New York; "Recent Improvements in Electric Traction," by Mr. L. H. McIntire, engineer Harlem Bridge, Morrisania and Fordham Railway, New York.

ILLUMINATION OF INTERIORS.

The illumination of the interior of buildings by artificial light is a subject that has always required the highest degree of skill to obtain the best results. To secure the proper amount of light in a given space is a problem that requires nice calculation, and since the advent of the electric light this subject has become a science. Coincident with the development of electric lighting the matter of fixtures for the lights has also received very close attention, and the combination of science and art has resulted in illuminating effects that are wonderful and beautiful to behold.

We print on another page an abstract of a paper on this subject read by Mr. W. H. Preece, the eminent English electrician, before the Royal Institute of British Architects, which is full of interest. Mr. Preece gives some general rules for the proper distribution of light, which no doubt will be valuable to many of our readers.

ELECTRICALLY ILLUMINATED SIGNS.

At the junction of Broadway and Fifth avenue, this city, an electrically illuminated sign nightly attracts a great deal of attention.

Hitherto, as a rule, the application of this class of signs has been confined in-doors, but this sign stands out boldly in the open air, where the thousands of passers-by cannot help seeing it, and marvel at its extent and character. It is an immense affair, and the same results could not possibly be attained by any other known method of illumination. This great sign is fully described and illustrated in another column.

This application of the electric light is an ingenious one and cannot fail to develop a large field for itself.

LAMP PATENT DECISION.

We publish elsewhere the decision of the commissioner of patents in the appeal from the decision of the examiners-in-chief in an interference case between Edison and Swan.

The examiners-in-chief awarded priority of invention to Edison on two interference issues involving the use of a carbon for an electric lamp formed by carbonizing a strip of card-board, paper or parchment-paper.

The dates of the invention of each party and the corelative facts are considered at length, and the commissioner refers to several decisions on like points to sustain his, that "when one of the contestants for priority has a patent for the invention in dispute and the other is an applicant for a patent, the latter, in order to prevail, must present a case both as to conception and as to reasonable diligence which does not admit of a reasonable doubt," and concludes that "Edison's case, as a whole, fails of affording that high degree of proof which the law and the surrounding facts call for." He therefore reverses the decision of the examiners-in-chief and awards priority of invention to Swan.

Joseph W. Swan was granted the patent October 19, 1880, and Mr. Edison filed his application May 27, 1881.

The decision affords interesting reading as the subject is one of considerable historical interest.

NOTABLE ELECTRICAL SIGN.

The beautiful exhibit at Madison Square Garden, New York city, during the recent Actors' Fund fair, of the novel developments in electric lighting by means of new small lamps, formed the initiative and experimental effort on a grand scale of a new department of the Edison General Electric Company—the sign and decorative lamp department.

The adaptability of the electrical incandescent light for ornamental sign work was considered as fully proved by the success encountered at the Actors' Fund fair, and the president of the Long Island R. R., Mr. Austin Corbin, while viewing the many pretty effects obtained, decided to have a sign of his own, and commissioned the new department to realize his ideas.

On the corner block on 23d street, formed by the confluence of Broadway and Fifth avenue, stands a small building behind which rises a huge overtowering construction nine stories high, exposing a plentiful surface of blank wall over the top of its dwarf neighbor. This surface, sixty feet wide by sixty-eight feet high, has for the past few evenings been the cynosure of the eyes of everybody coming down Broadway or Fifth avenue, or walking east or west along 23d street. Upon the surface of this wall is erected perhaps the largest illuminated sign in the world, and certainly the largest and most conspicuous electrically illuminated sign. By means of this sign Mr. Corbin brings on these hot days to the attention of a sweltering public the fact that the Coney Island of the well-to-do Manhattan Beach is swept by ocean breezes, and emphasizes the various other special attractions to be found at that well-known pleasure resort.

In this sign there are one hundred and seven letters, some six feet, some four feet and some three feet high, each one which is in reality a box of galvanized iron. In the interior of these boxes, arranged in the outline of the letters, are a small number of Edison porcelain series plug cut-outs which are here used as lamp receptacles. At the lower end of each letter is a small sliding door, giving access to the plug cut-out which serves to protect the lamp in that letter. Each letter is suspended and clasped top and bottom to two iron rods formed of strong steam piping, which are securely attached to the wall by expansion bolts.

The illumination of the sign is obtained by the use of no less than 1,457 16 C. P. Edison lamps of different colors—white frosted, red, blue and green. The current is taken from the mains of the Edison Electric Illuminating Co. There are seven sentences, each of which is on a separate and distinct circuit controlled by a lever switch. The switches are arranged temporarily on a rough wooden frame, and as the primary object of the sign is to keep the different sentences constantly appearing and vanishing, the operator is in a state of constant agitation from dusk until eleven o'clock at night, when all the circuits are opened and the brilliancy extinguished. It is a strange fact, but true, that so long as the changes are being rung the public is attracted and stands agape watching the sign, but as soon as the whole seven sentences are lighted and allowed to remain so the people move on their way and the crowd disperses. The number of possible changes on these seven sentences is 5,040.



ELECTRICALLY ILLUMINATED SIGN, JUNCTION OF BROADWAY AND FIFTH AVENUE, NEW YORK CITY.

From the switchboard, along the roof of the smaller building, the line is led to the base of the wall, whence the different wires shoot up into the air to their respective sentences.

At the end of each line is a small platform, and between each line a long rod of bicycle steel, each fastened securely to the wall, as are the letter supports, by expansion bolts. A flying ladder 8 feet long with small wheels, fits top and bottom to two of these rods and enables the

attendant himself to run along each line and replace any broken or burnt-out lamps or blown fuses in a very few minutes.

As an additional protection to the wires outside, they are run through conduit tubes thoroughly taped at their junctures, and are carried up the wall on porcelain insulators.

The great difficulty with this sign, as is the case with all outside electric lighting work, lay in preventing the deleterious effects of rain and moisture. This has been overcome by fastening to the galvanized iron box letter covers over each hole through which the lamps are thrust into the receptacles, small pent houses of iron which project out over the lamps and carry off the rain, without interfering in any way with the effect of the sign. Any rain which might collect on the lamp surface is prevented from running down into the receptacle by a small projecting brass ring fastened to the outside of the lamp near to the screw shell.

Each sentence is painted a different color, so that during the day the only one thing lacking is the brilliancy of the illumination.

The entire work on this was completed in about fifty days. It was designed by and constructed under the supervision of Mr. F. R. Upton, Mr. A. D. Page and Mr. McAllister, of the lamp works of the Edison General Electric Co., Mr. Corbin having practically given them *carte blanche*.

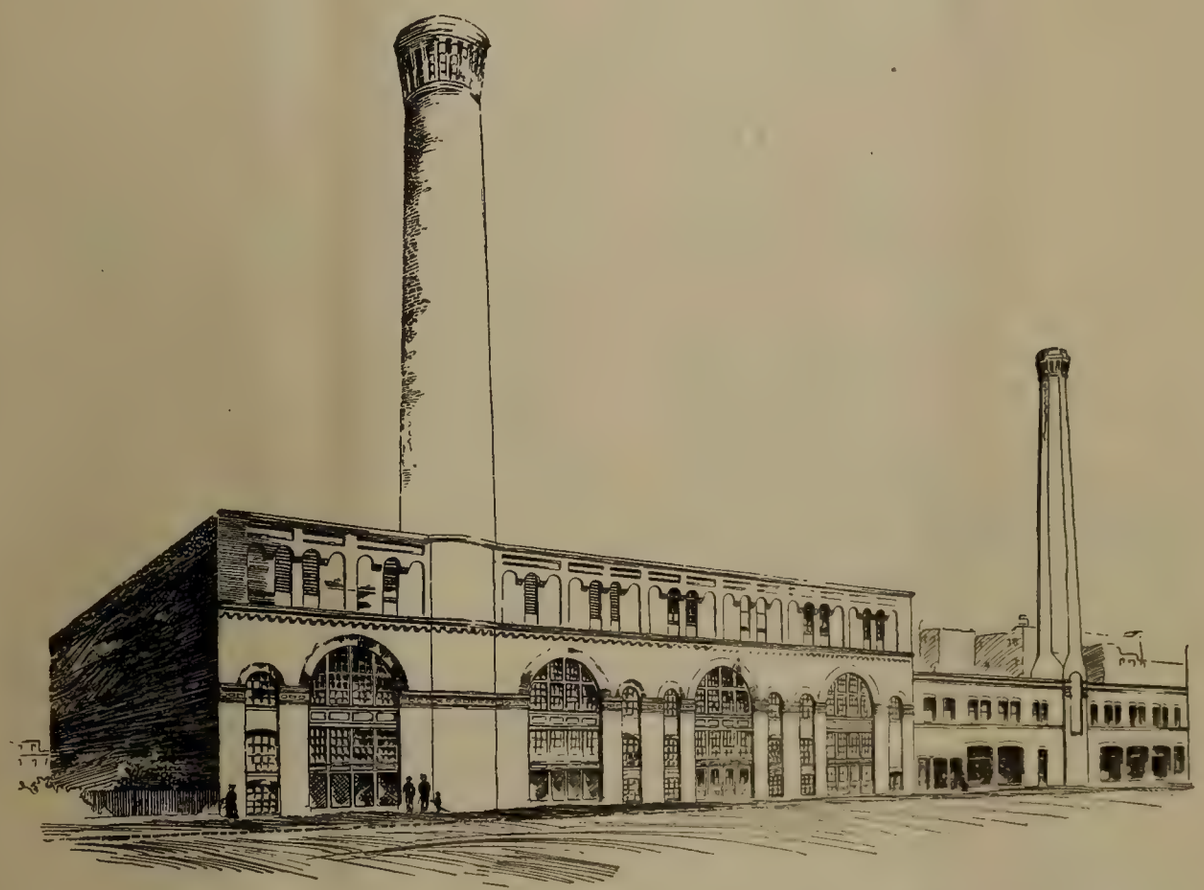
This illuminated sign is not only a commercial success, but when all the lamps are lighted is really a thing of glory. Its splendor is visible from far away up town, and its glow on the sky can easily be seen from the East and North rivers.

It is an immense step forward in the evolution of the electric light and its application to commercially advantageous uses.

SAN FRANCISCO'S NEW ELECTRIC STATION.

The accompanying illustration shows station "C," now in course of erection, on Jessie street, San Francisco, Cal., for the Edison Light and Power Co. The building, which was designed expressly and is in every way adapted to the purposes for which it will be used, has a frontage of 165 feet, and is 80 feet in depth. The foundations are of the most substantial character, being of cement concrete, and the walls are faced with stock bricks. A slab of concrete 28 feet square, with a thickness of 9 feet, constitutes the foundation for the smoke-stack, which will have the following dimensions when completed: Height, 175 feet; outside diameter at base, 18 feet 6 inches; flue, 12 feet in the clear.

The main building is divided into two sections—the boiler and engine rooms. The roof will be supported by steel trusses 17 feet deep. The trusses are made of this extraordinary depth in order to support the coal bunkers. The coal is dumped into hoppers under the sidewalk and carried by endless hoists to the bunkers and thence through chutes to the boilers.



NEW ELECTRIC LIGHT AND POWER STATION, SAN FRANCISCO.

The section of the building set apart for the engine-room will be provided with three floors and gallery. The second and third floors will be supported by the roof truss, while the first will be supported from the basement.

The engine foundations are made of solid concrete 9 feet in thickness, which will prevent any vibration.

The boiler plant will consist of 27 boilers, with an aggregate of 7,000 horse-power. Elevators are provided for lifting machinery, etc., from one floor to another, and in every respect the building will be complete and modern.

These facts and illustration are taken from the *California Architect*.

A DYNAMO INDICATOR; OR, INSTANTANEOUS CURVE-WRITING VOLTMETER.*

BY GEORGE S. MOLER.

In connection with the work in dynamo and motor testing in the physical laboratory of Cornell University, it was found desirable that some method should be devised which would enable the student experimenting to very quickly explore the field of a machine, so that he could study some of the changes which might take place even in a few seconds. The double-brush method of

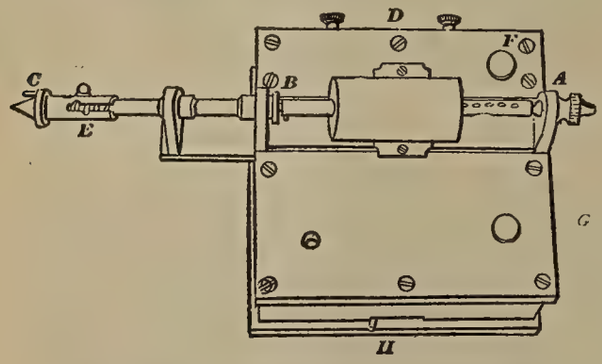


FIG. 1.—A CURVE-WRITING VOLTMETER.

Dr. S. P. Thompson and the single-brush method of Mr. W. M. Mordey are in use and give excellent results, but either of these methods requires a few minutes at the very shortest to obtain the data for a single curve.

To attempt to meet this want the writer devised the instrument which is the subject of this paper. It is intended to be used in tracing those curves which show the changes in potential of the two ends of a single coil of the armature, and also those showing the changes between one brush and one of the commutator bars, as the armature revolves. The instrument consists in the main of a very rapidly vibrating needle of a voltmeter, and a smoked cylinder against which the pointer is made to press at the required moment. The curve is traced during a single revolution of the armature and is then easily transferred to paper, and is thus placed in a permanent form to be studied at leisure. The voltmeter, which is inclosed in the body of the instrument, is of the permanent-magnet form. The needle is of soft iron, and is very short, and held at zero by being placed between the poles of a powerful steel magnet. The pointer is made of aluminium and is quite short. It is shaped so as to be as light as possible, and so that the air cannot offer much resistance to its motion. The cylinder is of metal and very smoothly finished, so that it will offer little resistance to the movement of the pointer. It is mounted upon a short shaft and is arranged so that it can be slid to several different positions; a spring dropping into notches holds it at each place. The stationary pivot at *A*, Fig. 1, is made with a spring so that the cylinder can be quickly removed for smoking or transferring the curves. This short shaft is connected with the driving shaft of the instrument by projecting pins at *B*, so that it will always maintain the same relative position with the pin at *C*. The pin *C* is attached to a sliding sleeve which is pushed toward the point of the shaft by a spring. A hole or a pin in the end of the armature shaft is to engage with the pin *C*, so that the cylinder will always have the same relative position with the armature. To operate the instrument two insulated wire hoops or bands are to be wound around some convenient part of the shaft or commutator, and one is to be connected to one commutator bar and the other to one of the adjacent ones. Small brushes are to be made to press upon these bands, and they are to be connected to the binding screws at *D*. The cylinder is then lightly smoked by removing it and revolving it over a candle or gas flame; then it is placed in position. The sleeve carrying the pin *C* is pulled back and latched in the notch *E*. Then the point is pressed into the centre hole in the end of the armature shaft; this will put the drum in motion; then by letting the projecting knob strike the finger the sleeve will be unlatched, and will spring forward and engage with the pin in the end of the armature shaft. Then pressing the button *F* closes the circuit, and pressing *G* brings the pointer against the drum. *H* is a reversing switch. The base line of the curve is drawn by pressing *G* only. Another form of curve will be obtained if one of the terminals of the indicator is attached to one of the permanent brushes of the dynamo, and the other to one of the brushes pressing upon the band connecting with one of the commutator strips. Also a temporary exploring coil may be wound upon the armature, and its terminals may be connected to the indicator.

The voltmeter of the indicator is necessarily one of low potential, so that the changes in a single coil will produce a suitable deflection. For greater changes of potential a resistance must be used in series with it. The curves are transferred from the smoked cylinder by dampening a sheet of paper and then rolling the cylinder over it. Three distinct copies have in this way been made from one set of curves. One of these instruments has been built and has been tested in various ways and is found to give very satisfactory results. The rate of vibration of the needle was determined while the pointer

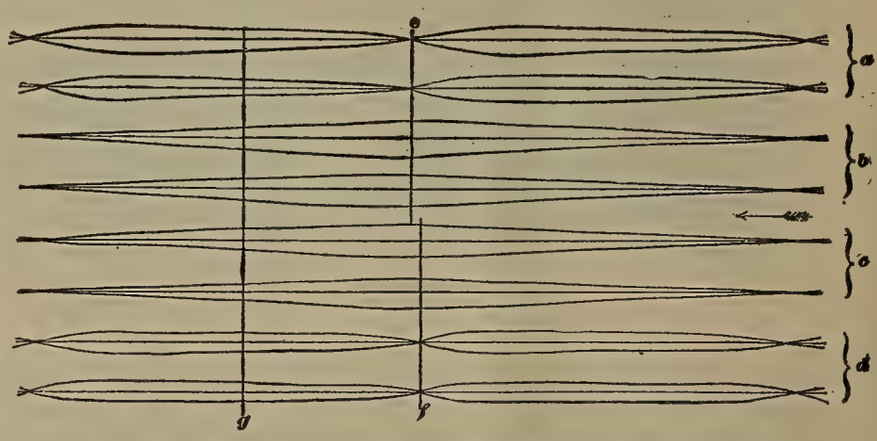


FIG. 2.—CURVES TAKEN FROM THE MOLER INSTRUMENT.

was in contact with the revolving drum, and was obtained as follows: A current was applied so as to produce a deflection, then while the drum was revolving at over a thousand revolutions per minute the needle was brought in contact with it and the circuit was then broken, making a wavy line extending part way around the drum before it died out. The average rate of oscillation as determined from over 40 measurements was 103 per second, and the damping effect was so great that in .04 of a second the needle was brought to rest. It was also observed that the deflection was not changed by bringing the pointer in contact with the revolving drum.

One of the desirable features of the indicator is the rapidity with which the curves can be made. The cylinder

* A paper read before the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

full of curves, eighteen in all, with their base lines, were made in 73 seconds, so it is seen we can explore the field many times while a dynamo is charging up just after being started, or while any great change in load is being made.

In Fig. 2 are shown some of the curves produced by exploring the field of a 20-ampère shunt-wound dynamo of the consequent-pole type. The dynamo was driven at a speed of 1,075 revolutions per minute, and had an automatic regulator, which held it at 115 volts, with slight variations. The curves *a* and *b* were made while 20 ampères were flowing in the main line, and *c* and *d* while the outside circuit was broken. The curves *a* and *d* show

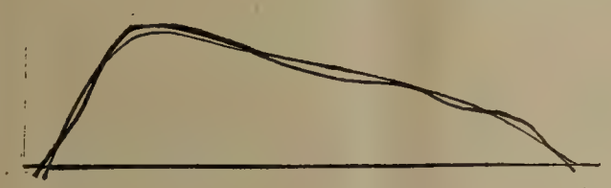


FIG 3.—COMPARISON OF CURVES TAKEN BY TWO METHODS.

the changes in potential of the two ends of a single coil. The line *g* shows the position of the centre of the pole-piece, and the arrow the forward direction of the curves. The double curves upon each base line were made by reversing the terminals by means of the switch *H*. The line *e* is the position of the neutral point when 20 amperes were flowing, and *f* its position when the line is open. The difference in shape of the curves shown at *a* and those at *d* is very marked. The curves *b* and *c* were made by connecting one terminal to one of the dynamo brushes, and the other to one of the brushes connected to one end of a coil. These also show the change of the neutral point, and a change in shape for open and closed circuit.

The instrument is calibrated by comparison with a standard voltmeter. For each reading on the voltmeter a line is drawn around the drum. When the pointer is not in contact with the drum some of the effects of inertia can be noticed, but when contact is made they seem to almost disappear, and corrections may be applied to compensate for the lag on that account.

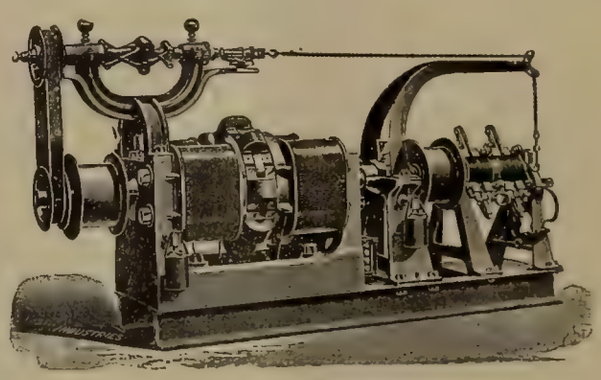
To test the reliability of the instrument one of the 20-ampère curves for half a revolution and similar to *a*, Fig. 2, was taken at random, and the data taken by two students, over which to obtain they worked at least an hour, and had to contend with fluctuating speed and voltage. These two curves were drawn to the same scale and are shown in Fig. 3, the heavier and most fluctuating line being by the experiment. The agreement is about all that can be expected, so it seems that the instrument is capable of giving reliable results.

RAILWAY LIGHTING PLANT.

Quite a number of American electricians give much thought and time in their effort to produce a perfectly practicable and reliable system of lighting railroad trains by electricity, and a considerable number of trains in this country are now lighted in this manner. Yet there is room for improvement, and it will interest these experimenters to learn something of what is being done in this particular line on the other side of the Atlantic.

The accompanying illustration shows an electric-light plant designed for English train service. It was recently exhibited by the Brush Electrical Engineering Company, London and Loughborough, and of which some sixty examples are now in use. Certain special qualities render the Brush dynamo peculiarly adapted for railway work. The Brush machines of this type add to simplicity and durability a constant electromotive force over a great range of speed, which is essential for successful railway work, and with this plant it has been shown that in a three-fold variation of speed, from about 500 to 1,500 volts, the electromotive force varies but 2 per cent.

The apparatus, which is entirely automatic, requiring only the guard to turn the lamps on or off as may be required, consists of a dynamo, battery cells and controlling gear, the carriage being usually wired with all the lamps in parallel. The lamps can be run from cells, whether the dynamo and train are running or not. When the train is at rest the brushes are not on the commutator, and the lamps are supplied with current from the accumulator. The dynamo, which measures about 6 feet by 17 inches by 3 feet high, is driven from the axle of the guard's van by means of a belt. When the train starts in either direction the brushes are automatically brought into the correct position on the commutator, and connections are made which give the field the polarity to suit the particular direction of rotation. When the train attains a speed so great as to drive the dynamo at about 500 revolutions per minute, which is the speed giving the necessary electromotive force, a centrifugal governor, shown in the illustration, connects a relay with the cells; this relay allows the cells to excite the fields, and when the latter are fully excited the charging circuit is closed by an automatic switch, and charging begins. At the same time a small resistance is inserted in the lamp circuit to compensate for the difference of electromotive force across the mains, due to the cells being charged. From this initial charging speed the dynamo maintains a practically constant



LIGHT PLANT FOR RAILWAY TRAINS.

pressure up to the highest speed attained, the usual range being 1 to 3. That is, the dynamo starts charging when the train is running at one-third speed and continues to charge at all higher speeds. That a remarkable constancy is maintained through a long range of speed variation will best be seen by the following results of an actual test:

Revs.	Volts.	Ampères in lamps.	Total ampères.
1,420	57	50	65
1,000	57	50	62
875	57	50	59
620	56	49	56

520 dynamo automatically cut out.

The lamp current and voltage is practically constant, the variation of the total current being due to change in the back electromotive force of the cells. The absence of sparking in this dynamo is attained by means of a centrifugal governor, which, through the medium of a chain, rocks the brush holders in the proper direction against a spring. This governor also answers the purpose of switching the dynamo in and out, and of closing or opening the exciting current at the proper speed.

NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENT.*

BY PROF. BENJ. F. THOMAS.

In the discussion of Mr. Milton E. Thompson's paper on "A Study of an Open Coil Arc Dynamo," read before the institute on the 21st of May, 1891, Dr. Geyer referred to some work done at Stevens Institute by the

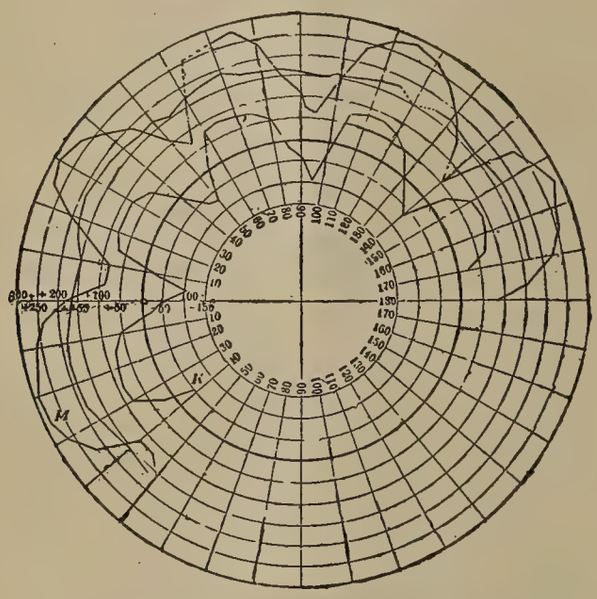


FIG. 1.

writer, in which work the wiping contact method seems to have been used for the first time. The following brief account of the work is presented at the request of several members of the institute.

In the latter part of July, 1880, President Morton requested the writer to determine the power required to maintain the arc of a Brush arc light, supplied with current by a Brush dynamo machine.

Ammeters and voltmeters were then unknown, and among the electrical instruments in the Stevens laboratory the most convenient for the purpose seemed to be a tangent galvanometer for the current measurement, and a condenser and Thomson galvanometer for potential. The condenser was a one-third microfarad standard, and the galvanometer a 7,000 ohm, four-coil astatic, both made by Elliott Bros. As every one knows would be the case, trouble was encountered the moment the potential readings began. The condenser being first connected to the two carbons, and then discharged through the gal-

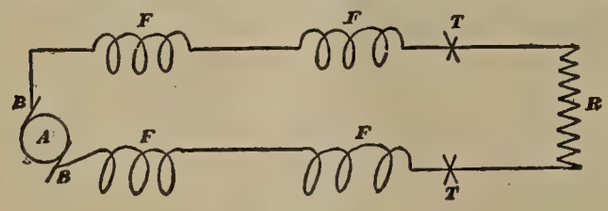


FIG. 2.

vanometer, the successive throws of the needle were found to vary widely, and what seemed at the time most curious, *the throws were sometimes to the right, and sometimes to the left.* A little reflection showed that while varying throws in one direction might be due to varying resistance of the arc, throws in opposite direction could only be produced by an actual reversal of the potentials of the two carbons. This, of course, led to the conclusion that the potential difference at the terminals of the dynamo must vary with the angular position of the armature as it revolved. Wishing to know the character and magnitude of the variation, the writer devised what is now known as the wiping contact method, the natural and only expedient for the purpose.

The condenser was joined, through the usual discharge key, to the terminals (or other points) of the dynamo by two well-insulated wires. At the dynamo one of these wires was cut, and the cut ends attached to a pair of well-insulated springs of flat metal, mounted on the outer end of a radial arm, the latter fastened to a horizontal rod coaxial with the armature. A well-insulated piece of

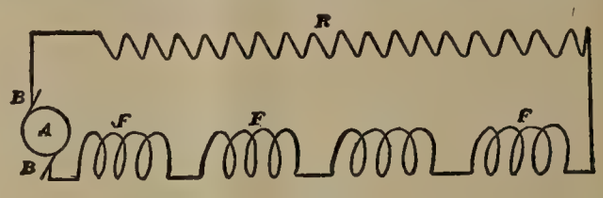


FIG. 3.

metal was fastened radially on the face of a disc attached to the armature shaft, and the two brushes set so that they were lightly touched by the radial strip at each revolution of the armature. A pointer attached to the horizontal shaft carrying the radial arm and contact springs moved over a divided circle on the support of the arm, so that angular positions could be read. The contact device thus acted as an open-circuit key, the closing of which, and the consequent charging of the condenser, could only take place when the armature was in a definite position. The process of obtaining the curve of potentials through a revolution of the armature is now so familiar that further description is unnecessary.

In carrying out the examination of the machine, a non-inductive resistance of German silver wires was prepared to avoid complications from the action of the arc lamp. When this was used as a load for the machine, the throws of the galvanometer changed at once from the erratic behavior observed at first to the beautifully regular and uniform character now so familiar to all who have used the method under proper conditions.

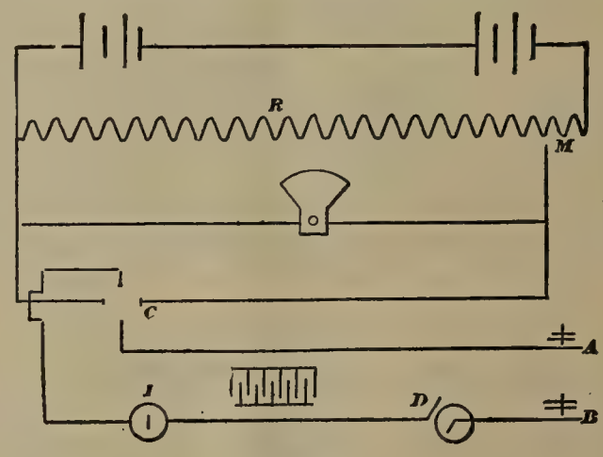


FIG. 4.

Fig. 1 is a copy, to scale $\frac{1}{10}$, of the original curves of measurements made Aug. 4. The inner circle gives the angular readings of the circle over which the pointer moved. Deflections of the galvanometer, on discharging the condenser through it, are plotted radially, at the angles at which they are obtained, the heavy circle being taken at zero. The scale is .2 volt per division. Curve *K* and *L* were obtained with the machine connected as in Fig. 2, in which *A* is the armature, *B B* the brushes, *F F* the four field coils, *T T* the terminals of the dynamo, and *R* the non-inductive resistance. The curve *K* gives the deflections obtained when the condenser leads and

* Paper read before the general meeting of the American Institute of Electrical Engineers, Chicago, June 6, 7 and 8, 1892.

wiper were joined at *T T*. It will be observed that the curve is symmetrical, giving eight maxima and eight minima per revolution. The minima are below zero, and explain the several deflections observed in the first work on the arc. The resistance *R* being non-inductive, *K* is also the curve of current strength, to a different scale, and shows that the machine was an alternating-current machine, although the excess of positive area over negative shows an average positive current. Curve *L* was taken with the machine in the same condition as before, but with the condenser leads attached to the brushes at *B B*. It gives the varying potential of the armature, as modified by the inductive reaction of the field, and shows the same symmetry, with less distortion. For curve *M* the field coils were all thrown on one side of the armature and condenser leads attached at *B B*, as in Fig. 3.

To ascertain the effect of an inductive external resistance on the terminal potentials of the machine normally connected, the connections used in obtaining curve *K* were repeated, the only change made being to insert the six coils of the large Stevens electromagnet with the non-inductive resistance *R*, adjusting *R* to get the same current strength used in getting curve *K*. The resulting curve showed the same characteristics as *K*, but much magnified, deflections ranging from −300 to +550. Many other curves were taken, with the machine self-excited and separately excited, on various loads and on open circuit, but the results, though interesting, are not of

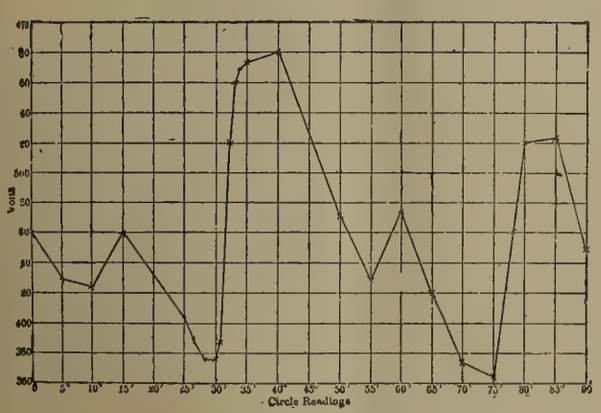


FIG. 5.

sufficient importance now to occupy your time. The most interesting curves and results were presented as a joint paper by Prof. Morton and the writer, and read by Prof. Morton before the American Association for the Advancement of Science, at its Boston meeting, Aug. 25–30, 1880. The curves presented and the original records from which they were prepared cannot now be found. Immediately after that meeting the writer entered on his duties at the University of Missouri, and had no opportunity to resume the use of the method until his removal to Ohio in 1885. It was used in that year by his students in an examination of the Thomson–Houston arc dynamo, substituting a Thomson portable electrometer, with Leyden jars to increase its capacity for the condenser and galvanometer. Since then the method has been used in this laboratory on various apparatus, and in various ways, but it is needless to recount the details.

Our experience with the method leads us to prefer the Thomson portable electrometer and Leyden jars to all other instruments for high potential curves. The electrometer is dead beat, is a zero instrument, and is easily and quickly set. As usually made, its constant is from two to three volts per division, and one can easily set to within that amount. The error resulting from an improper reading, say one division wrong, would be of course serious in reading low potentials, but these readings only occur on nearly straight parts of high potential curves, and might be entirely omitted without serious error.

Next to the portable electrometer we prefer the Thomson electrostatic voltmeters. For low potential curves nothing has yet proven superior to the potentiometer method as used here, and described by the writer at the American Association meeting at Washington last August. The potential difference to be measured is balanced against that produced by a battery in a resistance, as in Fig. 4.

In the figure, *R* is a resistance of some convenient form, with which contact may be made with a movable terminal *M*, or which may be varied between or beyond the terminals of a Weston voltmeter. From these terminals wires lead through a commutator *C*, a sensitive galvanometer or telephone *I*, and the wiper *D* to any points *A B*, whose potential curve is desired. The whole being in operation, and *C* properly placed, *M* or *R* (or both), is adjusted until *I* shows no current, when the potential difference existing at *A B* is read off directly in volts on the voltmeter. The use of the voltmeter and telephone is due to R. D. Mershon, a graduate of the university.

Fig. 5 is a part of the potential curve recently taken from a Brush open coil motor, run as a dynamo on an inductive load. One-fourth of the complete curve is shown, and the parts not given are quite symmetrical with this. No "smoothing" is applied, but the observed points are joined by straight lines. The sharp, angular form shown is due to the fact that readings were taken at intervals of five degrees, except between 25 degrees and 35 degrees, where readings were taken at each degree, to determine the character of the sharp variations between 30 degrees and 35 degrees. The change of 130 volts which occurs between 32 degrees and 33 degrees is unique and noteworthy, yet it is perfectly definite and characteristic, and has been repeatedly observed under like conditions. The use of ammeters and voltmeters or galvanometers in power measurements on such machines must, as pointed out in the paper of 1880, lead to incorrect results.

In Dr. Thompson's paper referred to above, reference is made to Joubert's use of the method in 1881, and in the recent edition of Thompson's "Dynamo-Electric Machinery," it is described as Joubert's method. In view of the work here described, and its presentation before the American Association in 1880, it seems proper to claim the method, which in the hands of Professor Ryan, Dr. Duncan and others, has led to such valuable results, as an American method.

MULTIPLE SWITCHBOARDS.*

BY JAMES A. BAYLIS.

It would be impossible in this paper to attempt to describe or even enumerate the many forms of switching apparatus that have been invented or are in use. I will confine myself to describing what is to-day regarded as the most perfect switching apparatus we have, viz., the multiple switchboard, the most elaborate and complicated electrical switch there is.

The telephone, transmitter and magneto, in use in a small town where there are 50 or a 100 subscribers are practically the same as those used in a city where the list shows thousands of names, yet the switching apparatus of the central is entirely different. In an office containing from 50 to 700 or 800 subscribers, the switching is a comparatively simple matter. The switch which is in most general use in Canada in such places is known as the standard switch, and it is, on the whole, a very satisfactory machine. When a subscriber has rung for the central and his annunciator has been actuated, the operator takes up any plug upon the table and inserts it into the jack of the subscriber calling, and, cutting in her tele-

* Abstract of paper read at the annual convention of the Canadian Electrical Association, at Hamilton, Ont., June 15, 1892.

phone by means of the switch which is in circuit with the pair of cords she is using, asks the subscriber whom he wants. If the line asked for is not in use, the connection is completed with the second plug, and the subscriber rung up. When the conversation is finished the bells are again rung, and the current actuates a drop which is in circuit with the pair of cords in use, and the operator is notified that that pair of cords is idle and disconnects the subscribers. Now suppose a subscriber calls for another whose line comes into a switch several feet away, and the cord will not reach, then recourse is had to short trunk lines connecting the different boards. Each switch has lines running to every other switch, and in this way each operator can have connection with all the others. This system works all right when there are not more than 800 or 1,000 subscribers. If there are more, the number of trunk lines between the switches becomes so great that confusion may arise and connections cannot be made quickly. Then, too, there are many chances for misunderstandings between operators, and mistakes are liable to occur. Thus the want was felt for a board on which each operator could make direct connection with every subscriber in the exchange without asking another operator for it, and without moving from her seat. As a result of this want the multiple board was invented, and, on the whole, it has proved to be very satisfactory.

Very many forms of multiple boards have been invented, but the board of the Western Electric Company, of Chicago, is the one that has been most favorably received, and it is some form of Western Electric board that may be found in almost every large telephone exchange in the United States and Canada to-day; a large number have also been installed in foreign countries. The boards in use in Canada are all made in Montreal in the telephone company's own shops. When multiple switches were first introduced metallic circuits were a rarity, so the board was designed for grounded lines only, whereas now, owing to cross talk, electric railways and other disturbing influences, metallic circuits have become a necessity, and, in the large cities at least, every multiple board installed to-day is fitted for both grounded and metallic lines. From the time the first board was built until now the form has been constantly changing, and even now no standard has been arrived at, and it is altogether likely that the next board built will be entirely different from all its predecessors. I suppose most of you have seen the Bell Telephone Company's new board here; this is a type of the most recent board in use, and it is with a switch similar to this that most of the large exchanges in the United States are equipped.

The general form of the board is vertical, about six feet high, and is made in sections six feet long. The upper portion of each section is divided into six panels. In these panels there is a spring jack for each subscriber in the exchange. The jacks are arranged in groups of 100, made up of five rows of 20. Each group is numbered from 1 to 100, and the number denoting the particular hundred is painted on the framework of the panel. The first group (the bottom left-hand one) is numbered 0, the next to the right 1, the next 2, and so on to the sixth panel, then another row from left to right, thus building upwards and allowing for future additions. Every one of these jacks appears in each board, so that the connecting places of subscribers are multiplied, hence the name multiple. The annunciators of the subscribers are situated below the jacks in a sort of trough. To facilitate answering calls the lines of the subscribers are brought back to special jacks, which are placed below the ordinary multiple jacks and are called answering jacks.

Everything is arranged for metallic circuits. The two wires of the subscriber's line enter the first board; one wire is soldered to the brass body of the jack and the other to a German-silver spring which rests on a brass stud. The wire coming to the body of the jack is carried right around the board from section to section. This is called the test or return side of the circuit. The other is the line side. The line, after reaching the spring, passes to the stud, and from there a wire is led to the spring of the corresponding jack of the next section, and this is repeated for the length of the board. From the last section the wires from the multiple are brought back to the section that contains the annunciator of that line and to the answering jack. Before reaching the annunciator, however, the line passes through the intermediate distributing board. The object of this board is to provide a means of placing a subscriber and any annunciator, and still not to change his position on the multiple part of the board. For example, suppose the operator looking after lines from No. 225 to No. 300 was very busy, and say No. 250 was an exceptionally busy line, by making a change on the intermediate board No. 250 can be taken off this section and put onto any spare annunciator on another board, and yet any operator wanting No. 250 will find it in its regular place in the multiple part of the board.

The annunciator used now is of the tubular form, and consists of a coil of 500 ohms of 36 wire wound over an iron coil and surrounded with a tubular iron jacket, thus giving a more perfect magnetic circuit. It is very sensitive and occupies but little space. The subscribers' jacks were first made separately, but now they are formed in rows of 20 mounted in an ebonite strip. In a multiple board there may be many sections, on each of which is found every subscriber in the exchange, so it is evident that before connecting a subscriber's line on one table some means is required of ascertaining if that wire is in use at another section. A test for this is necessary on any multiple system. There have been many methods suggested and tried to provide the "busy test," but the system used on the Hamilton board is almost as successful as any yet tried on metallic circuit boards. Nevertheless, a great deal of the complication and trouble on the board is caused by this test. The test merely consists of putting one pole of a battery, the other pole of which is grounded, to the brass part of the jack. The operator is provided with a peculiar telephone having two coils joined together and the junction being grounded. Now if an operator wishes to ascertain if the line is in use, she merely touches the tip of a front plug onto the brass of the jack. If the line is idle no sound is heard in the telephone. If it is in use a sharp click is heard, caused by the current from the battery which is connected to the plug in the jack passing to ground through one-half of the head telephone. The ring-off drop is 500 ohms bridged across the circuit and of high self-induction, and does not materially lessen the speaking effect. To ring a subscriber the two sides of a small magneto are brought into a circuit with the two conductors of a cord at the same time the other cord of the pair is cut off, thus signalling only the party desired.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The annual meeting of the New York Electrical Society, for the election of officers, reception of reports, etc., will be held on Thursday, July 14, 1892, at 7:45 P.M. sharp, at the Electric Club, 17 East 22d street. The business will be taken up at the time named without a minute's delay by the members, in order that the second part of the evening's programme, which is open to all, may be carried out.

Special arrangements have been concluded with the management of the Madison Square garden, through the kindness of Mr. David Henderson, whereby the members of the society will attend the performance of the successful extravaganza "Sinbad" in the Garden theatre at 8:15 P.M.

This opera includes a large number of brilliant spectacular effects, utilizing the projection arc lamp in a way and to an extent never before attempted. After the performance members will be at liberty to ascend the tower and to enjoy the attractions of the roof garden, which include not only a fine concert, but some beautiful decorative uses of the electric light. The invitation includes ladies as well as gentlemen, and it is hoped that there will be a large gathering of members and their friends.

THE "FULMEN" ARRESTER.

An electrical conductor suspended between the earth and clouds is liable to become charged with static electricity, which will discharge itself at any convenient point. The particular use for which lightning-arresters are designed is to provide a path to earth for atmospheric discharges, which, if required to pass through apparatus using magnetic coils or helices of wire, would be apt to destroy the insulation of the wire by short-circuiting two or more of the coils, or by jumping directly to the iron core or base of the apparatus in its passage to earth.

The simplest form of arrester consists of a pair of discharge plates, connected directly to line and earth, and



FIG. 1.—ARRESTER.

this form has been in use almost as long as electric circuits have existed, but its use is restricted to metallic circuits of low potential.

Various other forms of arresters have done good service in their respective fields, but the most difficult undertaking, in the line of indestructible arresters, awaited the experimenter in the field of power-circuit protection, for here we have not only high potential, but usually a ground return.

When a lightning discharge occurs from the overhead conductor of a circuit with a ground return, an arc is established between the discharge-plates of the arrester, which forms a short-circuit and does more or less damage to the arrester.

It is in this line that so much thought and experiment has been directed of late—to provide a lightning-arrester which would be thoroughly indestructible on electric, street, railway or similar circuits.

Indestructibility to an arrester, whose dischargers are separated by a minimum of air space, and a difference of

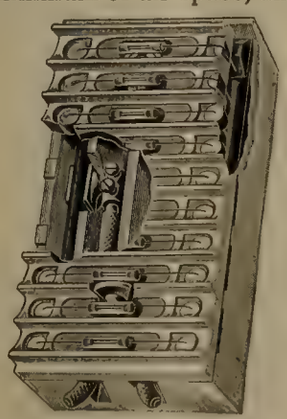


FIG. 2.—ARRESTER BOX.

potential equal to 500 volts of continuous current, has a more significant meaning to one who has experimented in that line than to the average electrician.

Realizing the difficulty of obtaining a satisfactory arrester which could be depended upon to withstand repeated discharges from the trolley wire of a street-railway circuit, Mr. C. D. Van Nuis, of New York city, set about an easier method of accomplishing the same result by substituting for the would-be indestructible arrester a series of cheap arresters, one of which would be wholly destructible with each lightning discharge, allowing a new arrester to take its place automatically.

The principle of the Fulmen arrester, illustrated in Fig. 1, is that of the simple discharge-plate and fuse combined, two fuses forming the dischargers.

To prevent dirt and dampness from short-circuiting the arrester, so that the separation between the line and ground dischargers may be reduced to a minimum, those parts of the fuse wires which constitute the dischargers are hermetically sealed into a small glass tube.

By connecting one end of this fuse-arrester to line and the other to ground, a simple and effective arrester is provided; for, being called upon to act but once, it has no opportunity to get out of order.

A series of these arresters are placed in a corrugated porcelain cover of an arrester-box, by the soft rubber plugs near either end of the fuse wire fitting tightly into holes in the cover, allowing the free ends of the wire to project through the cover $\frac{5}{16}$ of an inch.

Two carbon rods constitute the line and ground terminals, and these are placed in grooves in the porcelain box, directly under the holes in the cover which receive the rubber plugs of the arresters, but at such a depth that none of the fuse wires makes connection directly with the carbon terminals.

In placing the cover in position on the arrester-box, a small carbon wedge is made to rest against either carbon terminal, being supported by the free ends of the wires of the top fuse.

The discharges are thus brought into electrical contact with line and ground, and the operation of the arrester is apparent.

The atmospheric discharge causes an arc between the dischargers, which short-circuits the generator at that point, and the heavy overload entirely consumes the small fuse wires and allows the carbon wedges to drop to the next fuse; each successive fuse coming into operative position in turn.

Ten fuses are considered sufficient to protect one locality during a severe thunder-storm, after which the apparatus should be inspected and new fuses used to fill the places made vacant by any discharges which may have occurred; after which the cover is replaced with the carbon wedges connecting the top fuses as before.

ILLUMINATING BUILDING INTERIORS.

Artificial illumination of the interior of buildings is a subject that has engrossed the attention of architects for many years, we may say from time immemorial. Their efforts have been taxed to the utmost in late years, as civilization has become more refined and the demand for more light to illuminate artistic interiors has grown. When the electric light made its appearance it marked a new era in lighting, in that a demand was created in a new direction for beautiful illuminating effects. Artists exercised their knowledge and skill to the utmost limit, and the success which has attended their efforts is familiar to most every one who has a pair of good eyes in his head.

The *Journal of the Royal Institute of British Architects* in a recent number published an abstract of a paper on the subject of internal illumination of buildings, read before that body by Mr. W. H. Preece, the eminent English electrician.

As this abstract contains a good deal that is of interest, we publish it in full for the benefit of our readers:

"The art of internal illumination of buildings, the author considers, is just born, and will be an art in the

future. Electricity is rendering theatres bearable and houses healthier, while the architect is brought face to face with a new art, in which the aid of the electrician is required to solve some of the difficulties. History is silent as to the origin of tallow, pitch, wax and oil, but gas as an illuminant came in with the present century. From the earliest days, history, whether culled from paintings or writings, teaches that lights have been dim and crude until the middle of the present century. Light, by whatever means generated, follows the same laws, and is due to the rapid rhythmic undulation of the medium, called the ether, that fills all space. Wherever there is light there is heat, and the hope of the philosopher to supply light without any heat at all is at present but a dream. Light cannot be produced without heat, and the higher the temperature the brighter the light. Color varies with the rate of vibration of the ether, while changes of color are due to the changes of wave-motion of the ether. Light may become so intense that all sense of color is lost, and every bright illumination causes all colors to appear whitish. If light emanates from a point its intensity diminishes with the square of the distance. The candle is the British standard source of light, and the bright surface produced by it at a distance of one foot the standard illumination by which to measure the amount of light distributed by any other means. This standard Mr. Preece calls a 'lux.' A sixteen candle-power glow lamp is a lamp which gives a light equal to that of sixteen British standard candles concentrated on one spot, and it will at a distance of four feet give the illumination of a lux. Thus one candle-power at one foot, four candles at two feet, nine candles at three feet, sixteen candles at four feet, twenty-five candles at five feet, give exactly the same illumination, viz., one lux, on the paper on which we write or on the page from which we read. The great problem is to diffuse light throughout a room so that it be distributed uniformly over the working surfaces with an intensity of a lux. Sixteen-candle glow lamps suspended eight feet above the floor, and fixed in eight-feet squares, effect this very well; and groups of four such lamps fixed sixteen feet high produce a similar result. The light a lamp gives is owing to the expenditure of energy in its carbon filament; an electric current is driven through this filament by electric pressure, its resistance is overcome, it is intensely heated by the proceeding, and the result is pure unadulterated light. The energy expended per second by an *ampère* (the standard current), driven by a *volt* (the standard pressure), is called a *watt*. A sixteen-candle glow lamp takes sixty-four watts, which, assuming the lamps to be fixed eight feet high, means that one watt per square foot of surface is required to secure ample illumination from lamps so fixed. Therefore, in designing the normal illumination of rooms, Mr. Preece takes the floor area in square feet and divides it by sixty-four, which gives the number of sixteen candle-power lamps required, fixed eight feet high; these being increased or diminished according to the purposes of the room, its form and height, etc. The adaptability of the eye to nearly every degree of light is very great, and it is almost impossible for it to judge accurately of the amount of light present; but it is not as a mere source of light that the glow lamp is superior to the gas-burner. The former can be put anywhere and used without the adventitious aid of match or fire. It does not vitiate nor unnecessarily warm the air, and it simplifies the problem of ventilation, while it lends itself above all to the æsthetic harmony of furniture and decorations. Electric light is not always absolutely safe; security is to be obtained only by good design, perfect materials, first-class workmanship and rigid inspection. Imperfect materials erected by cheap contractors lead to many disasters; on the other hand, it is stated no fire has occurred in buildings fitted up under the rules and regulations, and inspected by the officers of the insurance companies in this country. Mr. Preece advocates keeping everything as much as possible in view, and not hiding the conductors under wainscots or floors or above ceilings. The glow lamp excited by three watts per candle is at present the most perfect source of domestic light, and when the patent expires—in a year or two—will be obtainable at one-third the present price. It is scarcely fair, Mr. Preece thinks, to say all light should come from the side of a room, as Lord Beaconsfield stated in 'Lothair' when describing the lighting of Belmont. The House of Commons is one of the best-lighted chambers in London, and is lighted from the roof, a false glass ceiling excluding the heat and glare, and admitting only the light. What is wanted is to avoid the glare of the incandescent filament in the eyes, and to prevent the lamp from being too obtrusive; it can be shaded from the eye without its effectiveness being destroyed, and without the flow of light being obstructed or its quality being deteriorated. Judging from the Crystal Palace Exhibition, at which several leading firms have not exhibited, the electric-light fitter has not seized upon the spirit of the age—which is the rule of science over more conventional æstheticism. Two exhibits at the Crystal Palace, however, the author considers, especially deserve inspection. The one is a Tudor ribbed ceiling erected by Messrs. Allen & Mannooch, who have applied glow-lamps to the moulded intersecting pendants in such a way that the feeling of the artist is maintained by day, and is rather intensified, and not marred, by the artificial illuminant at night. The other is a bold attempt of Messrs. Rashleigh, Phipps & Dawson to design in ironwork the whole of the fittings of a dining-room, so that they shall, in combination, convey an idea. The artist (Mr. Reynolds) has attempted to symbolize the solar system, the centre light over the table representing the sun, and the brackets on the walls the planets. A survey of the Royal Academy pictures, the author thinks, affords instructive study. There are many interiors, but few into which artificial light has been introduced. Having described several pictures in which artificial light has been introduced with more or less successful results, Mr. Preece, in conclusion, considers that science is advancing with giant strides. Science has subdued nature so as to bring it within the compass of the human intellect, and art must follow the knowledge thus acquired. These two being the chief instruments of modern civilization, the architect and engineer must work hand in hand."

EDISON VS. SWAN.

A decision was rendered by the commissioner of patents on June 22, in a case which possesses more than ordinary interest to electrical people on account of its historical features and the prominence of the parties at issue.

The following is a text of the decision:

APPEAL from Examiners-in-Chief.

ELECTRIC LAMP.

Application of Thomas A. Edison filed May 27, 1881, No. 34,395. Patent granted Joseph W. Swan October 19, 1880, No. 233,445.

Mr. R. N. Dyer for Edison.

Messrs. Witter & Kenyon for Swan.

SIMONDS, *Commissioner.*

"This is an appeal from the decision of the Examiners-in-Chief awarding priority of invention to Edison upon both of the following interference issues:

"1. A carbon formed from a straight strip of card-board, paper, or parchment-paper, and bent to the form of an arch, hoop, or loop, and carbonized by heat while in a bent condition, substantially as set forth.

"2. A carbon for an electric lamp made of the carbonized parchment-paper.

"The Examiner of Interferences awards priority of invention to Swan upon both issues. The three members of the Board of Examiners-in-Chief concur in making a finding for Edison upon the first issue; but one of them decides in favor of Swan upon the second issue.

"It is conceded that Swan's date of his invention is practically March 1, 1880, that being the time at which a letter was received in this country, which was written by him abroad, disclosing the invention in controversy. He filed his application for patent April 12, 1880, and his patent issued October 19, 1880.

"Edison's claim, according to his preliminary statement, is as follows:

"That he conceived the inventions set out in both issues of this interference as early as August, 1879, and at that time disclosed them to others; that he put into actual use the invention set out in the first issue in August, 1879, and has used it continuously since; that he put into actual use the invention set out in the second issue in August, 1877, and has used it sufficiently since to determine its value; that said last-mentioned invention is also described in his caveat No. 93, filed in the Patent Office December 22, 1879.

"In the testimony his claim is that he made the inventions in controversy in October and November, 1879. He filed his application for patent May 27, 1881. Edison's delay between the making of the invention and the application for patent, if October, 1879, be taken as the date of making the invention, is a year and seven months, and his delay in making such application after the issue of Swan's patent is seven months.

"When one of the contestants for priority has a patent for the invention in dispute and the other is an applicant for a patent, the latter, in order to prevail, must present a case both as to conception and as to reasonable diligence which does not admit of a reasonable doubt. (*Parkhurst* v. *Kinsman*, 1 Blatchf., 488; *Ellithorpe* v. *Robertson*, 4 Blatchf., 307; *Coxe* v. *Griggs*, 1 Biss., 362; *Brodie* v. *Ophir Silver Mining Co.*, 5 Saw., 608; *Draper* v. *Potoska Mills Corporation*, 3 Ban. and Ard., 214; *U. S. Stamping Co.* v. *Jewett*, 18 Blatchf., 469; *Signal Co.* v. *Signal Co.*, 6 Fed. Rep., 603; *Cartridge Co.* v. *Cartridge Co.*, 7 Fed. Rep., 344; *Duffy* v. *Reynolds*, 24 Fed. Rep., 855, &c.)

"The force of the foregoing proposition is intensified in this case by the existence of certain facts, to wit: Edison had the amplest financial means for developing and patenting his inventions. He was under an agreement to patent them promptly. He knew of the importance of keeping accurate records of his inventions and his experiments and did keep them. During the nineteen months that he waited in this case he made more than a hundred applications for other patents.

"The evidence offered by Edison in support of his contention that he made this invention in October and November, 1879, consists of the oral testimony of certain witnesses and of sketches and entries in books kept expressly for the purpose of making a record of his inventions and experiments. It is a fact to be considered in determining the weight of this testimony offered in Edison's behalf that by application for patent filed November 4, 1879 (eventuating in his well-known patent of January 27, 1880, No. 223,398), by a publication occupying more than a page of the New York *Sunday Herald* of December 21, 1879, by a somewhat similar publication a few days later in the London *Times*, and by a fourteen-page article prepared by Edison's mathematician and contained in *Scribner's Monthly* for February, 1880, a great deal of disclosure was made as to what Edison had done in the invention and development of what is popularly known as the 'incandescent light,' no part of which disclosures makes any allusion to the features of improvement now in controversy.

"Upon such a state of facts it is clear that Edison in order to prevail must present proof that is perfectly convincing. Speaking as to the first issue, an inspection of the sketches and entries offered in evidence taken by itself falls short of producing conviction that Edison in October and November, 1879, made use of or had a knowledge of the specific improvement recited in the first of the interference issues. If one is inclined to find this specific improvement disclosed in the sketches, he can do it. If he looks at them with the eye of keen criticism, he finds himself in doubt.

"In addition to the sketches and entries, Edison offers the oral testimony of a number of witnesses, all of which is open to the suspicion that the witnesses' memories may be based upon and strengthened by a favorable construction of the sketches and entries in question.

"Swan produces eight or nine witnesses for the purpose of rebutting the affirmative evidence offered by Edison, and their testimony is entitled to some, though not great, weight in the premises.

"The practical conclusion is this: Edison *may* have made the invention in October and November, 1879; but strong probabilities are against him. His sketches and entries do not carry conviction. His case rests at last upon oral testimony open to the suspicion just stated and contradicted in some degree by the oral testimony offered by Swan. Edison's case as a whole fails of affording that high degree of proof which the law and the surrounding facts call for.

"The second issue requires the use of 'parchment-paper.' Parchment-paper, as generally known at the time in question, was paper, preferably unsized, which had been immersed in a bath of dilute sulphuric acid and the acid afterward washed out. For the purposes of this case it was that kind of paper or some other kind of paper having equivalent qualities. Edison never used paper which had been dipped in dilute sulphuric acid and the acid afterwards washed out. He did use Crane's parchment-paper and vulcanized fibre. The burden of proof is upon Edison, therefore, to show that Crane's parchment-paper or the vulcanized fibre had the equivalent qualities of what was known as 'parchment-paper.' Not only does he fail to show that the things he used had the equivalent qualities, but the preponderance of evidence is to the effect that they did not have equivalent qualities. Therefore Edison cannot prevail upon the second issue.

"As regards the question whether Edison has produced that degree of proof which the law and the surrounding facts call for in order to enable him to prevail, it is a fact not without significance that the Examiner of Interferences has found one way and the Examiners-in-Chief the other.

"The decision of the Examiners-in-Chief is reversed and priority of invention is awarded to Swan."

THE ADVANTAGES OF ELECTRIC ELEVATORS.

It used to be said that steam plants in business buildings, hotels, etc., were a necessary evil, and something we could not get away from, but since the wide introduction of the electric motor a great change has taken place, and this assertion is no longer true. The evil can be escaped, and very easily too.

One of the most important uses to which power is applied in buildings of the class named is for elevator service. We find these valuable conveniences in the most unpretentious buildings nowadays, and in order to maintain them power is needed. To get the power we must maintain a hydraulic or steam plant, and to maintain a steam plant in a city building costs a large sum of money. The expense is not represented so much in the cost of fuel for the boilers or the quantity

consumed per hour, but more in the space necessary for the plant. Space in a city building is valuable; hence the room taken up by a steam plant, which consists of boilers, engines and auxiliary apparatus, means so much less income from the premises.

The question of economy of space is one that has always perplexed the architect and owners of buildings. Whether the power used for elevators be hydraulic or steam, a good deal of valuable room must necessarily be given over to the driving apparatus, which yields no visible return. The electric motor and its application to elevator service has, however, solved the problem.

Electric elevators are no new thing—in the sense that they are untried. They have long since passed out of the experimental stage of their career, and are now established, in a commercial sense, on a sound foundation.

They are great economizers of space and are in every way as reliable and efficient as steam or hydraulic elevators. The fact that electric elevators are being very largely put into new buildings, and in many cases displacing steam and hydraulic elevators in others, is a sure indication that the business public discern and appreciate their valuable features. They meet every requirement and challenge the most critical examination as to their merits.

Compared with steam or hydraulic elevators they are unique in that they may be placed in any position.

They may be placed on any floor, and in a horizontal, vertical, or any other position to suit the circumstances. Steam or hydraulic power does not possess such flexibility, and compared with other machines the electric elevator occupies a minimum amount of space.

In regard to the power necessary to drive electric elevators, it may be said that the energy consumed is in proportion to the amount of work performed. Thus a light load does not require as much current as a heavy one, and the motor takes no more than necessary.

The electric elevators now in use are giving the best of satisfaction, and all users are unanimous in their praises of their performance.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electric Welding.

When large currents of electricity were first generated electrical investigators naturally concluded that such currents might be applied for the specific purpose of generating heat, and by this means perform the operation of welding metals in place of the old method.

Prof. Elihu Thomson, the eminent electrician, was about the first one to give the subject of electric welding serious attention, and since 1886 he has brought the process to a high degree of development.

The old method of heating in a fire the ends of the metal to be welded and then hammering them together when sufficiently heated is too slow; it requires considerable time to effect a weld. By the electric process, however, a weld can be made in a remarkably short space of time, and a more homogeneous joint is obtained.

Electric welding has now obtained a very wide range of application, and metals that defied the skill of man to join by the old process can be welded by electricity without difficulty.

Electric welding machines are comparatively simple in construction. They consist essentially of an alternating-current dynamo to generate the initial current; a transformer, to convert the current from high potential to low potential and large volume, and the clamping apparatus.

In one form of the apparatus the converter is constructed with a laminated iron core enclosing a heavy copper tube. This tube takes the place and answers the purpose of the secondary coil.

The primary coil consists of an insulated copper wire wound in two sections through the interior of the tube, and enclosing its upper and lower parts, together with the adjacent parts of the core.

The primary coil, or circuit, is connected with the dynamo in the usual manner, and the terminals of the secondary coil (the copper tube) are connected to stout copper bars on which massive copper clamps slide. The metal bars to be welded are placed in these clamps, and after being tightly secured their ends are brought together and the current is turned on.

The current in passing the juncture of the two metals heats the ends to a sufficient degree to cause them to become plastic; the ends are then pressed firmly together by proper mechanism and the joint is completed.

No more of the metal is heated than is necessary to form the joint, because the clamps, which represent the terminals of the secondary coil of the converter, are brought together as near as possible when the metal bars are placed in position to be operated on.

The dynamo used in electric welding is constructed especially for this class of work, and gives a primary E. M. F. of 300 volts, for what is called the 20,000 watt welder. In the transformation process this E. M. F. is reduced to 1 volt in the secondary circuit, and the current measures about 16,000 ampères.

A welder of this size will weld bar-iron ranging from $\frac{3}{8}$ of an inch to $1\frac{1}{4}$ inches in diameter. The range for brass rods is about three-fourths of that for iron, and for copper about one-half.

In order to adapt the welder to a large range of work its primary circuit is connected in series to an auxiliary converter of special construction, by which the E. M. F. can be more fully controlled. This method of operation is known as the "indirect method," and is employed for heavy and complicated work and where several welders are operated by the current from a single dynamo. For lighter work what is known as the "direct method" is employed. In this method the welder is connected directly with the dynamo, the converter being dispensed with. The armature of the dynamo, however, is of special construction and practically takes the place of the converter or transformer.

The time required for effecting welds varies with the size and kinds of the metal used. For instance, fine wires can be joined in one or two seconds, and for heavy bars two or three minutes are required.

The range of application of the electric welder is practically unlimited. Not only can such metals as cast-iron, copper, lead, tin, zinc, brass, German-silver and bronze be welded, but any two of these dissimilar metals may be joined together.

ELECTRIC MOTORS AS SUBSTITUTES FOR STEAM LOCOMOTIVES.

Mr. Arthur T. Woods publishes an article on the above-named subject in the *Railroad Gazette* that is worthy of the most careful attention of electric railway men and others concerned in the development of electric railways.

Mr. Woods says:

"Judging from the editorial notes which appear frequently in certain 'electrical' journals, the reader might naturally infer that 'steam engineers' are a class of thick-headed obstructionists who can see nothing good in electricity in any shape, while on the other hand certain 'mechanical' journals would apparently have their readers believe that electrical engineers are ready to back any scheme, no matter how visionary, provided it involves

the electrical distribution of power. Here is a recent sample from a prominent electrical journal which has until recently occupied a very conservative position in regard to electricity as applied to steam roads:

"'Prompted probably by the near approach of a formidable rival in the form of electric locomotives, the builders of steam locomotives are continuing to make a little progress. Although the improvements are doubtless looked upon as important ones in the minds of steam engineers, nevertheless the actual increase of speed gained thereby, though not small, is by no means a great step in the solution of the problem of interurban rapid transit. Like the efficiency of the steam-engine, the speed of the modern locomotive is already very near to a limit which it cannot exceed from the very nature of its construction. Just as the speed of a revolving wheel, and therefore that of an electric motor, is limited quite definitely by the bursting of the parts, so the speed of the present locomotive is limited by the hammer-blow of the reciprocating parts. Besides this the danger of breakage increases very rapidly for higher speeds of steam locomotives. An increase of their size also requires heavier rails and stronger bridges.'

"Statements such as the above do not help the cause of electric traction; rather the contrary. Why not meet the question fairly and say that when it can be clearly demonstrated that it will pay to change the form of motive-power on railroads it will be done and not before?

"The possible advantages of electricity as a motive-power over steam locomotives are greater cleanliness, higher speed and reduced cost of operation, including interest charges, depreciation and repairs in the latter. The greater cleanliness is evident, and in some locations will doubtless prove to be a strong argument. Possible higher speed, as far as the structure of the locomotive is concerned, and as compared with the esential types of steam locomotives, may be also admitted to some extent, but the limiting speed for such locomotives has not yet been reached. The writer has carefully investigated the effects of the reciprocating parts of locomotives at high speed and is confident that there is no reason why steam locomotives cannot be built to run at a speed of 100 miles an hour and possibly considerably higher. That locomotives which were not intended for exceptionally high speeds have made runs at over 90 miles an hour simply speaks well for their construction, it does not prove that the limit has been very nearly reached. The difficulty with such speeds is not a question of the locomotive, it is rather with signals, the distance necessary in which to stop, and the practical operation of a road for high and low speed trains at the same time. If the railroads throughout the country could be built with no grade crossings and for high speed service alone, the problem would be very different. Speeds could be attained with electric motors which are impracticable with the present forms of steam locomotives, and the problem would become simply one of there being enough high-speed business to make the road a paying investment.

"But the general railroad problem is not a question of great speed, but rather, can existing railroads be operated electrically from power-stations so as to show greater net earnings than they can by steam locomotives? If a perfectly general answer could be made to this question, it would have to be negative in the present state of development of electrical machinery. There are, however, a few railroads for which the conditions are such that an opinion as to the commercial feasibility of employing electricity as the motive-power can be properly given only after a careful estimate.

"The general problem, as well as it can be generalized, has been carefully worked out by Messrs. Crosby and Bell in their recent treatise on the electric railway, and their discussion is well worth careful reading by all who are interested in the subject.

"The first question which arises is whether individual cars are to carry motors, as in street-railroad service, or whether there are to be electric locomotives in place of the present steam locomotives. The motor-car method would involve an entire reorganization of the train system on most steam railroads—that is, frequent light trains instead of heavy trains at longer intervals. There would seem to be no great difficulty in this in some cases, as, for example, for suburban service, where the traffic is not heavy; but when such traffic is heavy, amounting as it does at times to trains of from 10 to 15 cars at five-minute intervals, and for freight service, electric locomotives at the head of the train seem to be the preferable, if not the only practical solution. When in addition to this the many advantages of separate locomotives are considered, such as avoiding the multiplicity of trains, the taking on and setting off cars at stations, the fact that little or no change in the number and size of train crews would be necessary, and that for a given amount of power electric locomotives could be built cheaper and of higher efficiency than small motors, it is safe to say that if electricity is to be applied at all to existing roads it must generally be by means of electric locomotives.

"Assuming for the present that such locomotives could be as readily obtained in the market as steam locomotives of equal tractive power, the problem is reduced to the question of whether or not power can be generated in central stations, transmitted to electric locomotives and used to haul trains more cheaply, all considered, than the same work can be done by steam locomotives. In the power stations we would have the most economical type of steam engines for the particular locality, and these stations could be located at the most advantageous points in the district to be covered. The indicated horse-power thus economically generated suffers losses during transmission to trains in engine friction, in transmission to the electrical generators or dynamos, in the dynamos, in the line, in the electric locomotive, and in the air and track resistance of the locomotive. When finally delivered at the locomotive draw-bar the cost of this power, including interest and depreciation, must be enough less than the cost of the same power delivered at the same point by a steam locomotive to warrant the additional expenditure necessary for the electrical equipment. It is at once apparent that the problem is one requiring careful calculation at best, and when the uncertainty as to the probable losses in some of the links of the chain is considered, the difficulty of making an estimate which can successfully stand criticism will be appreciated.

"At first glance, when it is stated that a horse-power can be developed in a triple-expansion condensing engine with about one-half the consumption of steam that is required in a good single-expansion locomotive, the proposition of making the substitution sounds not only feasible but attractive. But when it is learned, as stated by Messrs. Crosby and Bell, that a 40 per cent. loss 'is about the best we do with our present systems of electric street-car propulsion' and the difference has to cover the increased first cost, the evidence of increased net earnings is not so clear. And when we remember that this low water consumption of the triple-expansion engine is obtained only when working under the most favorable conditions and when developing the power for which it is designed, and that when underloaded or overloaded its efficiency falls off rapidly, the electric side of the question does not look so financially attractive.

"The present status of the question of electric *versus* steam locomotives," says Mr. Woods, in conclusion, "may be summarized as follows:

"1. There is no prospect of electricity replacing steam for long-distance freight traffic.

"2. There is a possibility of electricity becoming an

economical substitute for steam locomotives for high-speed service wherever the traffic is sufficiently heavy and constant to warrant the construction of lines of track independent of those used for moderate speeds.

"3. There are very few localities in the United States in which the conditions are such as to make such a substitution commercially possible, with the efficiencies at present obtained with electrical machinery.

"4. If the electrical equipment could be purchased at reasonable prices, there are a few short lines of steam railroads on which the passenger traffic is such as to make electricity a possible form of motive-power at present speeds.

"5. It is probable that electric locomotives will be used in tunnels and for switching in cities, where freedom from smoke is important.

"6. No electric locomotive capable of doing the work of a medium-weight steam locomotive has as yet been constructed."

NEW INCORPORATIONS.

Valley Light and Water Company, Sumner, Wash., incorporated June 23, with a capital stock of $50,000. Among other things, it will construct and operate electric-light plants, gas-works, etc. Incorporators: George H. Ryan, P. D. Rice, George Herriott.

Morningside and Highland Park Street Railway Company, Pittsburg, Pa., incorporated June 22, with a capital stock of $35,000. Incorporators: Henry A. Davis, Charles E. Cornelius, Sewickley, Pa.; Wilkins Linhart, Allegheny, Pa.

Immisch Electric Navigation and Power Company, Hoboken, N. J., incorporated June 27, with a capital stock of $250,000, to manufacture machines for the production of electricity, etc. Incorporators: A. Schwarz, A. Henecke, Newark, N. J.; V. D. Walsh, O. Goerz, New York; T. Aub, Hoboken, N. J.

Bristol Electric Company, Rutland, Vt., incorporated June 24, with a capital stock of $15,000, to furnish light, heat and power. Incorporators: Rockwood, Barrett, Edward Dans, Horace N. Dyer, Rutland, Vt.

Northern Electrical Supply Company, Concord, N. H., incorporated June 15, with a capital stock of $5,000, to buy and sell railway, telegraph, telephone, light and heating supplies and all apparatus. Incorporators: W. B. Ross, Boston, Mass.; George P. Warde, Harley J. Lowell, N. E. Martin, all of Concord, N. H.

Hartford Electric Light and Power Company, Hartford, Vt., incorporated June 27, with a capital stock of $12,000. Incorporators: Allen L. Pease, Joseph F. Whiting, Alfred E. Watson, Hartford, Vt.

The Hollidaysburg Electric Light and Power Company, Hollidaysburg, Pa., incorporated June 29, with a capital stock of $23,000. Incorporators: H. F. Russ, Hollidaysburg, Pa.; W. F. Taylor, A. J. Anderson, Altoona, Pa.

Ashland Lighting and Street Railway Company, Ashland, Wis., incorporated June 29, with a capital stock of $200,000, to operate and maintain a lighting plant and electric railway. Incorporators: Thomas Barton, G. W. Harrison, G. H. Hopper, S. S. Fifield, John H. Knight.

The Delta Electric Company, Cairo, Ill., incorporated July 2, with a capital stock of $150,000. Incorporators: Henry Hasenjaeger, William Kluge, Harris Schulze.

The New Kensington Traction Company, New Kensington, Pa., incorporated July 1, with a capital stock of $2,000, to supply motor-power to passenger railways and the necessary apparatus for applying the same. Incorporators: S. E. Moore, James P. Anderson, Howard Childs, Pittsburg, Pa.

Claflin and Kimball, Boston, Mass., incorporated July 1, with a capital stock of $135,000, to manufacture and sell electric dynamos, motors, batteries, arc and incandescent lamps, and all kinds of electrical appliances. Incorporators: Adam D. Claflin, Marcus M. Kimball, Boston, Mass.

Waitsburg Light and Power Company, Waitsburg, Wash., incorporated June 29, with a capital stock of $25,000, to operate and maintain electric light plants, telegraph and telephone lines and cable and street railways, etc. Incorporators: George H. R. Preble, John C. Onderdonk, Spokane, Wash.; J. H. Morrow, P. A. Preston, Waitsburg; J. R. McKinley, New Whatcom, Wash.

Denison Electrical Manufacturing Company, Portland, Me., incorporated July 1, with a capital stock of $500,000. Incorporators: C. D. Wainwright, William M. Thayer, Boston, Mass.; Russell A. Denison, Providence, R. I.

The Queen City Electric Railway Company, Marion, Ind., incorporated June 30, with a capital stock of $180,000. Incorporators: Aretus W. Hatch, James C. Devor, Willard C. Nichols.

Newport Electric Light Company, Newport, N. H., incorporated June 29, with a capital stock of $15,000. Incorporators: Seth W. Richards, William T. Richards, Martin L. Whittier, Arthur B. Chase, Myron W. Tenney.

Pontiac Water, Light and Power Company, Chicago, Ill., incorporated June 30, with a capital stock of $60,000. Incorporators: John J. Hainsworth, W. C. Reeve, H. Ream.

Point Sewell Hotel Company, Norfolk, Va., incorporated June 28, with a capital stock of $300,000. Among other things it will construct and operate electric works. Incorporators: D. Lowenberg, J. W. Perry, Norfolk, Va.; W. E Clark, Washington, D. C.; N. Newton, J. T. Allyn, B. Myers.

Columbus Mining Company, Richmond, Va., has been incorporated with a capital stock of $50,000. Among other things it will construct and operate electric works. Incorporators: M. M. Child, W. J. Fell, R. W. Traylor, A. J. Pleasants, E. H. White.

The United States Wire and Cable Company, Schenectady, N. Y., incorporated July 1, with a capital stock of $1,000,000. Incorporators: B. E. Sunny, Chicago; S. A. Barton, Boston; S. Insull, S. Dana Greene, New York; John Kreusi, Schenectady.

Elevated Suspension Railway Company, Chicago, Ill., incorporated July 5, with a capital stock of $4,000,000. Incorporators: Lysander Johnston, Gustine I. Ladd, Henry A. Buell.

Port Gardner, Lake Stevens and Eastern Railway Co., Everett, Wash., incorporated July 1, with a capital stock of $250,000. Among other things it will build and operate electric-light plants and telegraph and telephone lines. Incorporators: John F. Hart, J. M. Davis, Tacoma, Wash.

NEW PUBLICATIONS.

Volume II. of the ALTERNATE CURRENT TRANSFORMER IN THEORY AND PRACTICE, by J. A. Fleming, published by D. Van Nostrand Co., New York, is now ready for sale. This volume treats of the utilization of Induced Currents, and has 600 pages and 313 illustrations. Price, $5.00.

This book and all others on electrical subjects can be purchased of the Electrical Age Publishing Co., first floor, World building, New York city.

PHILADELPHIA NOTES.

YOUR representative met Mr. Knight, of the Electric Construction and Supply Co., of 18 Cortlandt street, New

York, who is here superintending the installation of a "Ward" search lamp on the excursion steamer *Excelsior*. The Southern Electric Co. secured the contract, and all the work in connection with the installation, such as wiring, etc., was done by it, under the charge of Mr. Kingland.

MESSRS. PRIESTMAN & CO, 148–150 South Third street, Philadelphia, Pa., have issued a very neat pamphlet descriptive of the "Priestman" engine, manufactured by them, and which is operated by the combustion of atomized kerosene oil. The different uses to which this engine can be applied are almost numberless. In the pamphlet will be found a partial list of a number of prominent persons and concerns who have adopted or endorsed the engine. They are universally known and have been sold in every country on the face of the globe.

VALLEE BROS. & CO., 17 North Sixth street, are doing an excellent business in Meesen alternating motors. They have lately added a full line of electric fixtures, and also carry a large stock of supplies. They are headquarters for everything necessary for incandescent light systems, and if they have not exactly what is required, will go to great trouble and expense to procure same.

WALKER & REPLER are said to be the largest house in Philadelphia carrying dynamos, motors, motor and fan outfits of all systems. They sold nearly fifty of the Interior Conduit and Insulation Company's motors and fan outfits in one day, and are doing a nice business with Diehl ceiling fans and motors. So large is the stock carried by them, that one would imagine himself to be at an electrical fair in going through their establishment.

MR. ALFRED BOURNONVILLE, manager of A. T. Moore's insulated wire business, Third and Race streets, has just returned from an extended vacation of six weeks, and was looking well when your representative called. Mr. Bournonville has been connected with this house since his boyhood, and earned his vacation by his devotion to the business.

H. T. PAISTE is manufacturing all kinds of metal goods in quantities under contract, and is always anxious to bid on any line of goods that is required in quantities. He is well fitted out with presses and machinery, and has a first-class foreman to superintend the work.

WM. H. WESTON & CO., 838 Filbert st., start in this week working night and day to fill orders on their popular quick-break switches, cut-outs, etc.; also to meet the orders for marble boards with switches, rheostats, etc.

PARTRICK & CARTER, under the management of Messrs. Wilkins Brothers, still continue to hold the solid trade. This house has always been noted for catering to the strictly first-class trade only. Anything for the house, office, hotel, in fact electrical supplies of all kinds—will be found here.

J. ELLIOTT SHAW, 632 Arch street, is just as alive as ever, and doing a fine trade in electric gas-lighting supplies and batteries of all kinds. Mr. Shaw is always ready to attend to the wants of his customers.

THE GLOBE CORDAGE COMPANY, 1002 Arch street, is doing a very nice business with its flexible cord.

G. W. LORD, 316 Union street, is doing all the business in boiler compounds. One firm in the West uses a carload a week.

L. B. FLANDERS MACHINE WORKS, now owned by H. B. Underwood & Co., machinists and engineers, 1025 Hamilton street, have portable boilers and engines, which are taken to steam plants for the purpose of reboring cylinders, replacing packing, etc. The firm makes a specialty of repairing Corliss and other steam-engines. They are sole agents for St. John self-adjusting cylinder packing.

HORN, BRANAN & FORSYTH, 427–433 North Broad street, are among the largest manufacturers of electrical fixtures, and carry a complete line of elegant designs of electroliers and fixtures. They have in their employ some of the best designers in the country, and will prepare designs to suit the requirements of customers.

W. T. H.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 9, 1892.

THE ROSE ELECTRIC LIGHT SUPPLY COMPANY, of St. Louis, Mo., has established an office in room 232 in the Electrical Exchange Building, 136 Liberty street, under the management of the well-known expert Electrical Engineer Mr. H. F. Gray. The specialty of this company is the purchase, sale and exchange of electric-light apparatus of standard manufacture, a large supply of which is constantly kept on hand. Mr. Gray will be pleased to answer all inquiries relating to his line of business and give prompt attention to all orders received.

THE New York offices of the Edison Manufacturing Company have been removed from the Edison Building to 110 East 23d street, this city.

ON July 1 the main offices of the Thomson-Houston International Electric Company were removed from Boston to the Edison Building, 44 Broad street, city.

THE HERO ELECTRIC COMPANY, 80 Cortlandt street, manufacturer of electrical specialties, batteries for closed and open circuits, motors, etc., is making a specialty of its "Hero" motors for general power work. These motors are wound for from 2 to 20 volts, and use a low ampèrage of current for fan work. Two cells of the company's "Conqueror" battery will run them at a high speed, and keep up a nice circulation of air in a small office, bedroom, etc. The motors are also specially made to attach to the table of a sewing-machine, and they can be operated for a day with two cells of battery. These batteries are well constructed, and were described in a recent issue of the ELECTRICAL AGE. The company is making preparations for the introduction of several valuable specialties.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	85 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	203 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Commercial Cable Co	7,716,000	100 00	154 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	6 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	80 00
Edison Elec. Ill., N. Y.	5,400,000	100 00	85 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	84 00
Edison General	15,000,000	100 00	106 50
Edison General Receipts		100 00	106 50
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00

Names of Companies.	Capital.	Par.	Price.
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	44 50
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co	50,000,000	100 00	106 50
General Electric Co., 5s	4,000,000		*95
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y	50,000	50 00	40 00
Hickory Electric Co., N. C	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref	2,500,000	100 00	58 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*107
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	13 75
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Russell Electric Co., Boston	300,000	5 00	5 00
Sawyer-Man Elec. Light Co., N. Y	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*97
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Ongley Electric Co., N. Y	250,000	100 00	85 00
The Siemens & Halske Co., Ill	500,000	100 00	par
The Washington Wat. Pow., Wash	1,500 000	100 00	90
The Wells & French Co., Ill	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 00
Thomson-Houston pref	4,000,000	25 00	29 50
T.-H. Electric Co. 5s, Boston	500,000		*99
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	93 50
Westinghouse Elec. & Manf. Co	7,000,000	50 00	27 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	45 00
Westinghouse Ass. Rects		50 00	18 00
West Point W. Lt. & P. Co., Va	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Faith in the stability of the United States is grandly presented by the monthly statement in the fact that so large an amount is invested at an average of less than four per cent., when electric securities are freely offered in the market, without takers, actually earning and paying double the interest and daily increasing in value. The government statement is constantly being decreased; it was reduced last month $1,826,903, and for the fiscal year ending June 30 $11,386,299. From over two thousand millions when the books were made up at the close of the war, it has been brought down to $841,526,463, with $126,692,377 on hand; $559,664,830 of this bears interest at four per cent. and $25,364,500 at two per cent. That the government continues prosperous may be seen from the receipts which aggregated for June —$31,219,117, and for the year $356,933,302, which is about $45,000,000 less than the previous year; while the expense account shows $361,384,669, fully $28,000,000 less than the year before. It is to be hoped the census returns will be compiled before the full business begins, so that we may be able to draw a line showing where our commercial corporations stand. It is expected the figure will reach quite $60,000,000,000—an increase of one-third since 1880, or $20,000,000,000. Should the electricians' dream of to-day be realized and electricity supersede steam on the long as well as the short railroads, that class of securities will in fact, if not in name, assume an importance second to few of the financial features of the land. The electric multi-millionaires even at the end of only ten years' experience can scarcely be counted on the fingers, the next ten will see scores of them. Now is the time to join the army and grow up with it. The chances offered are legion and the prizes will be won by a very large minority. The government evidently will not purchase the business in this generation, and it is best to get in early and deep; the time can never be regained.

Now that the holiday season is with us, it must not be thought that all the investors or all the spare coin has gone either to Europe or the country; neither is it a fact that new securities have left New York out. Many have perfected their plants with the single view of floating their bonds here this summer, and they are succeeding too. The balance sheets they are able to produce are irresistible common stocks earning eight per cent., with no bonds out, are also on the market, and they still come from all sections of the country; the last two heard of are Denver and Chattanooga. The active South, as well as the Northwest, compete in this field. The choice is so extensive that the Eastern investor can generally find an opportunity to place his money in a security located in his old home, where he personally knows of the prospects, is familiar with the financial record of the officers, and therefore doubly assured of the certainty of his investment. Of course there must be a centre of information for such offers, and it can be found through the medium of the Electrical Age. The weekly changes in the regular list of quotations is the electrical history of financial improvement.

ORE SEPARATORS.

Editor Electrical Age: While the International Ore Separating Company does not desire to carry on, through your columns, any dispute with the Magnetic Separator Company, having had recourse to other effectual means, yet we must reply to the latest statement of that company, which infers that its service of suit had been evaded by the International Ore Separating Company. We wish to state distinctly and fully that no service nor attempted service of suit by any officer of the court or other person was made upon the International Ore Separating Company until after the denial of suit published by this company, and its expressed readiness to prove its claims before any court, as given under date of June 18. The publication of this denial, as intended, compelled the Magnetic Separator Company to make good its original statement or cease from its attacks. As previously stated, this company is prepared to protect its patents and to establish the illegality of the claims of the Magnetic Separator Company, and will do so as rapidly as the matter can be pushed.

Meanwhile the International Ore Separating Company will continue to do business "at the old stand," and will guarantee full protection to all its customers in their use of its machines or patent rights.

Very respectfully,
International Ore Separating Company,
By Harvey S. Chase, *Treasurer.*
No. 1 Broadway, New York,
July 2, 1892.

CATALOGUES.

Catalogue No. 3, just issued by Julius Lefmann, 2,200 N. Second street, St. Louis, Mo., manufacturer of the

three-joint iron and steel electric railway poles and overhead electric railway line supplies, is very complete in its details and illustrations. Mr. Lefmann's poles are very popular, and have given every satisfaction to those who have used them. Intending purchasers would consult their own interests by giving Mr. Lefmann an opportunity to figure before closing contracts.

The Crocker-Wheeler Electric Co., 430 West 14th street, New York, has issued a neat little illustrated pamphlet showing the various styles of motors manufactured by it for light, power and other purposes; and containing testimonials received from all over the country in recognition of the high grade of work turned out by them.

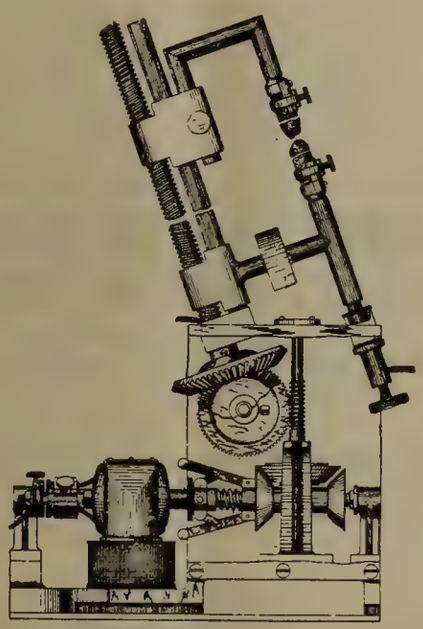
The Electrical Age's Illustrated Patent Record.

Issued July 5, 1892.

478,086. Electric Cyclometer for Velocipedes. Joseph Butcher, Melrose, Mass. Filed June 29, 1891.

478,097. Electric Measuring-Instrument. Sydney Evershed, London, Eng. Filed Dec. 18, 1891. Patented in England.

478,098. Apparatus for the Measurement of Electrical Resistances. Sydney Evershed, London, Eng. Filed Dec. 22, 1891. Patented in England.



478,145.—ELECTRIC-ARC LAMP.

478,104. Brush-Holder for Dynamos and Motors. Merrill H. Hathaway, Springfield, Mass. Filed Oct. 8, 1891.

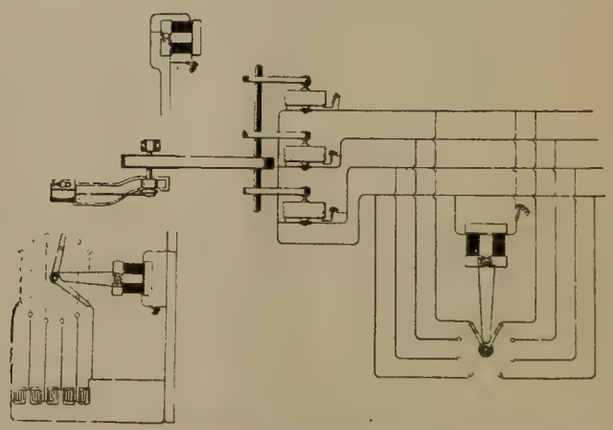
478,138. Electric Mine-Car. Elmer A. Sperry, Chicago, Ill. Filed Feb. 16, 1891.

478,139. Electric Locomotive. Elmer A. Sperry, Chicago, Ill. Filed April 8, 1891.

478,142. Dynamo-Electric Machine or Motor. Elmer A. Sperry, Chicago, Ill., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 16, 1891.

478,145. Electric-Arc Lamp. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 22, 1890.

478,149. Incandescent Electric-Lamp Socket. Henry E. Werline, Lancaster, assignor, by direct and mesne assignments, to the Werline Electrical Specialty Company, York, Pa. Filed Dec. 22, 1891.



478,344.—SYSTEM OF ELECTRICAL DISTRIBUTION.

478,155. Electric Alarm Clock. George C. Darche, Chicago, Ill. Filed June 1, 1891.

478,175. Electric-Railway Conduit. Milton Shoemaker, Sioux City, Ia., assignor of two-thirds to James W. Martin, same place, and Jason Passmore, Duncannon, Pa. Filed May 25, 1891.

478,180. Time-Switch for Electric Circuits. Benjamin E. Waters, Brockton, Mass., assignor to the Waters Electric Company, same place. Filed June 11, 1891.

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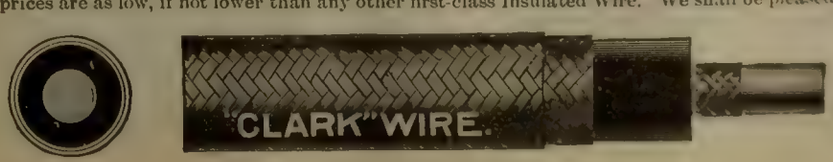
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

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HENRY A. CLARK, Treasurer and General Manager
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

478,182. Electrical Distribution for Cars. Samuel Young, Morris Moskowitz, Leon D. Adler and Joseph Loewenberg, Newark, N. J. Filed Oct. 15, 1891.

478,183. Electric Car-Lighting System. Samuel Young and Morris Moskowitz, Newark, N. J., assignors of one-fourth to Leon D. Adler and Joseph Loewenberg, same place. Filed Jan. 13, 1892.

478,186. Electric-Lighting System. Edward T. Cooke and William H. Mackey, St. Louis, Mo. Filed July 17, 1891.

478,201. Electrical Brazing Device. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Aug. 17, 1891.

478,230. Secondary Battery. James H. Gerry, Brooklyn, and Charles E. Long, New York, N. Y., assignors to the Gerry-Long Manufacturing Company, Jersey City, N. J. Filed Aug. 1, 1891.

478,237. Time-Registering Apparatus for Electricity. Henry H. Pattee, Monmouth, Ill. Filed Dec. 11, 1891.

478,242. Electric Locomotive. Sydney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 6, 1890.

478,245. Magnetic Lock. Henry V. Smith, South Yarra, near Melbourne, Victoria. Filed Dec. 18, 1891.

478,274. Electric Indicator. William E. Decrow, Boston, Mass. Filed March 8, 1892.

478,275. Suspension-Bar for Electric Lamps. Thomas Dillon, Indianapolis, Ind, assignor of one-half to John Caven, same place. Filed April 28, 1892.

478,276. Rheostat. Winslow P. Eayrs, Nashua, N. H., assignor of one-half to Frank A. McKean, same place. Filed Aug. 3, 1891.

478,324. Indicator for Electrical Signalling Systems. Charles F. Gillette, New York, N. Y., assignor to Joseph F. Bray, same place. Filed Aug. 13, 1891.

478,344. System of Electrical Distribution. Harry W. Leonard, New York, N. Y. Filed Nov. 27, 1891.

478,346. Electric Railway. Frank Mansfield, New York, N. Y. Filed Nov. 18, 1890.

478,367. Electric Cable. William H. Sawyer, Providence, R. I., assignor to the American Electrical Works, same place. Filed Feb. 18, 1892.

478,383. Lightning-Arrester. Charles S. Van Nuis, New Brunswick, N. J. Filed Sept. 16, 1891.

478,417. Swing-Joint for Electric-Light Brackets, Henry P. Drew, New York, N. Y. Filed March 15. 1892.

478,475. Electric Motor. Jerome B. Secor. Bridgeport, Conn., assignor of one-half to Mark Anthony, Berkeley, Cal. Filed Jan. 30, 1891.

478,477. Electric Locomotive. Sydney H. Short, Cleveland, O. Filed May 26, 1891.

478,485. Electric Battery. Charles F. Waldron, Boston, Mass. Filed Aug. 22, 1891.

478,510. Electric-Arc Lamp. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 12, 1891.

478,518. Insulator. Louis McCarthy, Boston, Mass. Filed April 19, 1892.

478,529. Dynamo-Electric Machine. Charles W. Thomas, Jersey City, N. J., assignor of part to Philip Van Volkenburgh, New York, and John H. Pendleton, Brooklyn, N. Y. Filed Oct. 21, 1890.

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FIRE LOSSES.

"The Chronicle Fire Tables" for 1892 show a gratifying record as regards electric wires and lights as factors in the starting of fires during the year 1891.

These "Fire Tables" review the fire losses in the United States during 1891 in every aspect, and show that during the year the increase in losses over the preceding year was greater than any yearly increase previously recorded. The number of fires also show an increase, though small, as compared with the increase in losses, and naturally we should expect to find an increase in the *causes* of fire. To a great extent this is the fact, but there are some classified causes which show a decrease, and among the latter we find "electric wires and lights."

This record simply bears out what we have on frequent occasions asserted, that with the introduction of improved appliances and methods electric wires will continue to grow less and less in importance as an active cause of fires.

While electric-wire fires show a decrease in number, lamp explosions, cigars, cigarettes and tobacco pipes show an increase. "Drunken men" are also recorded in the increase list of causes. Just how a drunken man causes a fire, simply because he is drunk, is hard to conceive. It may be that the "fire water" within him is responsible in some way or another.

STORAGE-BATTERY CARS.

Notwithstanding the frequent assertions from different sources that the storage-battery method of street-car propulsion is a failure there are some who believe otherwise. President Hart, of the Second avenue line, in this city, is one of the latter, and he is about to introduce the storage battery experimentally on his line. President Hart is inclined to think that the battery he is about to test in practice will prove successful in street-railway work. As far as he can judge from the facts already presented to him the storage-battery systems, as he intends to apply it, will cost for its operation about the same as with horses.

REMARKABLE ELECTRICAL STORM.

A most remarkable electrical storm took place on Saturday, July 16, causing great disturbance on telegraph wires.

The only evidence of the existence of such abnormal conditions during the daytime is their disturbing effect on the magnetic needle and telegraph circuits. On this occasion the electrical waves were most violent in their intensity, at one time the difference of potential being no less than 500 volts.

So far as known, no recorded electrical storm has been so violent in its effects as the one of Saturday last. Telegraph wires were rendered practically useless much of the time during the prevalence of the storm, which lasted until well into Sunday.

During these storms it is frequently possible to operate telegraph circuits by the aid of nature's supply of electricity alone. But as such currents are not steady they practically demoralize the telegraph service.

On Saturday night the visible manifestation of this remarkable storm was most brilliant and active. The northern part of the heavens was beautifully illuminated by the lights. One extraordinary feature of the display was the rapid succession of brilliant flashes in the northern sky resembling lightning.

A "spot" on the sun's face was observable on Sunday with the aid of telescope and the usual smoked glass. It was just a speck, but it caused as much disturbance here on earth as though it was a large "spot."

A GRAPHIC REPRESENTATION OF THE MAGNETIC FIELD.*

BY PROF. EDWIN J. HOUSTON.

BEING engaged in a study of the magnetic field and desiring to obtain some simple method of fixing and readily reproducing the peculiarities of different fields, I have, after numerous trials, succeeded in devising a modification of an old and well-known plan, so simple and efficient, that I have thought it may be of sufficient interest to others engaged in similar investigations, to describe it in detail.

The method consists essentially in forming a magnetic field with iron filings on a plate of glass in the usual manner, and subsequently fixing the filings so as to permit the plate to be used as a positive for obtaining a blue print, a silver print, a platinotype, or any other photographic print.

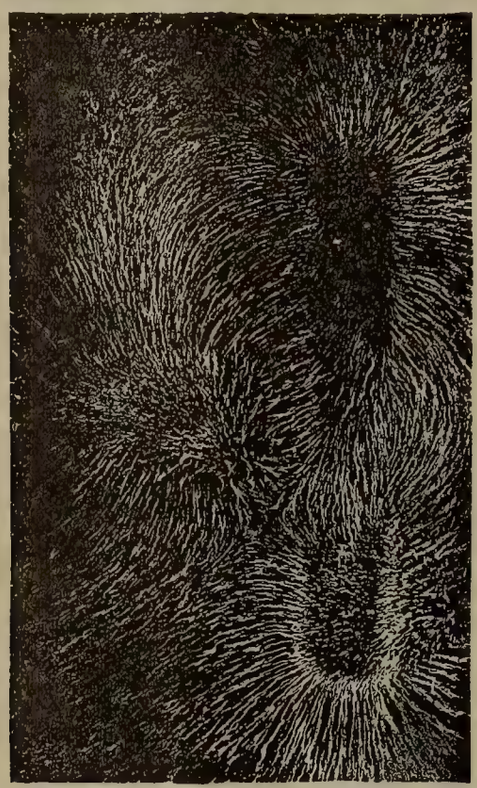


FIG. 1.—BAR MAGNETS AT RIGHT ANGLES TO EACH OTHER.

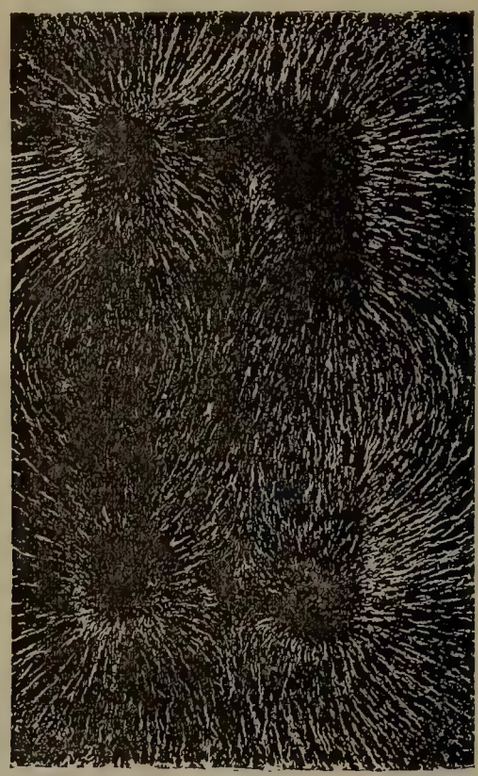


FIG. 2.—PARALLEL BAR-MAGNETS. SIMILAR POLES OPPOSED.

In order to readily fix the groupings of filings on the glass plate while in the field of the magnet, a thin film of wax is spread over one surface of the plate by any suitable process.

A convenient method of waxing the surface of the plate consists in first gradually heating the plate until its temperature is above that of the melting-point of wax, and spreading melted wax over its surface by means of a brush. The surplus wax is then allowed to drain off the plate, or it may be wiped off by a piece of warmed paper. The remaining wax is then spread in an even film over the surface by cautiously heating the plate by a Bunsen flame or other suitable source of heat; or, the same thing can be effected by placing the plate in a vertical position in an oven or sand bath, supported on a suitable vessel so as to catch the surplus wax which drains off.

Plates can be readily covered in this manner with an uniformly thin coating of wax sufficiently transparent to permit them to be successfully employed for photographic printing. For such purposes, of course, only pure white wax is employed.

The wax-covered glass plate so prepared is placed with its waxed surface upwards, in a horizontal position over the magnet whose field is to be fixed, and iron filings are sprinkled over its surface. The arrangement of the filings in the characteristic groupings of the field is aided by gently tapping the plate in the usual manner.

When a satisfactory grouping of filings has been obtained, the field is fixed on the plate by gently warming it so as to melt the wax. At first I adopted the plan of carefully lifting the plate from the magnet and melting the wax by holding it over a source of heat, such as a Bunsen burner; but, no matter how carefully the plate was lifted from the magnet, or how nearly it was raised vertically from the same, so as to avoid lateral displacement of the filings, a change of figure almost invariably attended its removal. Better results were obtained when the wax was melted while the plate was in place over the magnet. This can be readily effected either by holding a heated plate over the warm surface, or more conveniently by cautiously heating it by a Bunsen flame. After a slight heating, the flame may be permitted to play directly on the surface of the filings without displacing them.

After cooling, the plate with its fixed groupings of iron filings may be used as a positive for photographic printing. For this purpose it is placed in a printing frame with its surface of wax-fastened groupings of filings upwards, so as to come into contact with the surface of the sensitized paper.

If the plate has been properly prepared, but comparatively few filings will become detached from the waxed surface when it is brought into contact with the sensitized paper. These should be blown off before taking a second print from the plate.

In order to maintain the minimum of roughness of surface, it is necessary to use filings that are as nearly as possible of a uniform size. This can be readily in-

* Abstract of paper read before the Electrical Section of the Franklin Institute, Philadelphia, on May 31, 1892.

sured by previously sieving them through a fine-meshed were gauze.

It is advisable that the plates be covered with as smooth a coating of wax as possible. Otherwise, the filings will be prevented from readily arranging themselves in the directions which the lines of magnetic force pass.

In the case of powerful electro-magnets care must be taken to avoid a too great motion of the filings to the poles, since, in this manner, the portions of the surface over which the particles are moved, are swept clean of filings.

The best results are obtained by sieving the filings over the plate through a sieve whose meshes are sufficiently fine to insure a small quantity only of filings falling on the plates at any one time. This, of course, is necessary to insure the uniform distribution of the filings in the field of the magnet.

* * * * * * * *

I have prepared a number of fields according to the processes described. They have been printed by the platinotype process.



FIG. 3.—BAR MAGNETS. DISSIMILAR POLES OPPOSED.

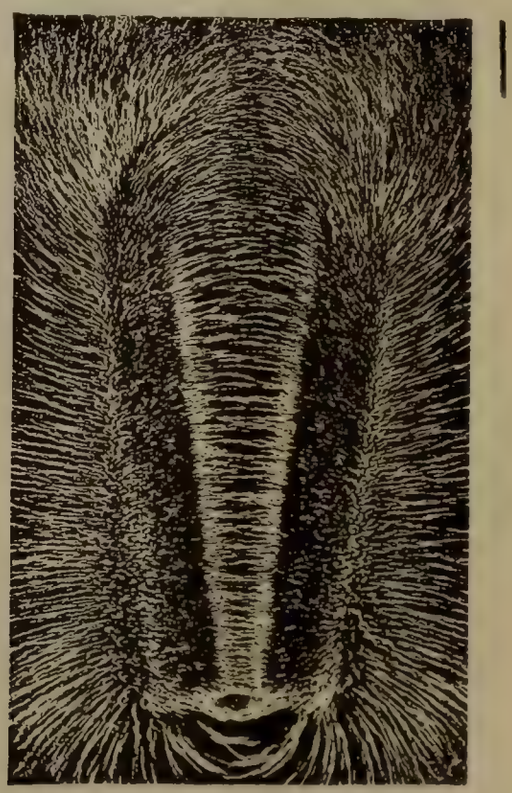


FIG. 4.—FIELD OF HORSESHOE MAGNET.

Fig. 1 shows a very curious field produced by two bar-magnets placed with their axes at right angles to each other so that one of the poles of one magnet is placed at right angles to the neutral point of the other and at a short distance from it. At the left-hand of the field is shown the curved deflections of the lines of force produced by the attractions of opposite poles. * * * At the right-hand of the field the repulsions existing between the similarly-directed lines of force produce characteristic parallel streamings. The curious area bounded by hyperbolic curves is shown in the space between the poles at the right of the figure.

Fig. 2 shows the field produced by two straight bar-magnets placed with their axes parallel to each other and their similar poles near together. The mutual repulsions of their fields are clearly shown. The curious areas bounded by hyperbolic curves are shown in the spaces at each end between the poles of the magnets.

Fig. 3 shows the field produced by the same parallel bar-magnets placed with their opposite poles near together. The attraction of their oppositely-directed lines of force is well marked. In the neighborhood of their neutral points, a very marked area bounded by hyperbolic curves is seen. The strength of the magnetic flux near the neutral points is also marked.

Fig. 4 shows the field of an ordinary horseshoe magnet. The magnetic leakage between the sides of the bar is marked, as is also the strength of the magnetic flux in the neighborhood of the equator or neutral point of the magnet.

It may be mentioned in this connection that it is in general advisable to avoid resting the plate on the surface of the magnet, since when the plate does not touch the poles it is left free to be gently tapped or vibrated so as to permit the filings to arrange or group themselves while in the field of magnet.

Fig. 5 shows a novel field obtained by short lengths of very thin iron wire, that act as small magnetic needles. Although the separate particles do not possess as great freedom of motion as the shorter and smaller iron filings, yet their tendency to come to rest with the lines of magnetic force passing through their greatest dimensions, so as to reduce the resistance of the magnetic circuit as much as possible, is manifest.

The peculiar wire field produced by these means is of especial interest when studied in the light of Ewing's theory of magnetism.

Fig. 6 shows a field produced by iron filings and iron wire. The peculiar groupings of the iron wire in chains of polarized particles are clearly shown.

A curious resemblance is possessed by this field and other wire fields to the discharge produced by a lightning flash, or other high potential discharge; such, for example, as the recent 500,000 volt discharge of Elihu Thomson. This resemblance quite naturally leads to the speculation, whether the peculiar forked or curved shapes of such discharges are not due to similar causes, viz.: to polarized chains of particles of the medium which offers paths of less resistance to the discharge than the spaces adjoining or surrounding them.

Since writing the above my attention has been called

to the fact that the process above described has been very fully anticipated by Prof. Mayer, in a publication printed in the *Journal of the Franklin Institute*, for May, 1871. As my process differs in some particulars from that described by Prof. Mayer, and as it appears to me advisable to call attention to both processes at this time, I have concluded to permit the paper to go to publication. To Prof. Mayer, however, the credit is due for the first conception of the general process.

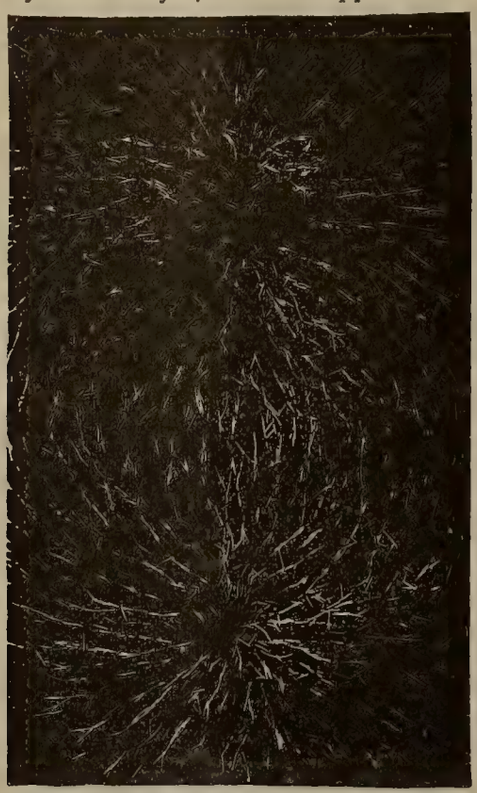


FIG 5.—WIRE FIELD OF BAR MAGNET.

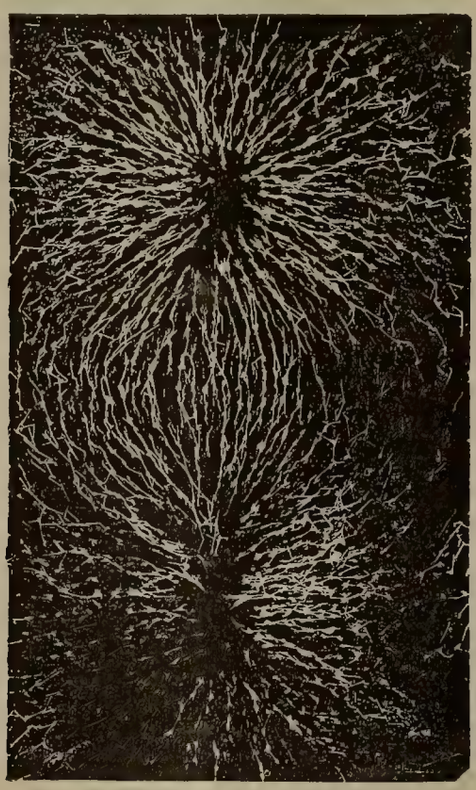


FIG 6.—WIRE AND FILINGS FIELD.

Since writing the above on last Saturday, I have devised a new plan which I believe to be far in advance of what I have just described.

According to this plan I place a dry sensitized photographic plate over the magnet whose field I desire to fix, and after the characteristic groupings of filings have been obtained I expose such plate while over the magnet to the light of a gas-flame for a few seconds.

This operation is necessarily performed in the dark photographic-room. After exposure the light is turned out and only the non-actinic red or yellow light left. The filings are allowed to fall off the surface of the dry plate, and the finer particles that still adhere to it are brushed off by a feather or dry camel's hair brush. The plate is then developed and fixed in the usual manner.

EARTH CURRENTS.

BY WILLIAM FINN.

A MAGNETIC storm of unexampled severity and duration swept over the United States on Saturday, July 16, almost completely paralyzing the entire telegraphic service of the country for several hours.

The writer had suspected the presence of abnormal earth currents in the wires on the morning of that date, and was engaged in making observations and taking readings for several hours prior to the advent of the storm.

Between 8 and 10 o'clock more or less difficulty had been experienced in operating many of the eastern and western circuits, and galvanometer tests had shown the existence of strong and variable earth currents in some of the wires.

From 10 to 11 A.M. continuous observations were made on a New York-Boston wire in which the current showed incessant variations, both in direction and magnitude, the latter averaging upwards of 10 milliampères.

Several tests between 11 and 12 showed similar variations in the polarity of the current, though somewhat diminished in strength.

Between 12 and 12:15 P.M. upwards of 150 changes in the direction of the current had been noted on a New York-Providence wire, during which time the current averaged 9 or 10 milliampères.

Suddenly, at 12:20 P.M., a tremendous wave struck the wire, which sent the galvanometer needle whirling around the scale and prevented further measurements being taken without the aid of a $\frac{1}{110}$th shunt. At the same instant every eastern and western circuit as well as many wires in other directions became either partially or wholly inoperative. A short while afterwards there was scarcely a wire in any direction—except local ones—that did not feel its effects, though here and there the curious anomaly presented itself of a circuit being operated between two points where other circuits between the same terminals were absolutely unworkable.

At 12:37 P.M. a reading obtained on a six-gauge iron wire to Boston, 213 miles in length, and measuring about 3,700 ohms, showed a current strength of 27 milliampères, which increased to 32 milliampères two minutes later, and continued to grow in intensity, until it finally attained the unprecedented magnitude of 133 milliampères at 12:40 P.M., representing a difference of potential between the two grounds of about 492 volts. This was the highest electromotive force observed in any subsequent tests, many of which, however, exhibited currents of higher values in the wires. For instance, the current strength noted in a wire to Elizabeth, N. J., rose from 55 milliampères at 1:51 P.M. to 95 milliampères at 1:55 P.M., and finally to a maximum of upwards of 150 milliam-

pères at 2:10 P.M., with an estimated E. M. F. at that time of about 210 volts.

A wire to Philadelphia measuring 900 ohms exhibited a current of 140 milliampères, thus showing a potential difference of 126 volts between the distant grounds.

The writer knows of no record of any previous storm in which the voltage and strength of the earth currents ever attained so high a value. The nearest approach in point of intensity is probably the electric storm of January 31, 1881, which developed a current of 41.4 milliampères in one of the London-Irish wires; the highest E. M. F. observed being 120 volts in another wire between Haverford west and Valentia.

During the prevalence of Saturday's storm it was found possible—as is usual in such cases—to converse, and even send business over the wires without the aid of the ordinary artificially produced signalling currents.

By 3 P.M. the disturbing forces had so far subsided as to admit of a resumption of working on most of the southern wires, as well as on several circuits in other directions.

About 4:15 P.M. another but less powerful wave struck the western wires, but did not appear to further affect other circuits, hardly any of which, however, was entirely free from interruption.

The storm continued to disturb the wires at intervals more or less frequent and with varying degrees of intensity during the whole of the night, and did not finally disappear until the afternoon of the following day.

Sun spots are probably responsible for this latest extraordinary electrical manifestation, as they have been undoubtedly concerned in the production of similar phenomena in the past.

The period of maximum sun spots, which occurs about every 11½ years, has always been associated with disturbances of this nature ever since the advent of telegraphy.

The present year falls in midst of a period when sun spots are most numerous, and already 11 electric storms have so far been recorded, viz.: Feb. 13, powerful and variable; March 6, comparatively mild; March 12, mild; April 24, 25 and 26, slight and sporadic; May 16, strong; May 17, mild; May 18, very strong and exhibiting curious anomalies; July 12, strong but comparatively steady; July 16, very powerful and very variable. Many of the principal characteristics of these storms have been recently presented to your readers, and it only remains to be said that it is generally believed by scientists that the tremendous eruptive forces in the sun during these particular periods disturb the electrostatic lines of force radiating from our electrically charged globe, and thus create the conditions necessary for producing those great differences of potential between various portions of the earth's surface which give rise to abnormal earth currents.

ELECTRIC LAUNCHES AT THE WORLD'S FAIR.

In our issue of June 11 last we gave an account of an exhibition test on the Passaic river, at Newark, N. J., of the electric launch "Electra," owned by the Electric Launch and Navigation Company, of New York, which launch was built as a sample boat for the passenger traffic on the enclosed waters at the World's Fair, Chicago, and to be submitted for test and approval by the exposition management. From General C. H. Barney, general manager of the company, we have received the following report of the tests:

"At the official test of electric launches made by the electrical engineers of the World's Columbian Exposition, at Jackson Park, Chicago, Ill., each boat was required to make a ten hours' consecutive run over a prescribed course, and making designated landings.

"Two boats entered, the 'Electra,' owned by the Electric Launch and Navigation Company, of New York, and a boat not named, built by the Columbian Launch Company, of Chicago.

"The 'Electra' made forty-five trips at the rate of eleven and a quarter minutes per trip. The Columbian boat made thirty-two trips at the rate of sixteen and a quarter minutes per trip.

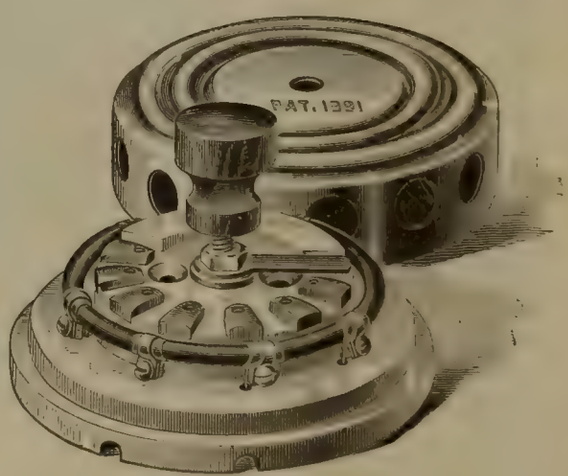
"Subsequently, a test was had of several cells of battery taken at random from the two boats. The cells were charged as fully as the contestants desired and then discharged at the uniform rate of 16 ampères. The batteries of the 'Electra' (the Consolidated Company's) were charged 160 ampère hours, and gave a discharge of 137. The Columbian batteries (Morrison's) were charged 200 ampère hours, and gave out 100. A second test of the latter resulted, charge, 235; discharge, 109."

RHEOSTAT SWITCH.

Under existing methods when the current is turned on to an incandescent lamp the filament receives a sudden shock that is very injurious. It breaks off infinitesimal particles of the carbon which soon blacken the bulb, and eventually the filament gives way under the strain and a "burned out" lamp is the result. Manifestly if we could admit the current into the lamp gradually, so as to avoid the sudden rush of current upon the delicate filament, we would greatly lengthen the life of the lamp and at the same time preserve the purity of the light.

The question of regulating the current admitted to a lamp is one that has for many years received the attention of electricians.

The McCreary Electrical Specialty Co., of 136 Liberty street, New York city, has just brought out a patented rheostat switch, which was designed with this very object in view. It can be used on either direct or alternating-



RHEOSTAT SWITCH.

current circuits, and has for resistance a series of carbon buttons of special construction.

This switch is about the size of an ordinary 10-ampère switch and can be connected as easily as any other. The great feature of the switch is that it permits of turning down the light to any degree, as is done with gas, and is particularly adapted for halls, sleeping apartments, hospitals, etc., where it is desired to keep a low light burning.

The company guarantees that the switch will prolong the life of any lamp it controls one hundred per cent. It also prevents the blackening of the bulbs which is so common where the ordinary methods are employed. This feature alone is an important one and reduces the cost of renewals very largely. It is claimed that the saving in lamps alone will pay for a switch in three months. This is a large item and is well worth the attention of users of incandescent lamps.

THE AMERICAN TYPE TELEGRAPH.

Printing telegraphs are almost as old as the electric telegraph itself. House, Hughes, Phelps and others followed quickly in the footsteps of Morse, with devices for supplanting the Morse character with the Roman letter.

In some countries they almost succeeded, and to this day continental Europe does a large amount of its telegraphing by means of the Hughes printing telegraph.

In England the Hughes machine was extensively employed by the old companies, and was only abandoned after the telegraph had been absorbed by the government.

In this country there was once a "House" telegraph line using that system exclusively, and the Western Union Company has for years transmitted press and other telegrams between Boston, New York, Philadelphia, Baltimore and Washington by means of the Phelps improved "motor printer" with success, and at a rate of speed far exceeding that of the Morse.

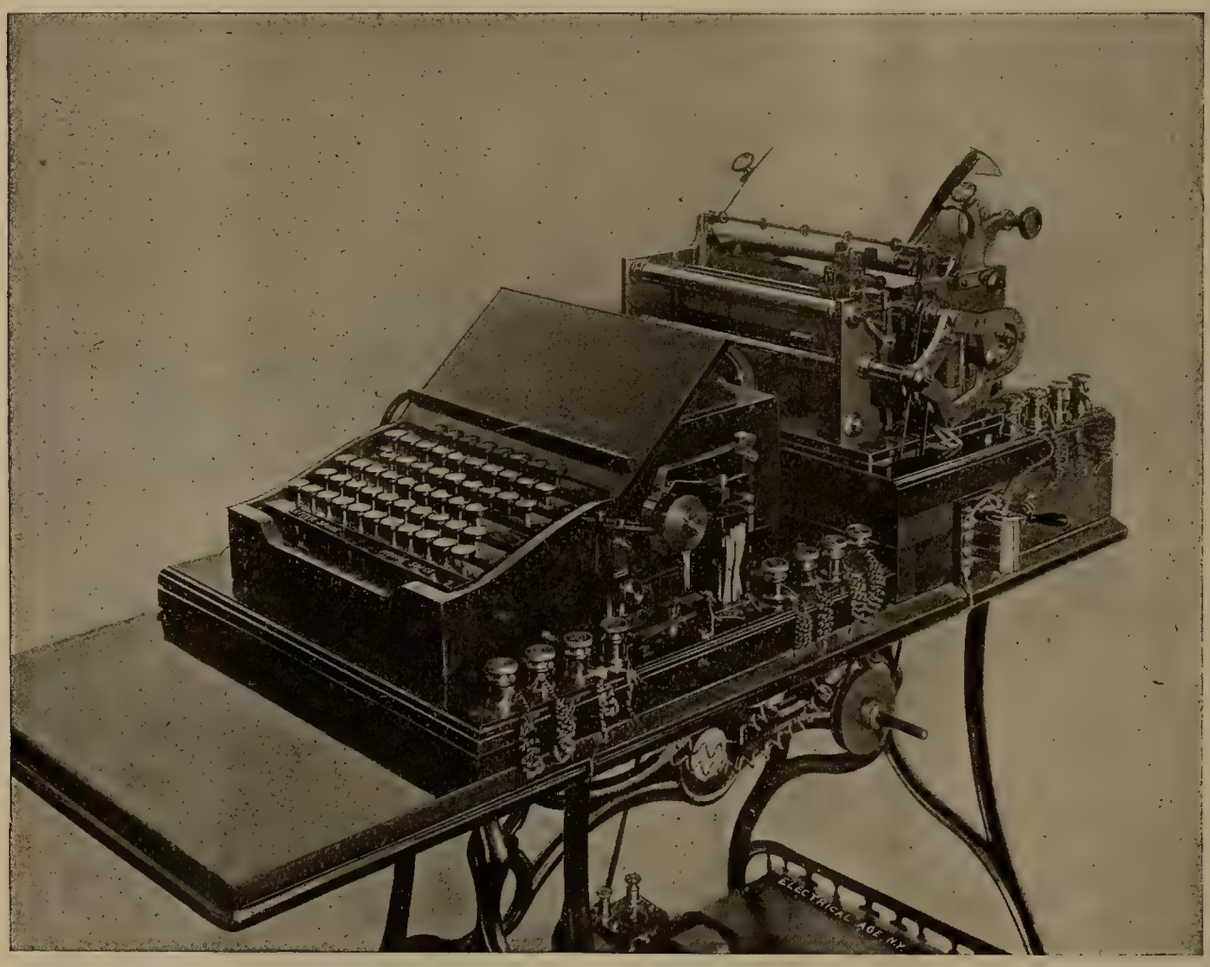
One of the chief objections to the printing telegraphs in the past has been the "form of delivery." All of them printed their messages on a narrow band of paper or "tape." A press despatch of a few hundred words would be many feet in length and liable to kinks, breaks and entanglement.

Users of the telegraph have always objected to receiving their despatches on a ribbon, and many have refused to accept them by the yard, asserting that filing with safety was impossible, and that portions of messages were frequently lost. As a result, all despatches received by printing telegraph in Europe are now torn into short lengths and clumsily pasted on ordinary delivery blanks.

The tearing and fouling of the tape in the basket of the ordinary "ticker" is familiar to all, often rendering impossible a backward search for some particular item of news.

The American Type Telegraph machine has been designed with a view to overcoming this and many other objections to printing telegraphs as they have heretofore existed. By means of this latest device, the delivery is in the form of a printed page, eight inches wide. All the letters, numerals, fractions and other signs necessary to ordinary typewriting are provided.

The receiving instrument is entirely automatic in its action, requiring no skilled operator to watch or adjust it. The transmitter is similar in form to the typewriter as far as the arrangement of the keys is concerned, and can be worked by any person familiar with that instrument. The transmitting operator, by means of his key-board, has full control of the machine at the distant end of the line, and can vary the length of a printed line or the space between two items of news, or two telegrams, at will.



TRANSMITTER AND RECEIVER, AMERICAN TYPE TELEGRAPH.

Electrically, this instrument has been designed with the object of relieving the electro-magnets which are operated or connected with the main line of as much work as possible. This object is accomplished by the use of a suitable motive-power (a small electric motor) independent of the magnets, for effecting the mechanical operation of the several parts of the printing and feed mechanisms and by utilizing the electro-magnets merely for releasing, arresting and generally for controlling the action of the said motive-power.

The type-wheel employed has four rows of characters, and is combined with means for raising or lowering the same for the proper alignment of any one of the rows. An oscillating movement is also given to the type-wheel, whereby any desired character is printed on the paper. Mechanism is provided for rotating the type-wheel to

present any desired character of a given row to the paper in the printing position; also for moving the type-wheel and its carriage laterally across the face of the paper and for its return to the starting or initial point, also for feeding the paper upward at the end of each printed line.

Mechanisms, all actuated by the above-mentioned motor, also set the type-wheel, make the printed impression, control the letter feed and spacing, return the type-wheel carriage and feed the paper. The first, second, third and fourth positions of the type-wheel, presenting the various rows of characters to be printed, are obtained by the action of the motor, as well as the restoration of the wheel from the fourth to its original or first position.

The setting mechanism which governs all of the above movements is a small light shaft actuated frictionally by the motor and released, step by step, by a sensitive polarized relay in the main-line circuit. Here inertia is small and a consequent high speed of revolution obtained, four hundred or more revolutions per minute.

On this shaft are an escapement wheel, ratchet-retaining wheel, unison device and a setting-pin and wedge. The moment the pin is placed in the proper position by the action of rapidly reversed currents, other magnets in the circuit, neutral and less sensitive, are affected by the prolongation of the current and release the mechanisms connected with the motor, necessary to perform the various functions already enumerated.

The work done by these magnets, which are in the main-line circuit (there are three of them), is of the lightest character possible, and the working of the instrument over long circuits where light currents are necessarily employed, is practically assured. In practice a speed of over 40 words per minute on a two hundred mile circuit, using the ordinary Morse power, has been reached, and will probably be exceeded when operators shall have become entirely familiar with the working of the machine.

Typewriting by wire and by ordinary typewriting methods have been the objects sought to be obtained in the American Type Telegraph. The width of the paper, the form and action of the keyboard, as well as the manipulation of the machine generally, are made to conform, as nearly as possible to the practice with which an ordinary typewriting operator is familiar. But all these qualities, were they not accompanied by the prime adjunct of a good commercial speed, would be insufficient. A new device, to he commercially successful, must maintain or increase the carrying capacity of a wire, and this the American Type Telegraph does.

The accompanying illustration shows the machine which has been referred to above. The company is, however, manufacturing another and smaller machine, which also works at a good speed and delivers its matter in the same form, for private line working. In this latter device the motor is eliminated and the construction is generally simpler.

A column or page-printing machine by the same inventor has been working successfully in London for the past three years delivering news reports to all the leading newspapers and clubs.

The instruments owned by The American Type Telegraph comprise the London machine as well as the two others referred to above. The success of the London machine may be taken as some indication of the capacity of the two latest machines which have not only been improved in every detail, but in principle also; the speed of motor machine being more than double that of the English one.

The inventor of these instruments, including the London one, is Mr. J. E. Wright, of New York.

"Great inventions are never, and great discoveries are seldom the work of any one mind."

GALVANIC BATTERY.

The application of the galvanic current as a remedial agent, especially for nervous ailments, is so universal, that no physician's office is looked upon as being complete nowadays without a galvanic battery.

One of the most successful batteries, and one that has given general satisfaction, is that manufactured by the Jerome Kidder Manufacturing Co., New York. This



BATTERY COMPLETE.

firm has been manufacturing galvanic batteries for over a quarter of a century, and with such an extended experience its batteries must of necessity be well-nigh perfection.

In the construction of a galvanic apparatus the chief feature to be considered is simplicity combined with reliability. It is preferable that the jars should be of glass,

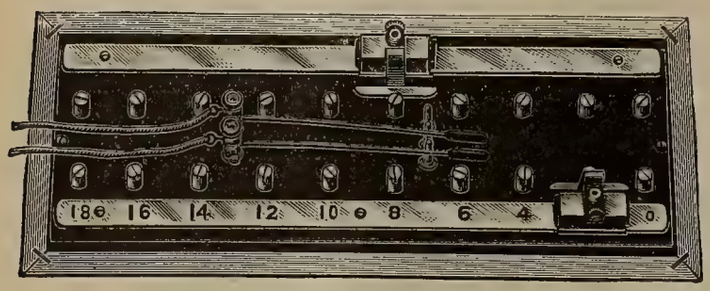


ARRANGEMENT OF ZINC AND CARBON PLATES.

as it permits of an easy examination of the fluid, but owing to the danger of being easily broken rubber jars are almost exclusively used. They should be made singly instead of compartment form, being less expensive to replace in case of damage by accident, and of a rectangular form, which permits of a more compact apparatus than

round jars. The tray should be so made as to permit the jars being readily raised, lowered and removed, without disturbing any other parts. The zinc plates should be flat and present a large surface to the action of the fluid, and so attached to the support that they can be easily removed or replaced at will.

The same rule applies to the carbon plates, which should be of the finest grade, hard and of smooth surface, so as not to absorb the fluid and corrode the contacts. The elements should be fixed in their position



HYDROSTAT.

and the jars movable, as the danger of breaking plates is thereby lessened. The apparatus should be provided with a device for selecting any single or number of cells without shock as desired. Also a polarity changer, so that the direction of the current may be changed without removing the electrodes. A hydrostat should be provided so as to make it portable, and it should be of a shape and material that can be replaced at home.

The Kidder battery possesses all of these features in a marked degree, and so well recognized is this fact that the company receives daily an immense amount of testimonials from physicians in all sections of the country.

The accompanying illustrations show the battery complete; the arrangement of the zinc and carbon plates, and the hydrostat.

COMBINATION CHANDELIER SWITCH.

The new combination chandelier switch, manufactured by the Interior Conduit and Insulation Co., of New York, is an article which deserves special mention.

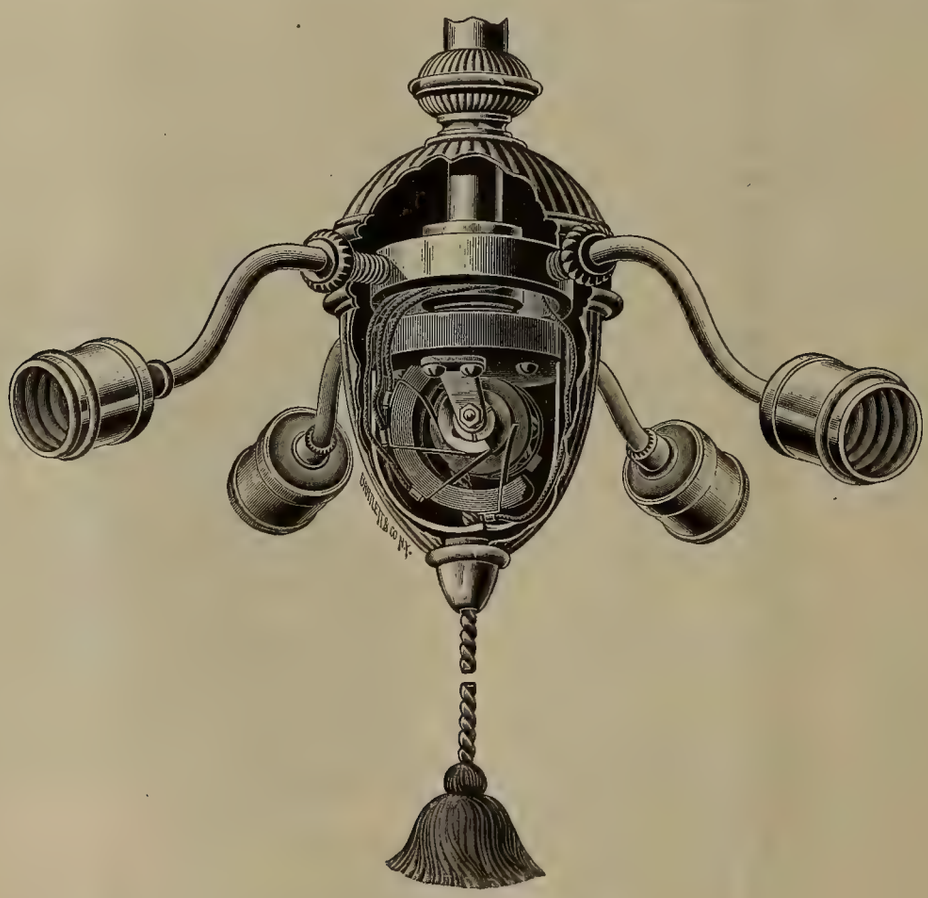
The accompanying illustration represents a chandelier made for four lights only, but as many lights as may be required can be controlled by this device, which embodies the same principles as are contained in the Greenfield Pull-Down Switches, also manufactured by the Interior Conduit and Insulation Co., and recently described and illustrated in these columns.

The mechanical arrangements of this new switch are most ingenious, and are contained in the shell or body of the chandelier. A pull on the cord turns on or off at will one or more lights consecutively, thus dispensing with switches on the side wall or key-sockets in the chandelier. No extra wiring for the switch and chandelier is required, each light is under direct control by simply pulling the cord, and the switch can be incorporated in the body of any chandelier, as it merely intersects the stem of the same.

This ingenious and extremely useful article has instantly and favorably commended itself to the attention of the trade.

CLAM-BAKE.

The American Electrical Works, Providence, R. I., will, on Saturday, July 23, tender to the electrical fraternity its 14th annual Rhode Island clam dinner, at Haute Rieve. These dinners are extremely enjoyable affairs.



CHANDELIER SWITCH.

THE incandescent lamp owes its existence largely to Prof. William Crookes, who discovered successful methods of producing perfect vacua.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

The Incandescent Lamp.

HISTORY credits J. W. Starr, of Cincinnati, Ohio, as being the first person to produce an incandescent lamp. On November 4, 1845, he obtained a patent for such a lamp, which was essentially the same as the incandescent lamp of to-day.

The material first used for the filaments of incandescent lamps was platinum. Iridium was also employed to a slight extent. Both these metals, however, are very expensive, particularly iridium, and they were eventually abandoned when it was discovered that carbon was much superior to either as material for filaments.

Platinum, next to carbon, is the most available substance for filaments. It possesses the advantage of being practically inoxidizable, and it is capable of being raised to a white heat, when it emits white light of dazzling brilliancy. It has the disadvantage, however, of being uncertain as to its resistance to fusion at very high temperatures. There is a point in the heat which, if when reached the temperature is very slightly increased, causes the platinum to fuse. This point is known as the "critical point," and is very suddenly reached.

We mention these facts concerning the behavior of platinum more on account of their historical than their practical bearing on the subject. The facts are interesting in themselves, but as it is the purpose of these articles to discuss practical questions, we will at once take up the subject in its actuality.

In the selection of a substance for lamp filaments, one with a high specific resistance is essential. Carbon possesses this requirement to a greater degree than any other substance, besides being infusible at the highest temperature and having greater illuminating power. Carbon has 250 times the electrical resistance of platinum, and while it has so far resisted all efforts to produce fusion, a temperature has been attained which caused it to become flexible. Such heat, however, is never met with in practice.

As carbon at high temperatures is readily volatilized in the presence of oxygen (in air), it is necessary to confine the lamp filament in a bulb or other receptacle from which all the air has been exhausted. In all the bulbs of incandescent lamps which we see on every hand these days, an almost absolute vacuum exists, the only thing within the void being the thread-like filament. It is well known that in case of a fracture of the bulb when the filament is incandescent, and the air is thereby admitted to the interior of the bulb, the filament becomes volatilized instantly.

Carbon possesses another property which is remarkable and which renders that substance peculiarly suitable for filaments, namely, a decrease of resistance with increase of temperature. In other words, the carbon filament has higher resistance when it is cold and non-incandescent than when it is hot and incandescent. The advantage of this property in carbon is that it renders overheating less possible. Carbon stands unique in its electrical behavior. The resistance of all metals and other conductors increases with the increase of temperature, whereas, in carbon, the reverse is the fact.

The preparation of carbon filaments for lamps is a delicate operation, and the methods of accomplishing the result are as various as are the makers.

Edison uses for the filament a thin strip of carbonized bamboo, and Swan prepares his by carbonizing a cotton thread after it has been "parchmentized" by immersion in sulphuric acid. In the operation the thread passes through the acid which acts on the fibres of the thread and gradually destroys their molecular structure, partially dissolving the material and converting it into a gelatinous semi-transparent state, as cellulose. The thread is then very thoroughly and carefully washed so as to remove every trace of the acid, after which it is dried and then carbonized. When it is dry it becomes remarkably tough and has a horny appearance. The process of carbonizing, which is one requiring great care and skill in its performance, causes the carbon to become remarkably elastic and metal-like.

Edison's method of preparing and treating bamboo for filaments is interesting. Manifestly any substance which is rich in carbon, is, all other things being equal, best for filaments. The object to be attained is to get as compact a carbon as possible, and as bamboo is rich in carbon and tough, it is peculiarly adapted to such uses. Bamboo, moreover, possesses a straight grain and great tensile strength, which qualities are of decided advantage in view of the fact that the fibre is necessarily subjected to harsh treatment in the process of reducing it to the proper size.

The bamboo is reduced to the proper proportions by shaving, or drawing through a series of dies, each of which successively removes a small portion of the fibre until the proper size is obtained. The fibres are then bent around blocks of graphite, in the shape of hairpins, and then carbonized. The process of carbonization, which is practically the same in the manufacture of all lamp filaments, consists of packing the fibres and moulds in a pot containing carbon dust, and then subjecting the pot and its contents to an intense heat for several hours. During the carbonization air is carefully excluded from the pot, otherwise the fibres would be destroyed.

After it is carbonized the filament possesses a brilliant surface and a remarkable elasticity. If one is struck a slight blow it emits a very metallic sound, just such a sound as a steel wire would give on being struck.

The bamboo is reduced to half its original size in the carbonizing process, but the fibre remains plainly visible. The residue is a very pure form of carbon and abundantly able to withstand the high temperatures for which lamps are designed.

The diameter of the filaments, of course, has an important bearing on the candle-power of the lamp, or the amount of light it will give under certain conditions, and is carefully determined according to the proposed voltage of the lamp.

After the filaments are carbonized they are put through another process, by which a coating of hard, gray brilliant carbon is deposited on their surface. This greatly increases their strength, and is known as "lashing." It consists in rendering the carbonized filaments incandescent, by an electric current or other means, in a carbon vapor bath. In this way carbon is deposited on the surface of the filaments, forming a hard, even, dense and homogeneous coating.

(*To be continued.*)

OBITUARY.

CYRUS W. FIELD.

Mr. Cyrus W. Field, who was known to electrical people all over the world through his prominent connection with the laying of the first Atlantic cable, died at his summer home at Ardsley, near Dobbs Ferry, N. Y., at 9.45 A.M. July 12.

Mr. Field was born at Stockbridge, Mass., November 30, 1819, and was consequently at the time of his death nearly 73 years of age.

He had a common-school education, and came to New

York at the age of fifteen to seek his fortune. His first business experience was as a clerk for the famous A. T. Stewart at a salary for the first year of $1 a week. He afterwards went into business for himself and succeeded in amassing a fortune which enabled him to retire from active business at the age of 35 years.

Mr. Field's connection with the Atlantic cable project will particularly interest our readers, and as it is of historical value and interest, we will give it in some detail.

In 1853 his brother, Matthew D. Field, introduced him to Mr. Fred. N. Gisborne, of Newfoundland, believing that they might be of mutual benefit in pushing forward a new scheme for greatly shortening the time consumed in transmitting news between Europe and America. Mr. Field was reluctant to consider the project and at first gave Mr. Gisborne no encouragement, but the enthusiasm of the latter finally won him to the idea. The Electric Telegraph Company of Newfoundland had been chartered to convey news by telegraph from New York to St. Johns, and thence by swift steamers to Ireland, the hope being that not more than five or six days would be needed to convey information from one country to the other. After Mr. Gisborne retired, it occurred to Mr. Field that instead of undertaking such a complicated plan as that proposed, it would be far better to endeavor to stretch a wire cable across the ocean from the Newfoundland point to the Irish coast. He consulted Lieutenant Maury as to the practicability of laying the cable, and Professor Morse, the father of American telegraphy, in regard to the scientific possibilities. Replies from both gentlemen reassured him, and he proceeded immediately to raise a company with a cash capital of $1,000,000.

The list of names of those who subscribed to the stock includes those of Peter Cooper, Moses Taylor, Marshall O. Roberts and Chandler White. He succeeded in obtaining from the Newfoundland Legislature a charter to the "New York, Newfoundland and London Telegraph Company," with liberal grants of land and cash. He then paid off the debts of the old telegraph company purchased from Mr. Gisborne, and on the 6th of May, 1854, the company was formally organized in the house of David Dudley Field, of this city, Messrs. Cooper, Taylor, Field, Roberts and White being directors. Mr. Cooper was president, Mr. White vice-president, and Mr. Taylor secretary. A capital of $1,500,000 was subscribed on the spot, of which Mr. Field contributed $200,000 in cash.

In a year's time Mr. Field had succeeded in completing the line from New York to St. Johns, a distance of one thousand miles, at an expense of $1,000,000. Then came the ocean work. The United States and Great Britain aided materially. Expeditions from both governments were induced by Mr. Field, and the surveys established the validity of his theory beyond question. In the summer of 1856 Mr. Field persuaded the English government to furnish ships to make soundings and for laying a cable; also to pay the company an annual subsidy of £14,000 for government messages, extra payment to be made if the ordinary tariff was exceeded, and it was most liberally provided that the messages of the United States government should be forwarded with the same expedition as those of Great Britain, the messages taking turn in the order of their reception. Mr. Field then organized a new company with a capital of £350,000, in 350 shares, of which he took eighty-eight shares.

The lobbying necessary in Washington nearly discouraged him, for he encountered far more opposition here than in England; but the measure passed the Senate by one vote, and after a risky voyage in the House received the President's signature on the 3d of March, 1857. In the summer of that year Mr. Field returned to England, and the cable was declared to be in readiness for laying. The United States government now placed at the disposal of the telegraph company the steam frigate "Niagara" and ordered the "Susquehanna" to accompany her on the expedition. The British government provided the steam frigate "Agamemnon," and ordered the "Leopard" to accompany her as an escort. The "Niagara" took on her share of the cable at Liverpool, and the "Agamemnon" received hers at London. It was agreed that the "Niagara" should begin the laying of the cable and continue it until her portion of it should be exhausted in mid-ocean, when her end of it should be united with the cable on board the "Agamemnon," which ship should continue laying the line until the shores of Newfoundland were reached.

On August 5 they sailed. All went well for two days. On the third, when two hundred miles out, the electrical continuity was lost. Then it was found, and all went well again until suddenly the cable parted. In 1858, new coiling mechanism having been devised, a second expedition sailed on June 10. The cable broke again. Undaunted, Mr. Field started again on July 17, and on August 5 the cable was laid, signals being sent from Trinity Bay, Newfoundland, to Valentia, Ireland, with ease and rapidity; but September 1 the current suddenly ceased.

After the repeated failures recorded and the loss of time and money to so great an extent, Mr. Field wisely concluded that it would be folly to look for further assistance from individual capitalists. Nor was he certain of obtaining government aid. He found more helpful friends in England than at home, and although the British government had already spent large sums in his enterprise, as well as in a similar disaster in the Red Sea, Mr. Field kept at the authorities until they increased the subsidy to £20,000 and agreed to guarantee eight per cent. on £600,000 of new capital for twenty-five years, upon the single condition that the cable should be made to work successfully. For two years a board appointed by the British government sounded the coast of Ireland and experimented in all the difficult problems of submarine telegraphy. They met in 1859 and reported favorably in 1861. All this time Mr. Field was working energetically in this country for his enterprise. He addressed public meetings, talked with capitalists and lobbied with politicians. He neglected all other business and finally succeeded in obtaining assurances from the President and re-established public confidence.

In 1863 bids were asked, and the enormous capital of £600,000 being taken, work on the new cable was begun by the early part of 1864. The "Great Eastern" was purchased, fitted up and loaded down. On the 23d of July, 1865, she started. All went well until 1,200 miles of cable were paid out, when again the cable broke and plunged into the sea. The steamer put back to England and the enterprise was abandoned for the year.

By this time his health and fortune were so impaired that his friends supposed he would abandon the project. But his main characteristic, perseverance, kept him up to his work. After a brief period of nervous recuperation, he put forth a paper in which he asserted that, although the expedition had been unsuccessful in carrying the cable across the ocean, it was by no means a failure.

He organized the Anglo-American Telegraph Company, with a capital of £600,000, and raised the money in less than three months, contributing £10,000 of it himself. He had infused hope and courage and confidence in the controllers of capital and was not disposed to be defeated in the end because other people disbelieved in the possibility of success. He again visited England, explaining his plans in detail by every means in his power and pushed the scheme to success.

Finally, the new cable and its ponderous machinery were completed and put on board the "Great Eastern" in June, 1866. The shore end was successfully laid and made fast to the cable on the steamer. Accompanied by her attendant, the "Great Eastern" left Valentia on Friday, July 13. For fourteen days and nights Mr. Field scarcely closed his eyes. It might almost be said he saw every inch of the cable as it was paid out over the enor-

mous drums. Mr. Field reported every night the progress made, and all the English papers printed his messages. On Friday morning, the 27th of July, 1866, the enormous hull of the leviathan was discerned by watchers on the Newfoundland coast, and with guns firing and bunting floating, with a trail of wire 2,000 miles long behind her, the "Great Eastern" steamed into the harbor of Heart's Content and dropped her anchor in front of the telegraph house—all safe, all well.

During the following September the lost cable of 1865 was picked up and completed.

Congress voted Mr. Field a gold medal and the thanks of the nation. John Bright in the English Parliament called him "the Columbus of modern times, who, by his cable, had moored the New World alongside of the Old."

The Paris Exposition, in 1867, gave Mr. Field the Grand Medal, the highest prize at its disposal. Other tokens of appreciation were the thanks of New York, with the freedom of the city and a gold snuff-box; the thanks of the Chamber of Commerce, of New York, with a gold medal; the thanks of the State of Wisconsin, with a gold medal; the thanks of the American Chamber of Commerce, of Liverpool, with a gold medal; a decoration from King Victor Emmanuel, of Italy, and an entire service of silver from George Peabody.

In 1876 Mr. Field became interested in the development of rapid transit in New York, and was among the first to lend his capital for the building of the elevated roads. After these were in successful operation he made a tour of the world. After he returned in 1881 he obtained concessions from the Hawaiian government for a cable to be laid from San Francisco to Honolulu, and thence across the Pacific ocean to China.

Mr. Field spent much of his time of late years at Ardsley, his country seat on the Hudson, near Dobbs Ferry, which was named after the manor-house in Ardsley, Yorkshire, England, where Zachariah Field, the founder of the American branch of the family, was born in 1600. His golden wedding anniversary was celebrated at his town residence, No. 123 East Twenty-first street, on Dec. 2, 1890.

LINES OF FORCE IN THE FIELD OF A DYNAMO.

Dr. Fleming estimates the lines of force in the fields of the best dynamos at from 6,000 to 10,000 per square centimeter. A definite value must be found for the maximum magnetization of iron; that is, the number of lines that can be forced through it per square centimeter, with a given magnetizing current must be ascertained. Ever since the investigation by Dr. Rowland of the laws of the magnetic circuit attempts have been made to settle this question. The nature of the iron bears so strongly upon the conditions, however, that it appeared for a long period almost hopeless to arrive at a definite basis for a workable theory. Later researches bearing upon the permeability (magnetic conductivity) of the iron have, however, proved so fruitful that, knowing the nature of the iron, it is possible to predict the number of lines that would result from a magnetizing current of so many ampères in the exciting coils.

From numerous experiments it would appear that the maximum number of lines of force which usually traverses a bar of soft, annealed iron one square centimeter in cross-section is about 32,000. In some of Prof. Ewing's experiments, however, a magnetization under extraordinary conditions, as high as 45,350 was attained. But beyond a certain limit the magnetizing current has to be so relatively enormous that in dynamos even the maximum here stated is almost unknown. There is probably, however, no theoretical limit to the magnetizability of soft iron.

MICA INSULATING JOINT.

The Roberts Insulating Joint, as is evidenced by the accompanying illustrations, is simple, compact and efficient.

Mica is the only insulation used, and how it is applied to the joint will be understood by reference to Fig. 2.

This new joint is approved by the Philadelphia Board of Fire Underwriters, which approval is positive evidence of its efficiency. It has a good many meritorious

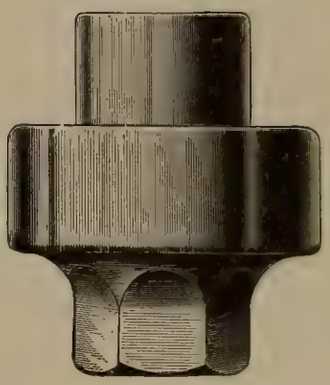


FIG. 1.

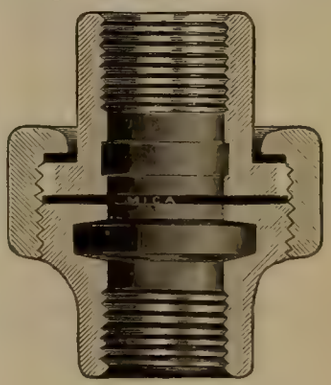


FIG. 2.

features, among which may be named the following: It is fire-proof, acid-proof and water-proof—all highly important in electric lighting. It is small in size—the illustration representing the full size of the joint—and all the parts are interchangeable.

Very ingenious locking devices are used to guard against turning of the parts upon each other. These locking devices are not shown in the cut.

Fig. 1 shows a general view of the joint.

These insulating joints are manufactured by Vallee Bros. & Co., dealers in general electrical supplies, 17 North Sixth street, Philadelphia, Pa.

THE GRAVITY COPPER ANCHOR.

The liability to displacement of the copper electrode has always been a serious obstacle in the way of getting the best results from the gravity battery. The accompanying illustration shows a very valuable improvement which has been lately made with the object of avoiding these difficulties, and consists of an anchor attachment for securely and permanently fastening or anchoring the copper to the bottom of the glass jar.



ANCHOR FOR COPPER ELECTRODE.

The new device shown above effectually prevents the copper from rising above the blue stone. The copper being held firmly on the bottom of the jar, a uniform distance is had between the two electrodes in all the cells of a battery, and consequently uniformity of resistance throughout, and the highest efficiency promoted.

The anchor is made of a piece of sheet copper with a coat of adhesive compound or cement on one side, the upper end being riveted to the electrode, together with the copper connecting wire. When packed for shipping the anchor is rolled up in the shape of a cartridge, with the cement on the inside.

To apply the anchor it is simply necessary to unroll the cartridge, bend it back at right angles parallel with the bottom of the jar, slightly heat the cement over the flame of a match or lamp, and the strip is then ready to be pressed down against the bottom of the jar into position. A little cold water is sufficient to chill and set the cement.

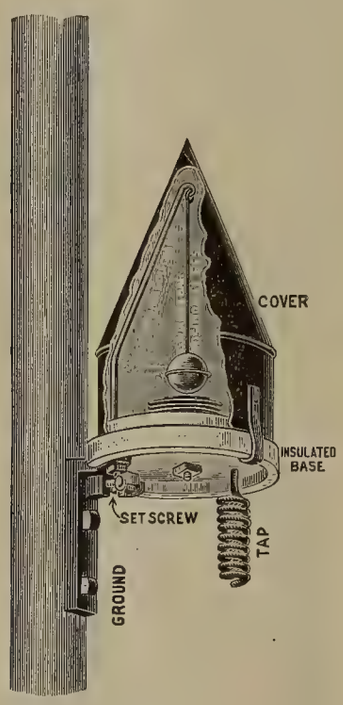
Thus fastened the cohesion of the cement is sufficient to stand a strain on the wire equal to many times the weight of the jar without dislodging the anchor.

This new copper is now being placed on the market by The E. S. Greeley & Company, New York city, sole agents.

IMPROVED SWINGING BALL LIGHTNING-ARRESTER.

The Swinging Ball Lightning-Arrester has proved itself in practice to be an excellent device, but with the improvements recently adopted it is rendered more reliable and serviceable than ever.

The accompanying illustration shows this lightning-arrester with the latest improvements. These consist of mica insulation in place of the paraffine paper formerly



SWINGING BALL LIGHTNING-ARRESTER.

used ; the substitution of a brass adjusting-rod for the iron one used in the old pattern, and the shortening of the top. The use of mica insures the best attainable insulation, and the other changes materially improve the device.

An improved porcelain base has been put in, which increases the insulation and prevents any escape of current across the base of the instrument. Messrs. Truex & Vail, 136 Liberty street, New York, the sole agents of the Swinging Ball Lightning-Arresters have met with great success in handling this device, and are determined to improve it in every way possible.

WASTE OF ENERGY.

When it is desired to convey energy to a distance by means of electricity, either for the purpose of producing light or mechanical motion, the chief problem to be faced is, how to reduce to a minimum the waste of energy during the transmission. When a wire is used to convey a current, the rate at which energy is lost in that wire can be measured by multiplying together the current strength in ampères and the difference of potential between the ends of the wire in volts, the result being the number of watts so expended. And since the electromotive force is equal to the product of the resistance of the wire and the current flowing, the loss in watts may also be calculated as the product of the resistance and the square of the current strength. That is to say, in the first place the power expended in any part of a circuit is proportional to the resistance of that part. Suppose, for example, a dynamo were employed to furnish current to a number of lamps arranged in parallel, their joint resistance being 10 ohms; then if the resistance of the machine and leads or connecting wires were also 10 ohms, exactly as much power would be wasted as would be usefully expended in the lamps ; a state of affairs which manifestly could not be tolerated. If the resistance of the machine and leads were reduced to 1 ohm, then the power wasted would be one-tenth of that usefully employed, and so on.

The resistance of the combination to which power has to be supplied is, as a rule, extremely low; and when the lamps or motors are joined in parallel, the current carried by the mains is equal to the sum of that required by the whole of them ; consequently the resistance of these mains must be extremely low, a small fraction of an ohm in fact, otherwise the proportion which the power wasted bears to the total quantity of power developed becomes excessive. To keep the resistance low, copper of high conductivity must always be employed; but the practical limit as regards sectional area is quickly reached on account of the high price of that metal.

Speaking generally, it may be said that transmission of energy to any distance by electricity is not economical, if we depend upon reducing waste merely by increasing the conductivity of the leads. Again stating the case as: watts lost $= C^2 R$, where R is the combined resistance of the leads and generator, we see that the only other way out of the difficulty is to reduce the current strength.

If this can be done the advantage is very decided; for, by halving the current, the power wasted in any portion of the circuit is reduced to one-fourth.

MUST PAY THE FEES.

In the suit of the city of Philadelphia against the Bankers' and Merchants' Telegraph Company and the Postal Telegraph Cable Company, to recover license fees for poles and wires erected in that city by those companies, Referee Robert Sturgis has filed a report in favor of the city.

A resolution was passed in 1885 by the common council, imposing a yearly license of $1 for each pole, and $2.50 for each mile of wire. The companies denied the right to impose the license fees, and hence the suit.

The object of the fees was to secure the proper construction of the poles for the safety of pedestrians. The Referee decided that the companies should pay the city $11,805, representing the amount due from 1885 to 1892.

CATALOGUE.

The Electrical Fiber Carbon Company, 1228–1234 Michigan avenue, Detroit, Mich., has just issued a neat little illustrated catalogue and price-list of its carbon batteries, carbon plates, etc.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The annual meeting of the New York Electrical Society was held at the Electric Club, 17 East 22d street, on Thursday evening, July 14. The following-named gentlemen were elected officers for the ensuing year:

President, Joseph Wetzler; vice-presidents, Dr. F. B. Crocker, J. J. Carty, Nikola Tesla, Thos. R. Taltavall, Chas. Cuttriss, R. S. Dobbie; secretary, G. H. Guy; treasurer, Hy. A. Sinclair.

The report of the secretary showed a substantial increase in membership during the past year. Several new members were admitted, and the association is in a prosperous condition. Everything points to activity and prosperity during the coming year.

After the business of the meeting was concluded, the members in a body attended the performance of "Sinbad," at the Madison Square Garden Theatre.

THE MAGNETIC CLUB.

The Magnetic Club of this city will hold its midsummer meeting at College Point, L. I., on Wednesday, July 27. The Western Union Telegraph Company's cable steamer "Western Union" will leave pier 20 N. R. at 3:15 P.M., to carry such members as can leave at that hour. The regular ferry line can be availed of by those who cannot leave on the "Western Union." An excellent dinner will be served at the Point, and a good time is promised.

NEW ELECTRICAL DICTIONARY.

A new electrical dictionary, to be known as "The Standard Electrical Dictionary," by Prof. T. O'Conor Sloane, author of "Arithmetic of Electricity," "Electricity Simplified," etc., etc., is being published by Messrs. Norman W. Henley & Co., of 150 Nassau street, New York. The work is nearly ready, and will be sold for $3. It can be obtained through the Electrical Age Publishing Company, first floor, World Building.

NEW BOOK.

ELECTRICITY ONE HUNDRED YEARS AGO AND TO-DAY is the title of an extremely interesting book which is now on the press and will be issued shortly by the Electrical Age Publishing Company. Prof. E. J. Houston, of Philadelphia, is the author.

FATAL ACCIDENT IN A POWER-HOUSE.

A dynamo in the power-house of the Fostoria Light and Power Company, Fostoria, Ohio, broke into pieces with terrific force on the night of July 7, smashing the fly-wheel on the engine to atoms. The engineer, Paul Hyder, was instantly killed, being horribly mangled; his skull was crushed, both legs broken and one arm nearly torn from the body. The steam connections from the engine were also broken, and the escaping steam added to the intensity of the situation.

NEW INCORPORATIONS.

The Manchester Road Electric Railway Company, St. Louis, Mo., incorporated July 11, with a capital stock of $20,000. Incorporators: Thomas W. Howard, M. C. Orton, James Daniels, St. Louis, Mo.

The Automatic and Electric Scale Company, Jersey City, N. J., incorporated July 9, with a capital stock of $200,000. Incorporators: H. M. Cross, Boston, Mass.; M. Marx, Brooklyn, N. Y., J. Griffin; Jersey City, N. J.

Country Club, Seattle, Wash., incorporated July 8, with a capital stock of $24,000, to construct, operate and lease, street railways, both steam and electric, cable roads, steamboats, telegraph and telephone lines, electric light, gas and water works. Incorporators: R. B. Albertson, William E. Bailey, Herman Chapin, George R. Carter, Josiah Collins, E. B. Downing, John R. Galt, George H. Heilbron, L. S. J. Hunt, William A. Peters, B. Pelly, George H. Preston, R. C. Washburn, of Seattle, Wash.

Elwood Electric Railway Company, Elwood, Ind., incorporated July 11, with a capital stock of $150,000. Incorporators: Aretus W. Hatch, Willard C. Nichols, Andrew T. Hart.

Everett and Lake Stevens Water and Electric Company, Everett, Wash., incorporated July 7, with a capital stock of $250,000. Incorporators: J. J. Falstad, George S. Brown, Everett, Wash.

Knapp-Sellner Chandelier Company, St. Louis, Mo., incorporated July 12, with a capital stock of $20,000, to manufacture and sell gas and electric light fixtures, etc. Incorporators: A. J. Knapp, H. A. Sellner, A. G. Sellner, all of St. Louis, Mo.

Webb City Light and Power Company, Webb city, Mo., incorporated July 12, with a capital stock of $150,000. Incorporators: W. C. Maybury, Detroit, Mich.; T. H. West, J. T. Davis, St. Louis, Mo.

Cedartown Company, Roanoke, Va., incorporated July 9, with a capital stock of $750,000. Among other things it will operate electric, gas and steam works. Incorporators: Dan Baugh, Philadelphia, Pa.; J. W. Adamson, Cedartown, Va.; E. M. Weston, R. R. Carson, N. B. Crenshaw.

Payette Real Estate and Investment Company, Boise city, Idaho, incorporated July 9, with a capital stock of $25,000. Among other things it will operate electric plants. Incorporators: R. D. Wolterbeck, W. S. Bruce, R. M. Boggs, B. W. Walker, P. C. Lellman.

Union Electric Company, Benton Harbor, Mich., incorporated July 9, with a capital stock of $150,000.

Standard Electric Light and Power Company, North Tonawanda, N. Y., incorporated July 1, with a capital stock of $100,000. Incorporators: George P. Smith, John D. Warren, Susan O. Smith.

Municipal Improvement and Investment Corporation (incorporated in W. Va.), New York city, N. Y., incorporated July 9, with a capital stock of $500,000, to acquire by purchase, lease or otherwise, street railways, water-works, gas and electric light plants, etc. Incorporators: H. A. Hoit, P. S. Swain, J. R. Turner, New York, N. Y.

Kalispell Water and Electric Company, Kalispell, Mont., incorporated July 5, with a capital stock of $250,000. Incorporators: Joseph A. Coram, Frank E. Corbett, John B. Wellcome, Kalispell, Mont.

The Chillicothe Electric Railway and Lighting Company, Chillicothe, O., incorporated July 7, with a capital stock of $100,000. Incorporators: William Poland, Clark W. Story, John A. Nipgen, Matthew Cahill, Richard Enderlin.

The Ceramic City Light Company, Newark, N. J., incorporated July 7, with a capital stock of $50,000, to transmit electricity for the purpose of furnishing light, heat and power. Incorporators: R. Arter, New Lisbon, O.; C. T. Harbaugh, S. E. Harbaugh, Sewickley, Pa.; C. M. McKeehan, W. H. Murphy, East Liverpool, O.; P. M. Smith, A. R. Wells, Wellsville, O.; W. F. Zimmerman, Newark, N. J.

Berlin Electric Light Company, Portland, Me., incorporated July 6, with a capital stock of $50,000. Incorporators: Henry H. Furbush, W. H. Furbush, Berlin, N. H.; Harry R. Virgin, Fred S. Hall, Portland, Me.

People's Electric Light and Power Company, Evansville, Ind., incorporated July 8, with a capital stock of $100,000. Incorporators: R. T. McDonald, H. J. Miller, Brainard Rorison, Fort Wayne, Ind.

Northern Light Company, Chicago, Ill., incorporated July 6, with a capital stock of $100,000, to operate an electric light and power plant. Incorporators: William W. Hutchinson, Lewis Lusk, A. C. Barnes.

North America Gas Company, Chicago, Ill., incorporated July 6, with a capital stock of $500,000, to manufacture and supply illuminating fuel and other gas and electricity for light, heat and power. Incorporators: Charles M. Hill, John D. Cameron, James R. D. Graham.

TO ADOPT ELECTRICITY.

It has been announced by General James Jourdan, president of the Kings County Elevated Railroad Company, Brooklyn, that electricity as a propelling power will be adopted on the system of that company in lieu of steam.

The General in a recent interview said:

"When the road was first built electricity as the propelling power was discussed, but at that time science had not advanced far enough in that branch, and when the time came for operating the road there was no electric system to adopt and we were compelled to buy steam-engines. These are now beginning to get old and need considerable repairing, and we will have to buy two or three more before long, but I hope that will be the last. I do not favor the trolley system of propulsion, or we would have introduced it long ago. It could be done at a very slight expense—a single pole between the tracks, fastened to the girders; across the top an arm extending over the tracks upon which to string the wires. The objection to it is that we would be compelled to run but one train at a time, and although the headway could be increased to two minutes or three minutes, I do not think it would prove satisfactory. We have got to have a means of propulsion which is in no danger of failing. If anything should happen to one of the cars there is no means of side tracking it, and so travel would be delayed for a long time. During the last six months I have given the most careful attention to the subject, paying particular attention to the storage-battery system. I find that the promoters of it have made great improvements. The weight of the storage-battery cars was one of the chief faults, and it has been reduced one-half. There are improvements being made all the time, and that is the system which I am in favor of. Another plan that I have been looking into is that of running the train by motors. In that way, instead of having fifty separate fires there would be but one, and that in the power-house. A power-house could be nicely located somewhere about the centre of the road, which is near Bedford avenue, where there is plenty of good property for sale. So firmly have we resolved to substitute electricity for steam, that before we would agree to make any arrangements with the surface road companies about the stringing of their trolley wires upon our structure, we had experts make a careful examination to determine whether or not the operation of our cars by electricity would be prevented by the interference of the two currents. The experts determined that both lines could be operated."

The Englewood Electric Light Co., Englewood, Ill., has ordered a 500 H. P. latest improved Ball Cross Compound engine through the Chicago office of the Ball Engine Co., Erie, Pa.

TO ADOPT THE STORAGE-BATTERY SYSTEM.

Speaking of the application for permission to adopt the storage-battery system as motive-power on the lines of the Second Avenue Railroad Company, President George S. Hart said:

"It is not our intention, if the desired permission should be granted, to make at once a sweeping change. We should put on a limited number of storage-battery cars—about ten—which we should probably first run from our depot, at Ninety-sixth street, to the Harlem river, a distance of about a mile and three-quarters. Should they prove successful, we might then run them down to Astor place and Broadway. Of course we have in view the ultimate adoption of the system on all our cars, but have not finally decided. Everything depends upon how the trial cars work.

"The system we shall try is not the Julien; more than that I do not feel at liberty to say. The cars we expect to use will be about the size of our present horse cars. We think it better to have small cars and more of them than to have the large cars, which necessitate twice as many stops and startings. They will be handsome and comfortable cars, lighted by electricity. The people who will furnish the system are very confident of its giving entire satisfaction, and we think, from our examination of it, that it is quite promising, they have been thoroughly tried in actual service.

"We cannot tell yet, either, whether they will be cheaper to operate than the horse cars. To equip a road will require from seven to eight thousand dollars a car. We run about 150 cars. A paper was read several years ago before the American Railroad Association, in which the writer estimated that the average cost of operating a horse car was twenty-four and three-quarters cents a mile, which would include every expense of every kind and the interest on the bonded debt, but not dividends. I do not know of any similiar calculation of the cost of operating an electric storage car. We infer from the facts before us that it will be about as cheap as horse-power, and, if the system worked, would probably give greater satisfaction to the public, while the cars would be more attractive to the eye.

"The first cost of the adoption of an electric system would certainly be less than that of a cable system. We have not thought of adopting the latter. We first want to see some of those already under way completed. It doesn't look as if they would ever be.

"We have not heard that any opposition to our application will be made, and we can see no reason why there should be any."

GREAT INDIGNATION.

The residents of the city of Brooklyn are loud in their denunciation of the action of the board of aldermen in granting a franchise for the construction and operation of an electric road on Union street to the Union Railroad Company who paid nothing for it; whereas, on the other hand, the Union Street Railroad Company, of which General Stewart L. Woodford is the head, offered to pay the city $30,000 for the same privilege. The granting of the franchise to the Union Railroad Company is looked upon in the light of a political deal, in view of the fact that one John Delmar, a prominent politician, is the prime factor in it, and that other politicians are associated with him.

It is hoped that the mayor will veto the ordinance, and it certainly is his bounden duty to do so in the premises, or else have a clause inserted that the Delmar Company pay the city the same amount offered by the Woodford Company.

The outcome of the isssue will be impatiently awaited by the public.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 16, 1892.

MR. T. J. Cope, of Philadelphia, was in town this week.

MR. ELIAS E. REIS, of the Reis Electric Co., Baltimore Md., paid New York a visit this week.

MR. J. H. CARR, of the Peninsula Electric Light Company, Detroit, Mich., gave us a call this week.

MR. A. E. KEITH, electrician of The Strowger Automatic Telephone Eexchange, 301 The Rookery, Chicago, was in town this week.

TRUEX & VAIL, 136 Liberty street, are always getting hold of good things in the electrical supply line at bottom prices, which enables them to sell below the market quotations. They have just secured a number of elegant fans and motors, which they are selling at less than cost. They will run on 20 and 120 volts, and the larger sizes, which may be had up to ½ H. P., can be used for power purposes in the running of light machinery, etc.

MR. POND, the inventor of self-winding clocks, was in town this week. He was president of the Self-Winding Clock Company, formerly of Murray street, and also organized the Telegraphic Time Company, of Temple Court. Mr. Pond has built up a town in Central Mississippi, and is looking forward to the establishment of a mill for manufacturing cotton thread. Mr. Pond does not go back on old electricity, as he talks of putting in large dynamos and motors for power purposes.

THE ENGINEERING EQUIPMENT COMPANY, 143 Liberty street, has secured, by papers just executed, United States rights of manufacture and sale of the Goodell Boiler and Pipe Covering. This is an important addition to the company's business, which is now divided into three special departments, viz.: (1) Belting; (2) Boiler and Pipe Covering; (3) Overhead Electric Railway Materials. In each of these specialties the company purposes to enlarge its facilities and strengthen its position in the trade from time to time.

MR. JAMES E. BROWN, the electrician and inventor of the Swinging Ball lightning-arrester, handled by Messrs. Truex & Vail, was met by your representative in the office of that firm. Mr. Brown guarantees that his latest invention, a recording ampéremeter, is perfect in recording the current on both direct and alternating circuits. It is a direct-reading meter. Mr. Brown is proud of the record of the fact that his father, Robert Brown, was the first man to operate a telegraph key on the old Bain telegraph line at 29 Wall street, 40 years ago. Miss Brown was the first lady operator.

THE MCCREARY ELECTRICAL SPECIALTY COMPANY, 136 Liberty street, is shipping 2,000 feet of flexible chain for suspending lamps and covering cord. It is to be used in one of the largest buildings in the country. The company's Almond flexible brackets are meeting with great sales; large shipments were made this week to Paris, London, Copenhagen, and the Western States of this country. Orders received for flexible arm portables have exceeded the production. The reflector and half shades are holding their own, and orders are increasing every week. The new rheostat switch is having a ready sale. The company will soon introduce a number of new specialties.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	62 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	203 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	156 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	8 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill., N. Y.	5,400,000	100 00	86 25
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	84 00
Edison General	15,000,000	100 00	108 75
Edison General Receipts		100 00	108 75
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	483 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	108 75
General Electric Co., 5s	4,000,000		*95
General Electric pref.		100 00	118 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref.	2,500,000	100 00	58 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	20,000		*107
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,585,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 75
Postal Telegraph	10,000,000	100 00	55 09
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s, Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	65 00
Thomson-Houston pref.	4,000,000	25 00	29 50
T.-H Electric Co. 5s, Boston	500,000		*99
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	93 50
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	27 25
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	44 00
Westinghouse Ass. Rects.		50 00	18 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The man above all others, in this country at all events, who is entitled to the honor of being named as the father of electrical finance, Cyrus W. Field, made his short circuit with the great unknown on the 12th inst. A most conservative, clear-minded, irrepressible, untiring promoter and financier, he overcame unspeakable difficulties—electrical, mechanical and monetary; hewed out, and will ever occupy the position of creator of the electrical connection between the Old and New World. He is said to have amassed by his reputable endeavors $5,000,000, most if not all of which has been lost within the last few years when his brain was no longer able to control the situation, and those upon whom he relied were either incompetent or recreant to the trust which they became possessed of. Twenty years ago this month he had the first cable laid across the Atlantic, and the first messages actually passed from land to land. Does any one doubt that the financial task was the greatest requisite to accomplish this end? But his genius and enthusiastic explanations to men of brains and capital carried it, and with the understanding that he was to act as commander-in-chief, which he did. The original corporation was formed in this city in May, 1854, with a capital of $1,500,000, including Peter Cooper, Moses Taylor, Marshal O. Roberts and Chandler White, men who have since gone down to their graves honored by the whole nation. Reflect! what an amount of weary mental and physical labor was crowded between May, 1854, and July, 1866. The British government aided to a considerable extent by the use of ships and officials for sounding and giving assurance of the mechanical feasibility of the enterprise, also by contracting for actual telegraphic business at a given price. Although Mr. Field was at all times and under all circumstances an American before all else, he had great difficulty with the U. S. Government. His bill only received a bare majority in the Senate, but to his great relief the President signed it in March, 1857, inaugurating a happy condition of comparatively clear sailing. It was easier to overcome obstacles, practical knowledge was gained in many ways, and his promotion and financial abilities sharpened under the new troubles until he was able to cope with them and in each case push on with renewed energy. Eventually he organized the Anglo-American Telegraph Co., Limited, got the capital subscribed—£600,000—and laid the cable from land to land to his eternal glory and honor.

The influx of commendable electric securities from the West and South continue to reach us, and it is full time that a general exchange was opened where investor and company official can meet and thoroughly go into specific details. There is no good reason why 6, 8 and 10 per cent. securities, earning and paying those profits, should ever fail to find investors in such a money centre as New York, nor is it commercial business to take these securities simply because they are endorsed by one of the parent companies. It is better for all concerned that the collateral be scattered. There are few holders of large amounts of collaterals to-day who really know or have any idea what their security represents beyond the parent company.

NEW AGENT.

Mr. Ira Cornwall, secretary of the Board of Trade, St. John, N. B., has been appointed agent for the Electric Heat Alarm Co., 113 Devonshire street, Boston. Mr. Cornwall is making an effort to form a company in St. John to purchase the Canadian patents of the Electric Heat Alarm Co.

WESTERN NOTE.

The Railway Equipment Co., Chicago, Ill., of which Mr. W. R. Mason is general manager, has removed to permanent and more convenient office and storerooms on the ground floor, Pullman Building, Michigan avenue side.

FRAUDS IN BOILER COMPOUNDS.

The value and utility of any article of commerce may be measured by the number of imitations of the same produced by unscrupulous dealers with intent to deceive consumers and deprive the proper persons—those who deal in the genuine goods—of the benefits that properly belong to them.

All first-class goods are imitated, and these imitations are palmed off on the unwary as the genuine. The success of these deceptions depends usually upon the similarity of names between them and the genuine, and unless buyers are posted in regard to the genuine goods, they are liable to fall into the traps that dishonest dealers set for them.

"Lord's Boiler Compound" has various imitations, and many steam users and engineers have been deluded by the claims made for these spurious goods.

"Lord's Boiler Compound" is the trade mark identifying the chemical preparations of Mr. Geo. W. Lord, 316 Union street, Philadelphia. The merits of his products are evident from the fact that "Lord's Boiler Compound" is very highly recommended in some 30 standard treatises on steam engineering.

Steam-users would do well to send to Mr. Lord for one of his manuals and learn all about his goods, and thus be on the safe side.

RESISTANCE TESTING SETS.

Queen & Co., Philadelphia, are having a great "run" on their standard portable testing sets, as the distinctive merits of these goods make them very popular. In every central station no matter how small, it is real economy to have accurate apparatus for measuring resistance of lines, dynamos, lamps, etc., and the Queen Set "1891" type, with its wide range, accurate adjustment, and dead-beat galvanometer proves wonderfully efficient. Although introduced less than one year ago it is to be found all over the country, and indications point to a steady and increasing demand.

A few years back a commercial resistance set correct within one or two per cent. was considered very close, but such finds little sale now in comparison with the improved forms made by Queen & Co., who guarantee them absolutely to $\frac{1}{5}$ of one per cent. Electrical engineers as well as central station superintendents will do well to examine the telling features of these sets before ordering such apparatus. They are fully described in Circular No. 285, which can be had by writing to the makers.

A "FLYER."

It has been discovered that the Reading Railroad's 3:30 P.M. train from Philadelphia to Atlantic city, known as the "Seventy-Minute Flyer," is actually the fastest regularly scheduled passenger train in the world. The distance from Chestnut street wharf to the Camden terminus of the railroad is about a mile and a half, and the ferry-boat trip and transfer of the passengers from the boat to the cars occupies ten minutes. This leaves sixty minutes for the rail ride, and that is precisely the time allowed by the schedule to cover the fifty-five and a half miles which intervene between the Camden depot and the station in Atlantic city. A little figuring will

show that this is a speed of sixty-five seconds to the mile, or a rate of fifty-five and a half miles per hour, beating the former record six seconds per mile and almost five miles an hour.

The rate of fifty-five and a half miles per hour is exceeded every day on the Reading Railroad, and possibly on some other lines, but on no railroad in the world, so far as known, is there a train run from end to end of its route at so great an average speed as that of the "Seventy-Minute Flyer."

When the latter was established it was not with the purpose of breaking the record, but the officials were confident of their ability to run a train safely and promptly in the specified time, or less if required. It was determined, however, to limit the train to six cars in order to insure quickness. This was found to be impracticable, and for more than a week the train has been carrying eight cars, including one or more heavy Pullmans, and making schedule time on every trip.

President McLeod can now congratulate himself that his road holds the "world's record" for the fastest mile (39⅘ seconds, as timed August 27, 1891), and also has upon its time-table the fastest regular train in the world.

CONSOLIDATED INTERESTS.

It is reported that the Hartman Electric Company, the Duluth Electric Light and Power Company, and the Northern Electric Subway Company, all of Duluth, Minn., have been consolidated, and will hereafter be known as the Hartman General Electric Company.

The company will erect a new plant having a capacity of 30,000 incandescent and 1,500 arc lights, besides power circuits and supplying of large blocks with steam.

A beneficial feature of this consolidation will be the lessening of the cost of production, and hence the reduction of prices.

The following officers and directors were elected at the meeting, the officers constituting part of the directorate: A. W. Hartman, president; Charles R. Haines, vice-president; R. A. Costello, treasurer; C. E. Van Bergen, secretary; Paul Sharvy, O. C. Hartman and F. B. Rogers of Boston.

"WARD" ARC LAMPS.

The following is a copy of a letter which speaks well for the "Ward" arc lamp:

PEOPLE'S INCANDESCENT LIGHT COMPANY,
MEADVILLE, PA., June 25, 1892.
ELECTRIC CONSTRUCTION AND SUPPLY COMPANY,
18 Cortlandt street, New York.

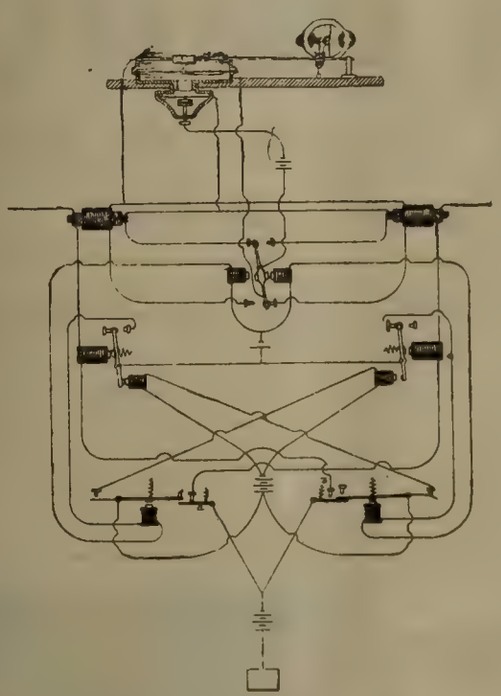
GENTLEMEN: We are in receipt of your favor of the 24th inst., and in reply will say we have in use on our incandescent circuits about forty of your "Ward" arc lamps, same having been in use for some two years, and have given both to ourselves and customers the best possible satisfaction, and we are pleased to recommend them to any one who could use arc lamps on their incandescent circuit. Respectfully yours,

PEOPLE'S INCANDESCENT LIGHT COMPANY,
F. R. SHRYOCK, *Secretary.*

The Electrical Age's Illustrated Patent Record.

Issued July 12, 1892.

478,551. Magnetic Separator. Clinton M. Ball, Troy, N. Y., and Sheldon Norton, Hokendauqua, Pa. Filed Oct. 12, 1891.



478,743.—TELEPHONE-REPEATER.

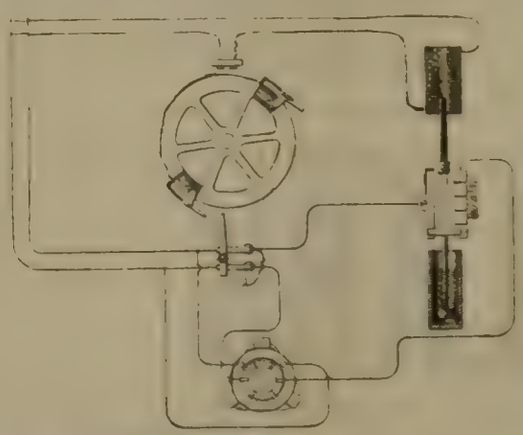
478,565. Desk Attachment for Telephones. Lewis C. Butler, West Bay City, Mich. Filed Feb. 9, 1891.

478,591. Electric Locomotive. Joshua Gray, Medford, Mass. Filed June 12, 1891.

478,629. Electric Rail-Bond. Thomas J. McTighe, New York, N. Y. Filed April 1, 1892.

478,661. Electrode for Storage-Batteries. Henri Tudor, Rosport, Luxemburg. Filed Jan. 8, 1892. Patented in Belgium.

478,664. Electrode. Armand Vanden-Kerckhove, Brussels, Belgium. Filed Feb. 12, 1892. Patented in Belgium, in France, in England, and in Italy.



478,821.—ELECTRIC ELEVATOR.

478,683. Apparatus for Lighting Locomotive-Engines. Alexander R. Cavner, Chicago, Ill.; Edward E. Holman, administrator of said Alexander R. Cavner, deceased, assignor to the Cavner Locomotive Improvement Company, same place. Filed Aug. 1, 1891.

478,692. Telephone. Paul H. D'Unger, Chicago, Ill., assignor to the D'Unger Long Distance Telephone Company, same place. Filed March 29, 1892.

PATENTS.—Continued.

478,709. Coin-Controlled Device for Phonographs. John F. Ott, Orange, assignor to Thomas A. Edison, Llewellyn Park, N. J. Filed April 24, 1891.

478,718. Arc-Extinguisher for Electric Switches. Sidney H. Short, Cleveland, Ohio. Filed March 10, 1891.

378,722. Distribution of Electric Currents. Elihu Thomson, Swampscott, Mass, assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed Dec. 6, 1886. Divided and this application filed July 26, 1890.

478,743. Telephone-Repeater. Thomas A. Edison, Menlo Park, N. J. Filed Oct. 14, 1885. Renewed March 1, 1892.

478,788. Electrical Thermostat. William L. Denio, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Dec. 8, 1891.

478,789. Electric Signalling Apparatus. William L. Denio, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Dec. 8, 1891.

478,792. Molds for Glass Battery-Jars. John Gayner, Salem, N. J. Filed Nov. 9, 1891.

478,816. Electro-Mechanical Apparatus for Starting or Reversing Machinery. Albert Piat, Paris, France. Filed April 2, 1890.

478,821. Electric Elevator. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y. Filed March 14, 1892.

478,865. Electric Time-Alarm. John Jacobi, Brooklyn, N. Y. Filed Nov. 17, 1891.

478,968. Electric Motor. Harlon F. Ong, Newberg, Oregon. Filed April 4, 1891.

JOHN A. CROSS,
Consulting
Electrical and Mechanical Engineer and Expert,
136 LIBERTY STREET, NEW YORK.
Electrical Exchange Building.
Lighting or Power Plants and Special Machinery Designed and Constructed.

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CROW FOOT ZINCS.
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THE CLARK COMPANY, NEW YORK, 192 BROADWAY,
CLARK is the only Company in the United States that makes a specialty of manufacturing under own patents, Electric Arc Lighting Apparatus for every purpose, including the finest arc lamp in every respect, suitable for any class of interior lighting, with plain or ornamental fixtures, and can be used on incandescent circuits, on any voltage from 65 upwards, in series or single, or on arc circuits of standard current.

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TELEPHONE & ELECTRICAL
RAILWAY POLES & CROSS ARMS
THE H. M. LOUD & SONS LUMBER CO.
OSCODA, MICH.

ELECTRICAL AGE

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NEW YORK, JULY 30, 1892.

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SEVERE STORM.

On the night of July 22 a severe thunderstorm surcharged with electricity caused a great deal of disturbance on telegraph and telephone circuits. In the central telephone station on Cortlandt street, with each flash of lightning great numbers of drops would fall in the same manner as if subscribers had rung up, and after one particular flash, fully 2,000 drops fell at once. The night operators were kept busy replacing them. During the height of the storm it was nearly impossible to work the telegraph wires. Several minor accidents occurred in various sections of the city.

FIRE.

Fire at 7 o'clock Monday morning, July 25, destroyed building No. 11 of the Schenectady works of the General Electric Company. The underground tubing and compound were manufactured in this building, but the company expect to resume the manufacture of tubes within 48 hours after the adjusters finish their work. The loss is stated to be $75,000, and is fully covered by insurance. From all reports it appears that the fire was started through the carelessness of one of the workmen.

DEVELOPMENT OF WATER-WHEELS.

Some idea may be had of the increasing availability of water-wheels for power purposes by reference to the illustration on another page of an immense machine of this class. The development of the water-wheel has been coincident with that of the dynamo for electric lighting, and while it has increased in size for large power it has also been increased in efficiency.

There is plenty of reliable water-power in different parts of the country which may be put to practical use through the medium of water-wheels.

TO BE OR NOT TO BE?

On July 18 a press despatch from Worcester, Mass., contained the information that the New York, New Haven and Hartford Railroad Company contemplated the use of electric power to haul freight and passenger trains between New York and New Haven. The distance between the two cities is 74 miles, and, according to the report, will be covered in 60 minutes.

Following this despatch came one the next day in the shape of a denial from Vice-President Tuttle, of the railroad company. Mr. Tuttle states that there is no truth whatever in the report, but the paper upon whose authority the despatch originated intimates in a later issue that perhaps Mr. Tuttle is not in the secret, and that its information came from a higher source.

So the matter stands; one party says it's so, and the other says it isn't.

A DEATH-DEALING MACHINE.

As is well known there exists no feeling of love between Frenchmen and Germans, and the strained relations between the two countries have apparently been put to a greater tension by a silly reports published in Paris a few days ago to the effect that Mr. Edison had invented an electrical machine which would accomplish the destruction of a whole town at a distance of thirty miles, and that he had sold his invention to the German government. The French at once jumped to the conclusion that Mr. Edison was animated in what he had done by the enemies of France; but Mr. Edison, according to the Parisian story, denies the truth of this assertion.

The story sounds like one of the yarns which emanate periodically from German soil with the object of arousing the wrath of the excitable Frenchman.

ELECTRIC POWER-PUMPS.*

Efficient power-pumps operated electrically have a most general application.

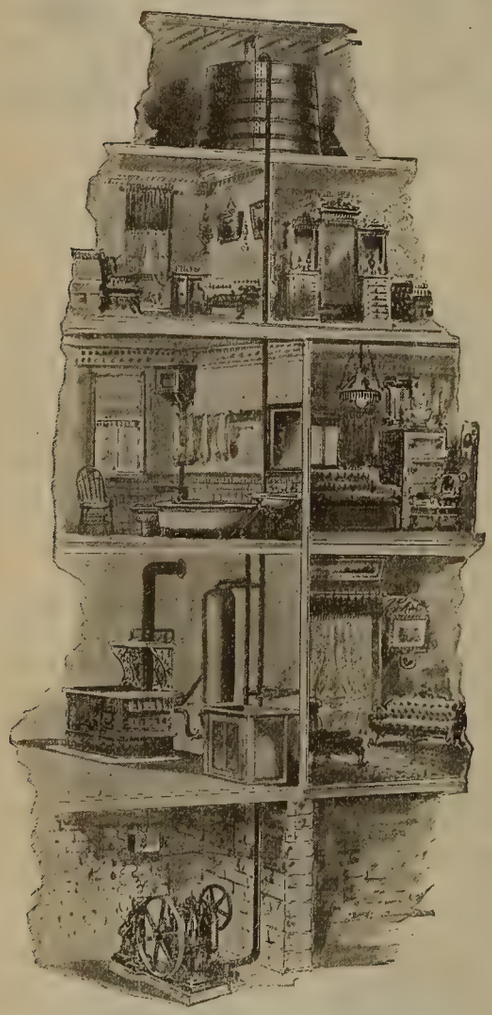


FIG. 1.—ELECTRIC POWER PUMP IN APARTMENT-HOUSE.

In thickly populated cities, for instance, where the force of the water is insufficient to raise to tanks and the upper stories of buildings, this deficiency can be supplied by electrically operated pumps. This combination in operation is automatically controlled, the pump stopping and starting with variations in the level of the water in the upper tank, and consuming a small fraction of power to perform the work.

Fig. 1 gives a view of an electric power-pump adapted to the uses of an apartment building, and shows the tank or reservoir on the roof. As soon as the tank is filled with water the electric current is automatically cut off from the motor and the flow of water ceases. As soon as the water falls below a fixed level the current is automatically turned on and the motor starts up again, pumping water into the tank as before.

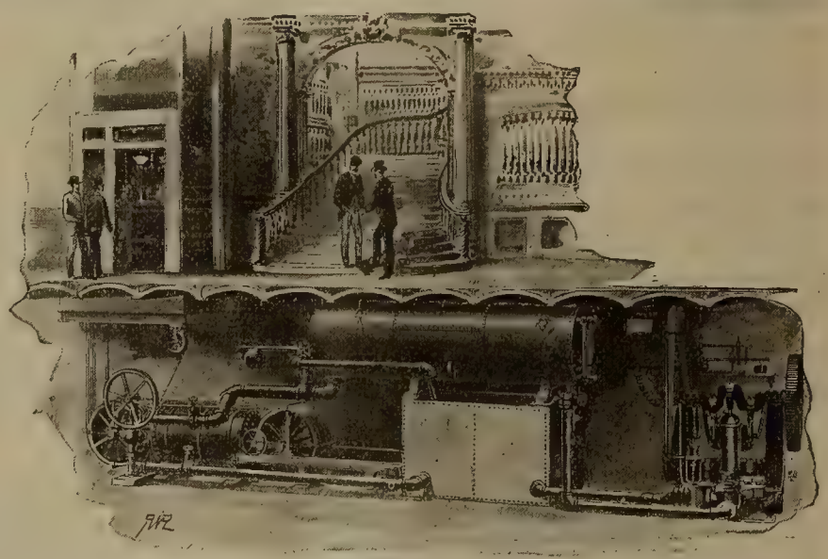


FIG. 2.—ELECTRIC POWER PUMP OPERATING HYDRAULIC ELEVATOR.

The problem of operating hydraulic elevators is greatly simplified by the employment of electrically operated pumps, doing away with the steam-boiler, its skilled attendance, dirt, and incident danger, etc., and presenting a clean, compact and easily managed and controlled electrical pumping plant, which supplies water to either a closed tank or a tank upon the roof, as desired. Thus the elevator is operated at a minimum cost and with the utmost safety.

Fig. 2 shows the mechanism of a hydraulic elevator on the closed or pressure-tank system, with the electric power-pump running continuously. The water is discharged into the tank until a predetermined pressure is reached, when the tank is automatically cut off. When the pressure falls below the fixed point the discharge of water is again admitted into the tank.

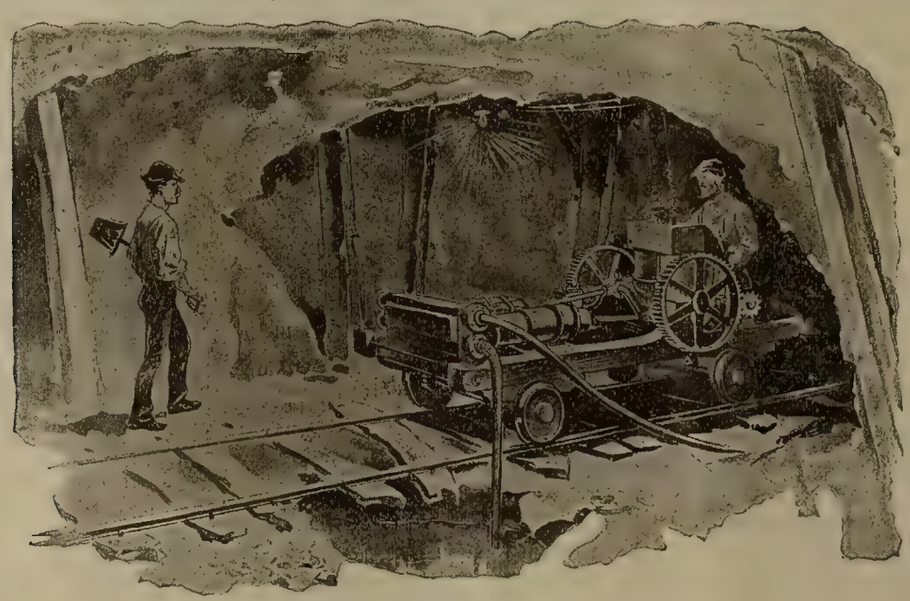


FIG. 4.—HORIZONTAL ELECTRIC MINE PUMP.

A most novel application is in supplying villages and towns with water. The electric pump is placed at the

* The Gould's Mfg. Co., Seneca Falls, N. Y.

point of water supply and here operated by current taken from the central-power station of town, pumping either direct into the water-mains or into reservoir or stand-pipes, as may be desired.



FIG. 5.—VERTICAL ELECTRIC MINE PUMP.

The controlling devices which are used in connection with this apparatus are so constructed as to operate the pump almost entirely automatically, maintaining a constant level in the reservoir or storage-tank.

It is evident that this arrangement will reduce the first cost of installation to simply a matter of motor and pump.

The method of operating is similar to that employed in taking care of street arc lamps; visits being regularly made to the motor and pump once in twenty-four hours to properly oil and adjust the working parts, the actual work being entirely controlled from the central station—current thrown on and off, pump started and stopped without any attention at the point of water supply.

This same application can be extended to supplying tanks along railroad lines, taking power from some economical source of generation, and transmitting along the railroad lines for automatically filling tanks, etc.

In Fig. 3 we have an example of the application of an electric power-pump to the pumping of water into a water-works reservoir.

As it is possible to operate an electric pumping plant at practically any distance from the source of motive-power, it may be possible to utilize the power of some old water privilege, or any source of economical generation of power, to perform the work of pumping water from spring, pond or lake direct to the water-works system of the town. Pumping water for villages or cities is a legitimate work for the electric light or power station, the same as operating power circuit on electric railway.



FIG. 3.—ELECTRICAL WATER-WORKS PUMP.

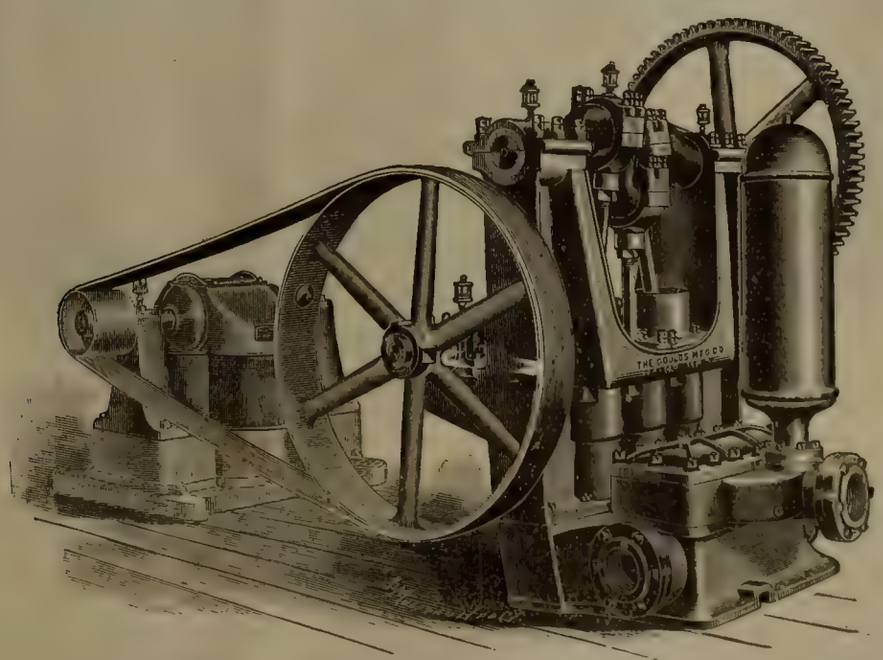


FIG. 6.—TRIPLEX ELECTRIC POWER PUMP.

But by far the most important application of electrical pumping is found in mine operation, and when statistics tell us that for every ton of coal mined nine tons of water are required to be pumped to the surface, we can only judge of the great importance of electrical pumping in this connection. Multitudes of small pumps in the various veins of mines, such as is shown in Fig. 4, are employed for forcing water from the small springs back to the sump at the foot of the mine shaft, and from this point a large heavy mine pump is used to raise water to the surface, all being electrically operated from the power-station above.

The electric transmission admits of using pumps in places where it was hitherto impossible to operate steam pumps, on account of the great difficulty in transmitting the steam from boilers above to the steam pumps below.

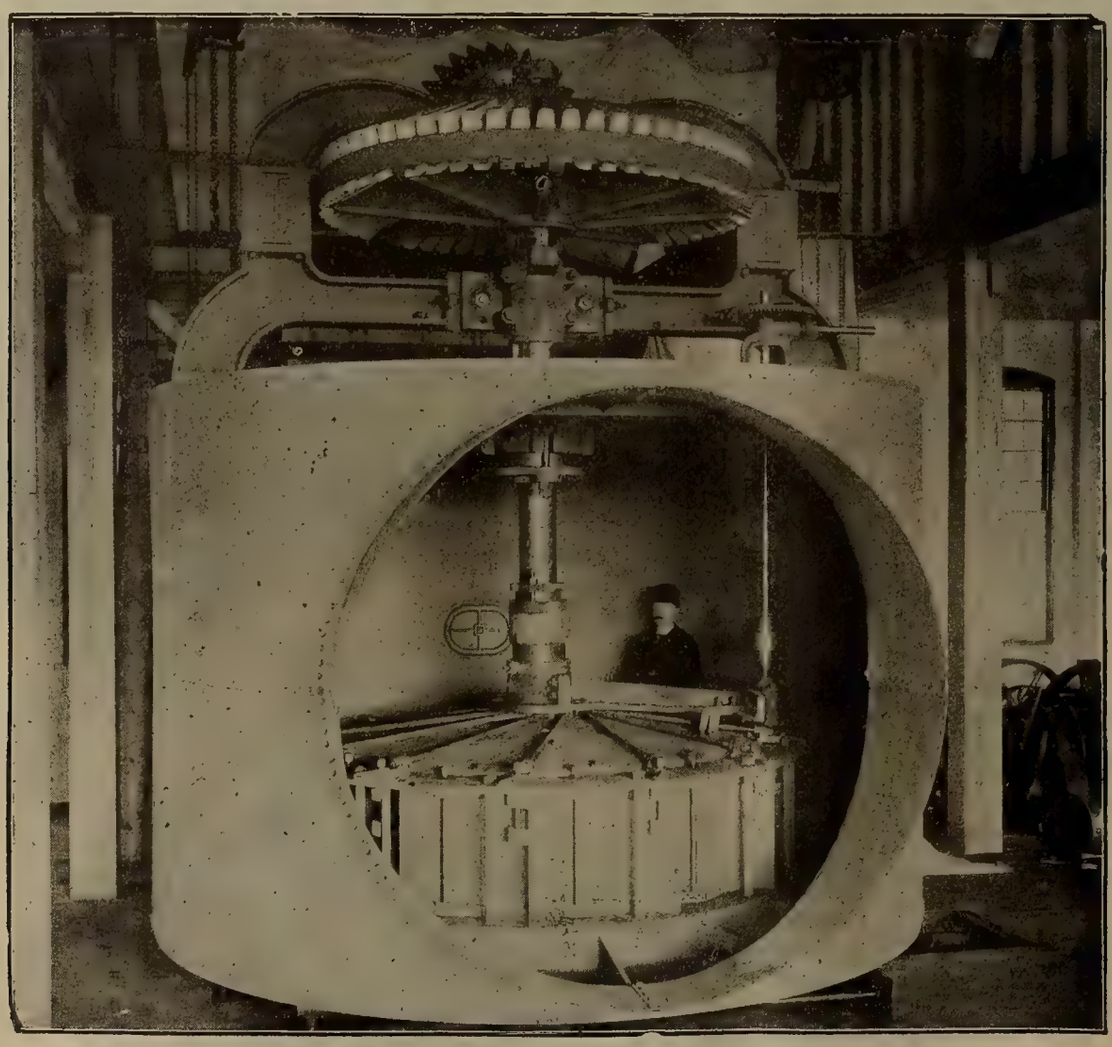
A great advantage is also gained in the fact that the electric pumps can be shifted from one place to another upon the mine trucks and wires connected with the least trouble and expense. All pumps for this connection must be of the best possible construction, the working parts made of material to resist the great strain due to the vertical height, and also to the chemical action of the mine water. Further, the machinery must be of such construction and design as to work with a minimum of attention and repairs, and so constructed that when repairs are necessary they can be effected with the least interruption to pump operation.

Fig. 5 shows an electric mine pump automatically pumping water from the base of a mine shaft to the sump, and from this point to the surface. The float is placed in the sump which automatically controls the operation of the pump.

Fig. 6 shows Gould's triplex electric power-pump, for elevations to 300 feet or equivalent pressure. The pinions are of rawhide and the operation of the apparatus is practically noiseless. It is connected by belt with the electric motor, which is seen at the left.

IMMENSE WATER-WHEEL.

The accompanying illustration shows the large water-wheel recently made by The James Leffel & Co., of Springfield, Ohio, as it sat in the shop before being taken down for shipment. The height of the casing of the wheel is 15 feet, and its surmounted iron bridge-tree arrangement for carrying the huge pair of gears and short horizontal shaft is 22 feet. This immense wheel weighs 57 tons, and will give nearly 600 horse-power under a comparatively low head. It is to be used for driving a large lumbering and house-finishing manufacturing plant at Menominee, Wis.



600 HORSE-POWER LEFFEL WATER-WHEEL.

Great care is exercised in the construction of these wheels, and nothing but the best of material and workmanship is employed and every effort made to have them perfectly reliable. That the company is successful in this direction is amply demonstrated by the immense demand for them from all quarters of the globe.

In every machine for the conversion of energy there is always a certain amount of loss attending the conversion; in other words, less energy appears in the new than existed in the original form. The more perfect the machine the less does this loss become, but it is practically impossible to avoid loss to some degree, because we cannot eliminate mechanical friction, etc.

CLIMAX BOILERS IN NEW POWER-HOUSE IN BROOKLYN.

Work on the new electric power-house of the Coney Island and Brooklyn Railroad, on Smith street, between 9th street and Hamilton avenue, Brooklyn, is now progressing at a satisfactory rate. At the present time the foundations are nearly completed and the structure promises to be substantial in every respect, and well adapted to the purposes for which it will be used. Its location is a convenient one, both as regards the railroad line and the matter of coal handling. The rear of the premises is on the Gowanus canal, and coal can be unloaded directly from the barges to the yard of the station.

In the erection of this station a curious anomaly is presented. Usually such buildings are constructed first and the boilers and machinery are put in afterwards, but in this case the boilers and machinery claimed precedence, and the result is we find the boilers in position and the engines well on the road to completion in their installation.

The accompanying illustrations were made from photographs taken by our special artist showing the two mammoth "Climax" boilers and the condition of work on the engines.

These boilers, which were made by the Clonbrock Steam Boiler Works, of Brooklyn, as will be seen, are of the upright type. Great economy of space is claimed for them, besides their advantage of being very economical in the matter of fuel consumption.

Each of the boilers shown is of 350 H. P. capacity; 12 feet in diameter and 25 feet high.



"CLIMAX" BOILERS IN POWER-HOUSE, BROOKLYN.

The grate used in these boilers is of very simple construction and is not liable to get out of order.

The steam generator proper consists of loop-shaped tubes and a vertical cylinder extending throughout the whole height of the boiler around which the tubes are arranged. The cylinder is similar in construction to any ordinary cylindrical boiler shell, is perfectly steam-tight, and is provided with the usual manhole plate.

Within the cylinder there is arranged another cylinder whose upper end is open and its lower end closed. The bottom of this cylinder rests on brackets riveted to the outer cylinder, and the upper end of the inner cylin-

der extends about up to the water-line. The latter cylinder is in fact a built-up one; it is made in short sections, so that they can be readily removed when repairs are necessary. The lower end of the tubes are connected to the inner cylinder by short tubes crossing the annular space. These short tubes are simply driven into the main tubes; their other ends rest in the holes through the inner cylinder. The ends of the short tubes need not be and are not expanded, as perfect steam-tight joints are not necessary.

The fire-box surrounds the outer cylinder and is annular in form. The casing is made in sections, bolted together.

This arrangement allows any one of the sections to be removed without disturbing the other sections, when it is necessary to replace a tube. Sometimes the inside of the casing is lined with terra-cotta.

In the action of the steam-generator the water, as it is heated, will ascend in the loop-like tubes, flow into the



GENERAL VIEW SHOWING CONDITION OF WORK ON NEW POWER-HOUSE.

annular space between the inner and outer cylinders referred to, and a fresh supply of water is drawn from the inner cylinder. In this manner a constant circulation is maintained in the tubes, causing the steam and water in the annular space to ascend and the solid water in the inner cylinder to descend.

A deflector directly above the inner cylinder tends to deposit any water that may be carried by the steam. The tubes above the water-line will dry and superheat the steam; the diaphragm plates above the deflector compel the steam to circulate in succession through each tier of the steam and drying tubes.

The feed-water in entering the generator has to flow through the coil resting on the upper tier of tubes, and is well heated.

The ratio of grate to heating surface in these generators is about 1 to 50. It will be seen that the heating surface is very effective, and consequently steam is very rapidly formed, and a high economy of fuel obtained. Another advantage is that, comparatively, very small floor space is required.

Since the largest diameter exposed to bursting pressure is the comparatively small vertical cylindrical shell, it will be seen that these generators can be made of large power and still be entirely safe under any pressure desired. When worked under ordinary pressures the factor of safety is high. One of these generators has been under steam for three years at Lorillard's tobacco factory, and shows no signs of failure anywhere; a tube recently cut out for examination was in as good condition as when first put in.

Several of them are now in use in electric light stations and other places, giving excellent satisfaction. The inventor is T. F. Morrin, of Jersey City.

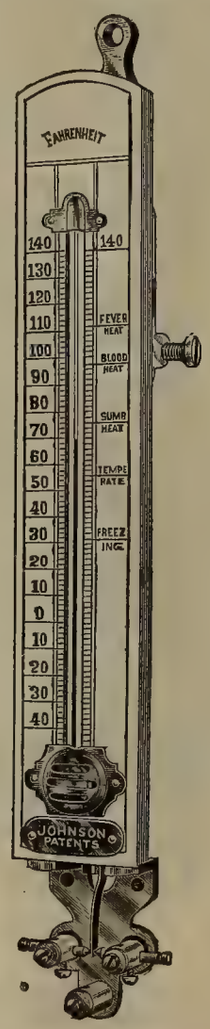
The large view of the boilers was taken from the dock, and the smaller general view from the Smith street side of the property. The latter view shows the tops of the boilers, and the parts of the engines being put in place. They are Wright engines, two in number, and of 1,000 H. P. each. They are of the tandem-compound type.

At the present moment facts concerning the electrical plant are not available. We will give them in a later issue.

TEMPERATURE REGULATION BY THE AID OF ELECTRICITY.

BY THEO. C. IVES.

In these days when labor-saving seems to be the bent of every inventor, when every new contrivance is designed to be as automatic as possible, to perform its work independent of the immediate attention of man, it



THERMOSTAT.

is a strange fact that so few people have considered how much of their time and attention might be saved if the regulation of the temperature in which they live or in which they store the products of industry was not dependent upon the work of their own hands or those of an employé.

There is an automatic means to accomplish this control, the indispensable agent employed being electricity; and it matters not what system of heating or cooling is

adopted to fulfil varying conditions, electricity can be made the silent governor of temperature.

Few people will discover they are too warm until they are greatly overheated. Then all the sources of heat are shut off and the cooling process effected by the opening of windows and creating drafts. Thus it is that the average man while in his home or office subjects himself to a continually varying degree of heat or cold, which is detrimental to health, and promotes discomfort.

There are many processes of manufacture which require a maintenance of a fixed degree of temperature or the product will be destroyed and become a total loss. To accomplish this uniformity without the aid of electricity requires constant personal attention,a very frequent reading of the thermometer, and as frequent readjustment of valves or dampers. But when the electric thermometer or thermostat, as it is technically called, is placed in the atmosphere to be regulated, then further attention from man is no longer required.

Several great principles of natural forces are utilized in what is known as the Johnson System of Heat Regulation to perform the duty which we have described.

The unequal expansion and contraction of different materials due to heat and cold is taken advantage of in the following manner: Behind the face of the thermometer in the apartment to be governed is a thin strip of brass not more than half an inch wide riveted to a like strip of vulcanized rubber so that the surface of one cannot slide upon the surface of the other. At the end of this thermostatic strip is a little metal tongue between two electric points situated just below the face of the thermometer.

When this thermostatic strip is affected by heat the brass expanding more than the rubber, thus becoming longer, causes the strip to bow slightly and presses the metal tongue against one of the electric points and so forms a contact. And vice versa, the effect of cold contracts the brass more than the rubber, the bow forming in the opposite direction and making the electrical contact on the opposite point.

In the first case the electric current opens a port in a small pipe which permits the *power*, which is stored compressed air at a pressure of 10 pounds to the square inch, to rush to its duty of closing valves or dampers, thus cutting off from an apartment its source of heat, the required temperature of said apartment having been attained.

But in the second case the electric current opens a port which permits the air to escape, and the valve or damper being relieved of the power which kept it closed opens by the aid of a spring or weight. Thus heat is admitted to the apartment the temperature of which was tending to fall bellow the degree desired to be maintained.

The thermostatic strip is so delicate in its adjustment that a variation of but a fraction of a degree causes it to reverse the electrical contacts; thus the heat sources or sources of cold are at very short intervals being turned on and turned off, and so producing the uniformity of temperature desired.

The electric thermometer can be set to maintain such degree of heat or cold as the heating or cooling plant can afford, simply by the use of a little key which limits the bow of the thermostatic strip.

Different chambers in the same building are in this manner governed to suit the wishes of the occupant of each, though the central source of heat or cold is common to all. In private houses the air pressure is maintained by an automatic hydraulic pump, a few gallons of water a day being all that is wasted. But in manufactories the steam power which is at hand is usually employed for this service.

Through the agency of compressed air at only ten pounds pressure per square inch it can be readily understood what power can be exerted at any desired point, the diaphragm valves used presenting a surface for the action of the air according to the duties to be performed.

The smallest size of diaphragm valves such as are applied to ordinary direct radiators are in the neighborhood of four inches in diameter, giving an area of over twelve square inches, which, acted upon by ten pounds pressure, will develop a moving power of over one hundred and twenty pounds.

We learn that in New York's municipal buildings, where this system of regulation has been adopted, and also on the new propeller ferry-boats of the Pennsylvania Railroad, and those of the Hoboken line, diaphragm valves are used to move the big heavy dampers that are twelve inches in diameter; thus the moving force exerted, due to the little ten-pound air pressure, is over one thousand pounds, as more than one hundred square inches of surface to be acted upon is presented.

This air pressure is conducted through little ⅛-inch pipes, which can go into walls or partitions the same as wires for the operation of bells, telephones, or electric light service, and be entirely concealed.

By the combination of natural forces which we have endeavored to describe a little four-cell open-circuit battery, its trifling power being controlled by the thermostatic strip, can automatically put into effective service any degree of force required.

The Metropolitan Electric Service Company, of 126 Liberty street, New York, supplies this system of temperature regulation, and makes a most interesting exhibit in its own office of what is possible to be accomplished.

KOLON PRIMARY BATTERY.

A private exhibition of the Kolon Primary Battery was given last week, and to all appearances the claims as to the new cell's internal resistance E. M. F. and large current discharge were fully sustained.

Figure 1 represents the external appearance of the new cell (7½ by 7½ by 9½ inches), which bears a close resemblance to a storage cell, this similarity being carried out as well in its action, being equal in discharge capacity to a secondary battery of the same size, and possessing the advantage of being uninjured by heavy current outputs.

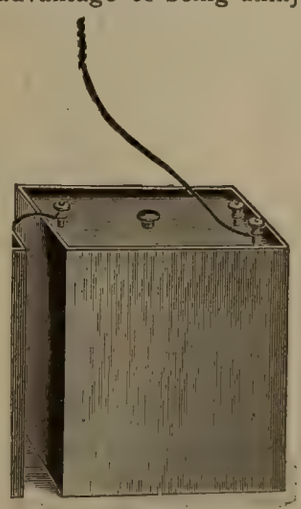


FIG. 1.



FIG. 2.

Figure 2 shows the carbon-cup, which acts in the dual capacity of porous-cup and positive electrode, and in the careful construction and material of which lie the numerous advantages this battery possesses over previous forms of primary cells. The walls are five-eighths of an inch thick, between which are moulded five carbon plates, the whole presenting over 1,000 square inches of carbon surface to the action of the chronic depolarizer with which the cup is filled. This cup sets in the hard rubber cell shown in Figure 1, which is lined with a thin zinc plate

bent in rectangular form. The extremely low internal resistance is partially accounted for by the fact that the distance between the zinc electrode and the walls of the carbon-cup forming part of the positive electrode, is but one-half inch. The usual acidulated water fills this space.

On test, using a Weston ammeter and voltmeter, a single cell repeatedly discharged over 100 ampères at an E. M. F. of .5 volt, with instant recovery of over 2 volts when the circuit was broken, this too, when the wires leading to the ammeter heated during the test. Such a remarkable result was all the more interesting when the thick carbon walls replacing the ordinary thin clay diaphragm, were taken into consideration. While they appear to completely separate the two solutions on open circuit, thus eliminating the bugbear "local action," they offer an extremely low electrical internal resistance, else the above results could not have been obtained. On low rates of discharge the internal resistance was but .025 of an ohm.

Careful attention has been paid to all mechanical and chemical points in the construction of the cell, which is made of the best material throughout. Though rolled zinc is employed, it is saturated with mercury, avoiding all troublesome amalgamation. There are no fumes, corrosion or creeping salts. The carbon is perfectly uniform and presents an even appearance. Simplicity is also a feature of this cell, only two working parts being used, avoiding all multiplicity of electrodes, connections, porous-pots, etc.

For fan work, running motors under one-quarter horse-power, small incandescent lights, cautery and dental applications, phonographs and the many uses to which attempts have been made to apply primary batteries, the Kolon should prove successful. It possesses all of the good points and none of the defects of the storage battery.

It is supplied by Converse D. Marsh, of 136 Liberty street.

The Durango Railway and Realty Company, Durango, Col.; was incorporated July 5, with a capital stock of $250,000. Incorporators: George Ditchfield, S. E. Herr, W. G. White, W. S. Pickerell, J. M. McClockey, Durango, Col.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

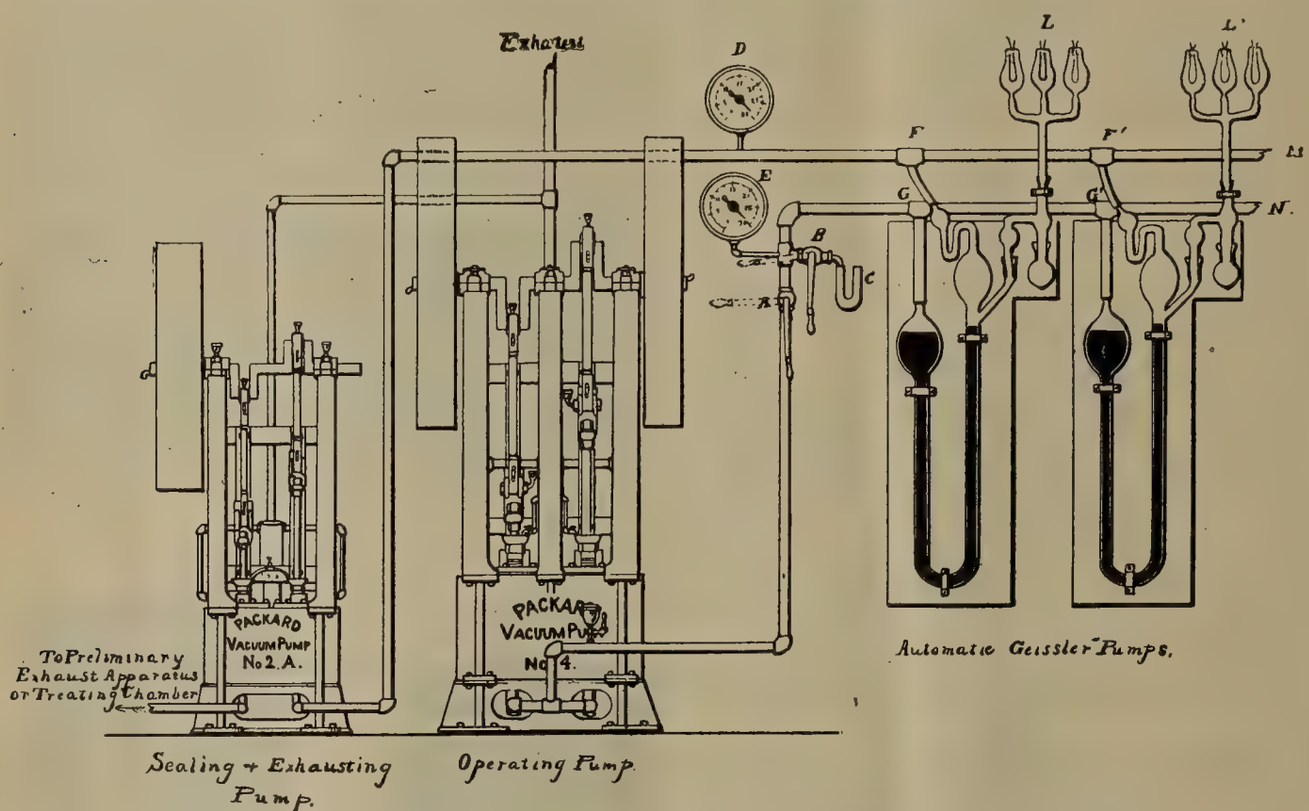
The Incandescent Lamp (*concluded*).

In the first part of this article, in last issue, a new word was inadvertently introduced into the electrical vocabulary. This is already cumbersome enough and we have no desire to confuse students by the unsanctioned use of new words, therefore we wish to say that the word "lashing" in the last paragraph should have been "flashing."

In the process of carbonizing the delicate filaments do not altogether preserve their uniformity of size. They are liable to be weaker at some points than others, and if these weak spots were not fortified they would bring the lamp to an untimely end, and possibly the users of lamps as well. In the "flashing" process these weaknesses are doctored, and the filament is built up at such points sufficiently to make it uniform in size throughout. The importance of having uniformity in size will be readily understood when it is remembered that a weak spot will offer greater resistance to the current and necessarily cause an increase of temperature. Such conditions would naturally cause the filament to give way at such point, long before the lifetime of the lamp had been spanned.

The flashing is continued until the filament assumes a uniform temperature. This condition is indicated by the uniformity of luminosity.

On the completion of the flashing process the next step in lamp-making is to fix the filament in the bulb. The ends of the carbon loop are attached to platinum wires which run through a little piece of glass seen at the base of all incandescent lamps. This glass is firmly attached in a proper manner to the glass bulb of the lamp, and the other end of the bulb, which is usually marked in all lamps by a little glass projection, is attached to the receiver of the air-pump. After the air has been exhausted to the proper degree, a glass-blower very dexterously melts off the neck, which seals the bulb hermetically.



MECHANICAL AND MERCURIAL PUMPS FOR EXHAUSTING AIR FROM LAMP-BULBS.

Platinum is used for the "leading-in" wires because it is the most available material for the purpose. "Leading-in" wires are those short pieces of platinum wire to which the carbon filament is connected. The outside ends of the platinum wires are free, to be connected with the metal parts of the base.

The reason platinum is the best material for this purpose is because it expands and contracts with variations of temperature at about the same degree as the glass in which it is fused.

Were any other substance used whose co-efficient of expansion varied with that of glass the result would be inevitable admission of air to the interior of the bulb through the small space between the glass and the platinum leading-in wires, and consequent destruction of the lamp.

After the filament has been permanently placed in the bulb at its base, the lamp is ready for exhaustion.

The process of exhausting the air from lamp-bulbs is one of the most interesting and delicate of all processes pertaining to lamp-making. The task is not an easy one of accomplishment. Air is a difficult thing to get rid of. It is easy enough to get rid of part of it with an ordinary air-pump, but a perfect vacuum cannot be obtained by the use of a mechanical pump. A mercurial air-pump is used to get the high vacua required for lamp-bulbs, although it is the practice to use a mechanical pump during the first stage, then to substitute the mercurial pump to finish the work.

The accompanying illustration shows how mechanical and mercurial pumps are combined so as to exhaust lamp-bulbs. The lamp-bulbs are indicated at *L L*, there being two groups of three bulbs attached to the pumps. After the proper degree of exhaustion of air in the bulbs has been attained the small glass-tube connection between the bulb and the exhaust-tube is fused by a flame, drawn out and "sealed off." In this process there is no chance for the admission of air into the bulb, because the opening is fused and closed before the connection with the pump is broken.

When this stage of the work has been completed, the lamp is ready for its base. In the base of every lamp there is embedded in the centre of the plaster filling a brass rod. This rod is connected with one of the platinum leading-in wires, and the shell of the socket is connected with the other leading-in wire, so that when the lamp is in position for lighting the circuit is completed through the shell, the leading-in wire connected therewith, the filament, the other leading-in wire, and the central rod.

After the construction of the lamp is completed, it is subjected to tests to determine its candle-power. This process will be described in our next article.

ELECTRO-HEATING APPARATUS.

The commissioner of patents has affirmed the decision of the examiners-in-chief in the case of Morford *vs.* Carpenter, relating to electro-heating apparatus. This was an appeal from the decision of the examiners-in-chief awarding priority of invention to Morford with reference to the following interference issue:

"In an electro-heating apparatus, the combination, with the heated surface-plate and the resistance, of a coating of enamel or its equivalent securing the resistance to but insulating it from said plate."

Carpenter's application for patent was filed September 27, 1890. Morford's application was filed December 19, 1890. A patent inadvertently issued upon Carpenter's application February 24, 1891, No. 447,023; but in this interference the status of both contestants is that of applicants.

CORRESPONDENCE.

ALUMINUM CASTINGS.

EDITOR ELECTRICAL AGE: Will you kindly through the columns of the ELECTRICAL AGE give some information relative to the state of the trade in aluminum. Having seen quite a few of your own medals struck from this metal for advertising purposes, also others for other houses, and in fact quite a few novelties, led the writer to look into the capabilities of this new metal, thinking perhaps at last an advertiser could get out something practically new and come within his means. In the first place we took the matter up with a view to getting out medals, and found we had better at once give away three or five cent pieces, as that is about the cost of each medal. A good set of dies will cost anywhere from $30 to $50, and take, say, ten or twenty thousand medals, the total cost to the consumer is very great. I say "consumer;" who is he? Again, why is this metal not used more, and brought more conspicuously to the front? and in the manufactures, why should not aluminum take the place of iron and brass to a degree? Is it expensive to produce in the ingot, or is it that the general manufacturer cannot work it successfully from the ingot to the casting? It must be the former, for the average manufacturer will have no trouble in making his castings. For instance, the writer desired to have some castings made of this metal, and the parties working the metal wanted an outrageously high price for the castings complete. They also assured us that it would be impossible for us to work the metal, as there were secrets connected with its manipulation, and should we melt it in the manner of ordinary metals, we would lose the whole of it. Is this so?

Having a little faith in our own mechanical ingenuity we purchased the metal in the ingot; had no trouble whatever in making our castings, and by adding other metals such as brass, or from one to two thirds copper, we got any desired hardness for a good working casting

The writer has great faith in aluminum, and thinks the day not far distant when it will be universally used by the manufacturer to take the place of quite a few of the common metals. It certainly has advantages over all metals in more ways than one, and either the manufacturers have been grossly misled as to the methods of working it, or the cost to produce it in the ingot is great. One of these must be the reason for its remaining in the background. Tell us which it is, please.

A READER.

EARTH-CURRENTS IN CANADA.

EDITOR ELECTRICAL AGE.—During nearly the whole of last week all long telegraph wires in Canada were affected to a greater or less extent by earth-currents, which reached their climax at noon on Saturday, the 16th inst.

About two months ago the overland circuits of the Canadian Pacific Railway's telegraph were arranged so that, in case of earth-currents interfering with the working of the wires, they could be made metallic instead of earth return, and also worked duplex. A duplex worked well under this arrangement, even when the currents were so strong that wires with earth return would not work by the ordinary "single" Morse system.

On Saturday morning the earth currents were so strong that the overland circuits were all made metallic and duplexed, working well until noon. About that time, however, the currents became so violent that for about half an hour not one wire was worked out of this office in any direction.

The storm in 1882 was very bad, but that of Saturday was much worse. In 1882 wires were worked from Mon-

treal to Toronto on earth-currents alone, but although of high potential they were not constant for more than a minute at a time, and the wires were alternately on battery and earth-shifting on an average about once a minute. On Saturday we worked from Montreal to St. John, N. B. (485 miles), on two wires continuously from 12:35 to 1:30 with both ends of each wire to earth, and not one cell of battery in either circuit. At 1:30 the earth-currents began to weaken, and became too unsteady to do satisfactory work with them. Metallic circuits were then established and worked singly, giving good service.

From about 12:20 to 3:30 P.M. it was impossible to do anything on the Montreal-Winnipeg circuits. Single metallic circuits were tried without success, only an occasional word being exchanged with the next repeater office, Sudbury. About 4 o'clock a metallic single circuit was got to work, and at 8 P.M. it was duplexed, working well from that hour until Sunday night, when the wires were split, and the trouble has not been felt since.

During the storm on Saturday afternoon a quadruplex was successfully worked with Toronto by using a metallic return. Wires in that direction did not appear to catch so much of the storm, but still we could not work single wires with earth return.

Only brief reports have been as yet received from other points in Canada as to the storm; but from what we have heard, it was much worse north of Lake Superior and in Manitoba. At Sudbury and Fort William, Ont., the wires had to be disconnected for a short time for fear of the offices taking fire. Even at Montreal sparks fully an inch long were formed when the plush arresters were pushed down. Sometimes the arresters would fail to open and an arc would form on the switch.

On Saturday evening the aurora presented a wonderful sight, the whole sky being covered with beautiful streamers of the most brilliant colors—red, green, yellow in various shades, the whole pointing to the zenith and uniting in a crown directly overhead. Portions of the streamers would remain almost steady, whilst others were continually dancing from one point to another.

I understand that the storm was pretty general all over the continent, and was felt on the Atlantic cables.

From the experience we have now had we find that wires worked on metallic return overcome all ordinary earth-currents, but when such an extraordinary storm is experienced they are useless. W. J. CAMP.

MONTREAL, July 21, 1892.

EXHIBITION OF ELECTRO-MEDICAL APPARATUS.

The committee of arrangements has decided to have an exhibit of medical electrical apparatus in connection with the annual meeting of the American Electro-Therapeutic Association, to be held at the New York Academy of Medicine, 17 West 43d street, October 4, 5 and 6 next. The committee has also arranged to accommodate the manufacturers with suitable space in a room adjoining that where the meeting will be held. It feels certain that the manufacturers will see the advantages such an opportunity offers for bringing their instruments to the notice of that part of the profession, who are directly interested, and for promoting the general interest in electricity and extending its use, and that they will be quiet willing to contribute liberally to defray the expense incurred by the committee for this purpose.

The committee states that the choice of space will be given in the order of application, which should be accompanied by a voluntary subscription of not less than ten ($10) dollars, or a promise of compliance on demand.

Each subscriber will be furnished with a space 5 x 6 feet, which may be exceeded, if desired, by a proportionate increase in the amount subscribed.

Publishers of books upon medical electricity are invited to apply for space upon the same conditions as manufacturers.

An early reply is urgently requested, that every one may be furnished with the space required.

The exhibition will last three days, Tuesday, Wednesday, and Thursday, October 4, 5 and 6, from 9 o'clock A.M.

Dr. Robert Newman, 68 West 36th street, New York city, is chairman of the committee.

LEGAL.

AGAINST THE CONSOLIDATION.

Two bills in equity have been presented to Justice Colt in the United States Circuit Court at Boston, Mass. The Mather Electric Company of Connecticut and District-Attorney F. D. Allen respectively are the complainants. The defendants are the General Electric Company of New York, the Edison General Electric Company of New York, the Thomson-Houston Company of Boston, Sidney B. Paine, A. R. Bush and C. A. Coffin, of Lynn, and Eugene Griffin of Boston, the latter officers and agents of the defendant companies.

The object of the suit is to test the validity of the Sherman anti-trust law, it being claimed that the defendants are endeavoring to create a monopoly and force the plaintiff out of business. An injunction is asked for on the grounds that in response to an advertisement by the State House Annex Commissioners the plaintiff made a bid to furnish electric light for the Annex of over $60,000, and that while being the lowest bidder, it is in danger of losing the contract because the General Electric Company, which is a consolidation of the other two companies named, has informed the commissioners that the plaintiff is infringing its patents and cannot therefore fulfil its contracts.

Judge Colt refused to grant the injunction, and set the case down for a hearing July 25.

CLAM-BAKE.

Its 14th annual Rhode Island clam dinner was tendered by the American Electrical Works, of Providence, R. I., to the electrical fraternity at Haute Rieve Union Club Country House, near Providence, on July 23, and was without doubt the most enjoyable and successful of any of its thirteen predecessors. By exact count there were 200 persons present, and that the day was spent in an enjoyable fashion may be inferred from the story which follows:

At 10:30 A.M. the party took the steamer for the scene of action, and in half an hour its destination was reached. At once every one threw aside all the dignity which electrical men must assume in their relations with ordinary humanity, and for the time being became as boys. They threw off all restraint, and much of their clothing, and when they had divested themselves of as much of their apparel as comfort called for, and hung it up on pegs provided for the purpose, the interior of the club-house looked like a Chatham street second-hand clothing store.

Football, rifle shooting, singing, dancing and base-ball were the principal exercises indulged in, and some of the feats executed in each class by some of the contestants would have made a professional's head swim.

The base-ball match was a creditable affair, and was earnestly contested by two nines, representing New York and Boston. Three innings were played, and the score

stood 6 to 4 in favor of New York. The following are the names of the two nines:

NEW YORK.—Charles Abell (captain), 2d base; A. F. Hamilton, 3d base; D. Chalmers, r. f.; J. C. Pierrez, s.s.; Geo. F. Porter, l. f.; E. F. Peck, c.; P. C. Ackerman, p.; L. H. Hart, 1st base; C. H. McIntire, c. f.

BOSTON.—C. E. Bibber, 1st base; T. H. Bibber, p.; C. B. Price, 3d base; E. P. Morris, s. s.; C. B. Burleigh, l. f.; D. A. Patten, c. f.; J. Cooney, c.; G. P. Hart, r. f.; M. W. Mead, 2d base.

Umpires: W. A. Hathaway and Mart Day.

A lunch was provided at 11:30, and shortly after 2 o'clock the crowd, as hungry as ever, sat down to the tables, which were arranged under a huge tent, and at once proceeded to the task of absorbing the good things provided by the bill of fare.

The following is a copy of the menu:

LUNCH.

Lobster salad. Little Necks. Fried pork in crumbs.
Crackers. Cheese. Doughnuts.
Raw oysters.

DINNER.

Clam chowder.
Broiled bluefish. Cream potatoes.
Fried eels. Soft shell crabs.
Olives. Pickles.
Frogs' legs.
Clam fritters. Saratoga chips.
Rolls. Brown bread.

BAKE.

Clams. Lobsters. Oysters.
Sweet potatoes. Sweet corn.
Tripe.
Indian pudding and cream. Fruit.
Black coffee.

When coffee was reached and cigars lighted Mr. C. W. Price, who acted as toastmaster, opened the post prandial exercises by calling upon Mr. Eugene F. Phillips, president of the American Electrical Works. Mr. Phillips expressed great pleasure at meeting so many of his friends and wished them joy and contentment.

Governor Brown, of Rhode Island, responded to the toast "Rhode Island," and was followed by Judge McCleary, of San Antonio, Texas, who spoke for Texas.

Mr. Stiness, of Pawtucket, kept the company in a roar of laughter for a few minutes with his humorous remarks, as did Mr. Martin C. Day, who spoke for "The Press."

To the toast "The National Electric Light Association," Mr. Charles R. Huntley, ex-president, responded. He was followed by Mr. C. W. Hagar, of Montreal, who spoke for the Canadian electrical interests, and General Embler, who responded to the toast "The Telephone Interest." Thus the "bake" closed.

The "boys" again resumed active exercise, and a few cannon fire-crackers were exploded to make things more interesting.

At 5 o'clock the party began to disintegrate and wend their way homeward rejoicing with the feeling that they had not so fully enjoyed an outing in many a day.

The following-named gentlemen composed the reception committee: W. A. Hathaway, W. H. Sawyer, C. R. Remington, Jr., P. C. Ackerman, E. Rowland Phillips, C. H. Wangenseil, A. L. Capper and John Carroll.

A complete list of the names of those who attended follows:

Ackerman, P. C., New York
Abell, C. L., Buffalo
Andrews, G. E., Providence
Austin, W. H., Charville, N. C
Austin, W. H., Boston
Andrews, J. E., Pawtucket
Baker, C. O., Jr., Newark, N. J
Bibber, C. E., Boston
Brown, Maybin W., Boston
Breck, R. C., Bridgewater, Mass
Burleigh, C. B., Boston
Baldwin, A. T., Boston
Baldwin, C. A., Boston
Bibber, T. H., Boston
Ballard, H. M., Boston
Brown, Jas., Pawtucket
Bullock, C. H., Pawtucket
Bly, C. L., Boston
Burbank, M. P., Whitinsville, Me
Buckminster, G. H., Boston
Boynton, F. J., Lowell
Baker, E. B., New Haven
Babcock, W. H., Boston
Brock, R. A. S., Riverpoint, R. I
Baird, M. E., Hartford
Bradford, H. C., Providence
Balcom, C. A., Newton
Brown, Hon. D. Russell, Governor, R. I
Cutter, H. B., Philadelphia
Caldwell, Edw., New York
Chalmers, D., New York
Cooney, J. A., New York
Cleverly, H. A., Philadelphia
Carney, J. A., New York
Clewly, W. H., Providence, R. I
Clark, C. A., Boston
Carhart, E. M., Providence
Caleb, G. E., Haverhill, Mass
Colton, D. P., Hartford
Cram, H. B., Boston
Card, C. W., Boston
Coleman, A., Taunton
Crowley, H. P., Providence
Clarke, G., Boston
Coughlin, W. N., Worcester
Condes, S. B., Boston
Capwell, R. F., Providence
Clarke, E. A., New Haven
Carroll, John, Montreal
Cary, E. C., Boston
Chapel, E. A., Chelsea, Mass
Clark, J. H., Boston
Curl, H. J., Philadelphia
Carey, Wm. A., Boston
Darling, J. O., Providence
Darling, G. H., Providence
Dumoulin, L. S., Boston
Day, M. C., Providence
Dempster, W. W., Providence
De Khotinsky, Capt. A., Marlboro, Mass
Dresser, G. H., Boston
Denison, N. B., Pawtucket
Drake, J. J., Providence
Durgin, W. E., Boston
Embler, A. H., New Haven
Fish, W. C., Boston
Fairbanks, H. H., Worcester, Mass
Fahey, P., Boston
Fessenden, R., Providence
Farrand, D., Newark
French, H. M., Boston
Grush, G. G., Fall River
Glidder, C. J., Lowell
Gilley, F. N., Chelsea, Mass
Gould, T., Jr., Boston
Huntley, C. R., Buffalo
Hart, L. H., New York
Hunt, W. T., New York
Hart, G. P., New Britain, Ct
Hotchkiss, F. D., Rochester, N. Y
Hylan, E. S., Lowell
Hamilton, G. A., Elizabeth, N. J
Hamilton, B. F., New York
Hughes, E. C., Providence
Hurlbut, Sam., Elizabeth
Hodges, W. N., Pawtucket
Harrington, D. A., Boston
Hazels, W. J., Boston
Hill, W. S., Boston
Holtzer, C. W., Boston
Hathaway, W. A., Providence
Herrick, C. H., Boston
Hagar, C. W., Montreal
Holmes, W. E., Newton
Jenney, J. A., Pawtucket
Jenney, A. E., Pawtucket
Johnson, G. D., Hartford
Johnson, F. E., Newport
Key, W. S., Boston
Kimball, F. M., Boston
Knowles, J. S., Providence
Langstaff, H. C., Providence
Larned, J. H., Boston
Lockrow, —, Newport, R. I
Leedom, S. A., Boston
Lillie, W. W., Boston
Lane, T. W., Jr., Manchester
Luther, C. F., Pawtucket
Lucas, J. L., Boston
Leavitt, B. F., Providence
Mead, M. W., Pittsburg, Pa
Mason, F. C., Brooklyn
McIntire, C. H., Newark, N. J
Morss, C. D., Milbury, Mass
Miller, S. L., Narragansett Pier
Mace, R., New York
Martin, Wm., Pittsburg
Morris, E. P., Boston
McLeary, J. H., San Antonio, Tex
Monk, H. E., New York
McKenney, W. A., Boston
McCoy, J. A., Boston
Magoon, J. M., Providence
Murdock, F., Newton, Mass
Munro, W. N., Providence
Oakley, A. G., Providence
Peck, E. F., Brooklyn, N. Y
Price, C. W., New York
Porter, G. F., New York
Price, C. D., Boston
Patten, D. A., New York
Pearce, F., New York
Pierrez, J. C., New York
Phillips, E. F., Providence
Phillips, E. R., Providence
Pearce, J. B., Bristol, R. I
Payson, S. R., Providence
Phillips, G. W., Norwich, Conn
Palmer, F. S., Boston
Peterson, C. G. A., Providence
Pool, H. W., New York
Raymond, A. R., Philadelphia
Ring, C. L., Boston
Richardson, S. A., Boston
Rice, H. R., Lowell
Russell, C. W., Providence
Ross, R. F., Boston
Remington, C. R., Jr., Providence
Smith, Gerritt, New York
Shaw, A. C., Boston
Sawyer, W. H., Providence
Smith, A. O., Boston
Sayward, A. D., Providence
Shepardson, A. O., Waterbury
Sylvester, Chas., Fall River
Stiness, S. S., Pawtucket
Sherman, H. H., Auburn
Sprague, L., Fall River
Smith, Orin, Jr., Pawtucket
Swan, F. A., Boston
Studley, J. H., Jr., Boston
Smith, R. W., Boston
Smith, S., Boston.
Smith, E. A., Providence
Taltavall, T. R., New York
Tilton, E. R., Boston
Tanner, W. E., Fall River
Thurston, S. L., Providence
Thurston, W. T., Providence
Taylor, Jos., Providence
Thurston, G. H., Providence
Thurman, W. R., New Bedford
Tatein, J. B., Putnam, Ct
Townsend, W. S., Worcester
Thomas, V. A., Providence
Urquhart, L. S., Lynn, Mass
Woods, E. E., New York
Wesser, Roland, Providence, R. I

Wright, A., Providence
White, J. W., Providence
Wright, H. G., Providence
White, C. A., Providence
Whitney, D. C., New Britain
Wagner, W. K., New Bedford
Woods, H. F., Boston
Wilmot. G., Whitinsville, Me
Watters, W. R., Boston
Wolcott, C. W., Boston
Wright, I. O., Boston
Whittemore, W. F., Leicester, Mass
Whittier, R. H., Providence
Wright, W. D., Providence
White, A. C., Providence
Wood, C. N., Boston
Young, S., Lowell, Mass
Young, A. M., Waterbury, Mass
Ziegler, A. A., Boston

CLAM-BAKE NOTES.

Mr. Eugene F. Phillips, the enterprising president of the American Electrical Works and promoter of these elegant and enjoyable affairs, beamed with smiles as he looked upon his large company frolicking around having a good time, and his countenance showed that he was enjoying inward pleasure at having given so many an opportunity to banish all business care from their minds and have a good time.

At each plate at dinner was a neat box containing a unique and elegant souvenir of the occasion. It consisted of an oxidized silver clam-shell, with the two halves slightly separated to hold a neatly folded piece of white silk on which was printed the menu. On one of the half shells were the words in raised letters, "American Electrical Works, 14th Annual Clam-Bake, Providence, July 23d, '92." This souvenir was the neatest and most artistic thing of the kind that we have ever seen.

NEW INCORPORATIONS.

Alaska Railway Construction Company, Chicago, Ill., incorporated July 19, with a capital stock of $100,000. Incorporators: E. A. Filkins, M. Hewetson, Paul Dickinson.

Stamford Electric Light Company, Stamford, N. Y.; incorporated July 6, with a capital stock of $20,000. Incorporators: I. Maynard S. E. Churchill, E. W. Churchill, all of Stamford, N. Y.

Bath Electric Illuminating and Power Company, Bath, N. Y.; incorporated July 14, with a capital stock of $35,000. Incorporators: William M. Sheeham, Walter E. Hyer, Robert J. Boyd, all of Newburg, N. Y.

The Sharon Hill Electric Company, Sharon Hill, Pa.; incorporated July 11, with a capital stock of $1,000, to supply electric light, heat and power. Incorporators: Robert Barry, Thomas Garvin, John Muldoon.

Bradley General Electric Company, Chicago, Ill.; incorporated July 16, with a capital stock of $1,000,000, to manufacture and sell electric devices and machinery, construct electric railroads, etc. Incorporators: Homer C. Hartman, Edwin S. Douglas, Francis I. Furber.

Fort Madison Water and Light Company, Fort Madison, Ia., incorporated July 19, with a capital stock of $500,000. Incorporators: H. P. Russell, Clarence D. Turney, Harold F. James, New York, N. Y.; William J. McCray, Charles H. Peters, Fort Madison, Ia.

Home Electrical Concern of Brooklyn (incorporated in W. Va.), Brooklyn, N. Y.; incorporated July 13, with a capital stock of $100,000, to manufacture sell and lease all kinds of electrical or mechanical devices. Incorporators: Winthrop Pond, Frank Daniels, Henry C. Baldwin, New York.

Columbia Cronophone Company, Camden, N. J.; incorporated July 15, with a capital stock of $500,000, to manufacture, utilize, sell and dispose of the machine or device known as "The Electric Time-Call and Set-Back," etc. Incorporators: R. W. Borphly, Hammonton, N. J.; W. S. Anderson, W. Brady, J. E. Byram, Philadelphia, Pa.

ELECTRIC POTENTIAL.

Like everything else in the universe, the earth itself is always more or less electrified, and as a consequence, it is always at a certain potential. It will therefore be seen that were a body which had been electrified to a higher potential than the earth to be connected with the earth, a flow of electricity would take place, passing from that body to the earth, so that both the body and earth assume the same potential; and it may be mentioned that the passage of this flow could be easily observed by the introduction of certain apparatus. On the other hand, were a body to be electrified to a potential lower than that of the earth and to be connected with it, a flow of electricity would be determined between the earth and the body, and the passage of this electricity could also be rendered evident. Consequently, when copper and zinc strips are immersed in acidulated water and the exposed ends become electrified, the one to a higher and the other to a lower potential than the earth, the connection of these extremities with the earth causes a flow of electricity from the plate of higher potential to the earth, and from the earth to the plate of lower potential. These flows will be equivalent to joining the plates directly together and so releasing the electrical stress.

Thus it is with every battery: the potential of the earth is above that of one end of the battery and below that of the other end. There is no need for a current to flow between the two earth connections, and the assumption of such a state of affairs is quite gratuitous. It must not, however, be supposed that the flow of electricity from or to the earth can sensibly affect its charge or potential, the terrestrial charge as a whole being so enormous as to make any other charge or potential incomparably feeble and insignificant. To make this clearer we will employ an analogy. Let us suppose that we have two tanks containing water, the bottom of one being placed ten feet above the level of the ocean, and the other, which we will suppose to be very deep, immersed until the surface of the contained water is ten feet below the ocean level. If now we suppose holes to be made in the bottoms of the tanks, all the water will flow out of the higher tank into the sea below, while water will flow up into the lower one until the ocean level is reached. But, of course, no one would contend that these changes would make any difference in the level of the surrounding waters, even if more water were received from the higher tank than was given to the lower; and what is true in this case is equally true in the case of electricity. In fact, the earth is a body whose capacity for electricity, so far as we are concerned, is infinite, and nothing that we can do can alter its charge.

BOSTON NOTES.

Mr. White, of the Eco Watchman Clock Company, 520 Atlantic avenue, is looking happy, which is a sure sign that Eco clocks are in good demand.

The American Circular Loom Company, 620 Atlantic avenue, is kept busy filling orders for its flexible conduit or tubing for interior wiring.

H. L. Slade & Co., successors of Kendall & Slade, 134 Congress street, make a specialty of installing electric lighting plants, motors and house fittings.

Samson Cordage Works, 115 Congress street, manufacturers of solid braided cordage for suspending arc lamps, trolley cords, etc., report an excellent trade in the above lines.

Mr. Emil C. Pfeffer, 1 Beacon street, advertising expert, makes a specialty of preparing designs for artistic advertising, also designs advertisements for solid advertisers, and is recommended very highly.

THE BERNSTEIN ELECTRIC COMPANY is kept busy filling orders for their well-constructed fan motors for both direct and alternating circuits ; their lamps are too well known to need any further praise.

MR. WM. H. DENNEY, of Lancaster, Pa., was run across by your representative. He reports a big demand for his adjustable hand-screw, a valuable device for manufacturing electricians in the cabinet department.

THE GERMANIA ELECTRIC COMPANY was found nicely located in its present quarters, 620 Atlantic avenue, and prepared to receive orders for the popular Germania lamps, shade-holders, converters or transformers manufactured by it.

M. K. KENDALL & Co, formerly of Kendall & Slade, are holding forth at 8 Oliver street, where they will be glad to contract for electrical construction work, railway and lighting plants. They make a specialty of incandescent wiring.

THE ECONOMIC ELECTRIC MANUFACTURING COMPANY, 1 Beacon street, reports exceedingly good demand and sale for its lamps. The company is bringing out a new railway lamp which, it claims, will be of superior construction.

MR. PARSELLES, of the Consolidated Electric Manufacturing Company, who was met by your representative, reports that the company is now bringing out a line of its special railway and power motors, which will be placed on the market shortly.

R. HOLLINGS & Co., 547 Washington street, manufacturers of the new electric-light support for adjusting incandescent lamps at any angle, report a very good sale. These supports are valuable in electrical manufacturing companies' shops, also in mills, factories, etc.

THE BOSTON ELECTRIC COMPANY, Mr. C. C. Allen manager and treasurer, continues to cater to the wants of the trade and buyers generally in everything electrical. The company is bringing out a new motor and fan that can be adjusted to any position, and will give three speeds without a rheostat or resistance.

J. A. GRANT & Co., 8 Oliver street, eastern representatives of the McIntosh & Seymour electric-light engines and engines for high-speed service, were found as busy as ever, preparing designs, plans and estimates for light and power plants. This firm have made a big success of these engines here in the east.

THE CONSOLIDATED ELECTRIC MANUFACTURING COMPANY will remove its offices and salesrooms from 154 Franklin street to the factory, where everything will then be under one roof and expenses reduced, thereby enabling the company to give greater advantages to its customers. Mr. C. E. Bibber, the popular manager of the company, is always on the alert to benefit his patrons.

MR. J. E. HUBINGER, of Hubinger & Pool Co., New Haven, Conn., was in town and reports that the company will shortly put on the market its new and improved dynamo and motor. Long days have been spent in experimenting with and improving this machine, and it has been pronounced by several prominent specialists and practical electricians to be a perfect one and of superior quality.

THE REDDING ELECTRIC CO., 41 Federal street, Boston, is carrying a full line of electric-light supplies, having given up the household and general electrical supply business. This departure was decided on recently on account of the rapid development in the electric light supply trade during the past few years which became the largest part of the business. The company is bringing out a large line of new specialties.

MR. J. C. PIERREZ, the popular representative of the Columbia Rubber Works Company, 65 Reade street, New York, is here hustling up the trade. His company makes everything in the line of hard rubber for electrical uses, which cannot be beat in quality and price, such as sockets, bushings, tubing, etc. The company also makes friction tape and all styles of soft rubber goods, also columbia compound, a new material for insulating purposes. I met him several times and each time he had many new and large orders. Mr. Pierrez is very popular with all he has dealings with.

SWAN & LANE, 194 Summer street, who lately opened salesrooms at the above address, when visited by your representative, were busily engaged unpacking a large line of Indianapolis Jenney motors, for which they are agents. They carry a large line of motors, among which is the "Sea Breeze" revolving and vibrating fan motors. Swan & Lane also make a specialty of electrical contracting, furnishing specifications and estimates for the installation of electric light and power plants, theatrical electrical supplies and wiring of all kinds. This part of their business is an artistic success.

MR. WALLACE, of the Eastern Electric Supply Company, 79 Franklin street, has started for New York to secure his usual quota of orders from the many new and extending railway companies. The company's showrooms exhibit the wide range and quantity of electric railway stock carried. Large quantities of trolley-wheels, poles, hangers, brackets, etc., lie about in attractive style ready for immediate delivery. Mr. Brown, the well-known manager of the company, has just returned from a very successful trip through Massachusetts, having secured a large number of orders. He reports business in good shape.

W. T. H.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 23, 1892.

MR. MARSHALL, of the Iona Mfg. Co., Boston, was in town July 25, taking orders for his new lamp-socket.

Two unsophisticated Philadelphians wandered away from home last week, and were seen in New York amid the rush and turmoil of the metropolis. The two wanderers were H. A. Cleverly, of the Cleverly Electrical Works, and N. H. Balsley, of the Philadelphia Telephone Co.

OUR representative had the pleasure of calling on E. A. Storey & Company, contractors for all kinds of electrical work, in the Electrical Exchange Building. The firm consists of E. A. Storey and John Hill, both well known in the electrical fraternity. They are agents for the Ries Electrical Specialty Company, of Baltimore.

THE NEW HOME SEWING-MACHINE COMPANY, 931 Broadway, has on exhibition one of its famous sewing-machines made of pure aluminum. This is the first and only sewing-machine ever made of this metal. Every part of the machine is made of pure aluminum and it works as perfectly as any of the regular machines. It weighs two-thirds less than those constructed of iron and steel.

P. CLAUS & Co., 52 Broad street, have secured the agency for the United States of a new dynamometer of German manufacture. This instrument is made of the finest materials, and will give direct reading in horse-power, speed of dynamos, engines, etc. One of the largest institutes of learning in this country is testing

these instruments. Claus & Co. sold on Tuesday, July 19, two 100-light dynamos.

MR. Z. LATSHAW, general manager of the National Electric Manufacturing and Construction Co., 136 Liberty street, has just closed a contract with the Queens County Electric Light and Power Co., for the installation of a 4,000-light plant to be installed at Baldwins, L. I. From this plant the villages of Seaford, Ridgewood, Bellmore, Merrick, Freeport, Baldwins, Rockville Centre, Pearsalls, Valley Stream, East Rockaway and Oceanville will be lighted. The extreme distance from the station to the farthest point will be seven miles.

J. H. BUNNELL & Co., dealers in telegraph, telephone, electric-light and electric-railway supplies, 76 Cortland street, are distributing among the trade a unique paper-weight. It is made of heavy, clear glass, and at the back, on white ground, are excellent reproductions of photographs of J. H. Bunnell and Chas. McLaughlin, who compose the firm. Between the two pictures are the figures "73." The whole thing is a capital idea, and these paper-weights will constantly remind their possessors that J. H. Bunnell & Co. have everything that is needed in the electrical line.

H. G. MADDEN has opened a general electrical supply store at 114 Liberty street, known as The H. G. Madden Agency, where all well-known goods will be kept constantly on hand. Electrical specialties will be one of its great features. Parties manufacturing goods of taking quality will do well to communicate with him. Mr. Madden is well known in the electrical fraternity, and we would advise concerns desiring a New York representative to communicate with him before the space he has rented is entirely occupied. The expense necessary to run a large corporation is avoided, thereby giving the purchaser an opportunity to buy goods at prices that Mr. Madden claims were never heard of before.

Mr. Charles H. Disbrow, 2 West 14th street, dealer in new and second-hand electric light and power machinery, is very busy placing arc and incandescent plants throughout the country, and reports the season more lively in that respect than ever before. Mr. Disbrow's assortment of arc, incandescent and motor machines is numerous, and any one can find just the article he wants in first-class order and at low prices. His experience with the Gramme dynamo is large, and he is prepared to build and repair armatures of that type, as used by the American system, with despatch; also to furnish lamp parts for that system at factory prices, and in fact to furnish everything connected with electric lighting, including engines, pumps, boilers and general machinery. Mr. Disbrow has placed search-light apparatus on western rivers with much success; also arc and incandescent plant installations.

THE COLUMBIA TYPEWRITER COMPANY, 150 Centre street, New York, manufacturer of the Bar-Lock typewriting machines, has just brought out a new machine known as the Columbia Bar-Lock No. 4, which contains every improvement found on all other machines, and many others all its own. The Bar-Lock Typewriter is the invention of Mr. Charles Spiro, who has had a practical experience of fifteen years, and is particularly adapted for fast writing. One of the chief features is that the matter being written is visible to the operator without lifting the carriage or removing the ribbon. Great care has been taken to avoid all complications and have the mechanism as simple as possible. The best of material and workmanship is employed in the construction of these machines and all the parts are made interchangeable. The Columbia machine is of a neat design and it is said to be equal to any machine made.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	203 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	158 50
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	94 00
Edison General	15,000,000	100 00	108 75
Edison General Receipts		100 00	108 75
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	75 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	108 75
General Electric Co., 5s	4,000,000		*95
General Electric pref.		100 00	119 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref.	2,500,000	100 00	60 75
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	20,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	13 75
Postal Telegraph	10,000,000	100 00	63 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	66 00
Thomson-Houston pref.	4,000,000	25 00	29 50
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*99
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	93 50
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	27 75

Westinghouse Elec. Co. pref. 7s.....	4,000,000	50 00	45 50
Westinghouse Ass. Rects.....		50 00	19 00
West Point W. Lt. & P. Co., Va.....	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Two very important financial matters have been settled this month, both of which affect electric shareholders as much or more than any other industry. The first is the unlimited free coinage of silver and making it a legal tender for all debts, public or private. I do not believe one thousand dollars in gold coin has changed hands in settlement of electric accounts within the United States during the month; and it is quite certain that one million dollars of silver coin has been paid and gladly welcomed. If one or two of our richest men were to turn misers, put all their wealth into standard gold coin, run the coin into bars, deposit it in a particular bank and loan their checks for six per cent., demanding gold coin for all increase, putting that through the same course as fast as received, it would not take over a couple of generations for them to become honestly possessed of all the floating or circulating gold coin in the country, with the possible exception of such as the State might retain in its vaults for State purpose, and not over ten thousand people in the whole country would miss it. Silver, on the other hand, is the people's money all over the world, but with a government stamp on it. Neither gold or silver bullion is a legal tender under any circumstance. The lack of fractional silver is the cause of millions of I. O. U.'s being issued and passing current at all points distant from banking centres. The South is full of them, and only last year it was found the great State of New York used quantities of this class of evidences of indebtedness; some of it good for a shave, some good for certain amounts at company (or issuers) stores. In the language of the West, Uncle Sam's brand is good even on a soap-bubble as long as it can be identified. The people are the government, and any loss they sustain by the fluctuation in bullion, if divided per capita, will be sustained without regret. The second incident, in possibly less proportion, touches the wallets of electric expectants; I allude to the closing of the World's Fair on Sundays and the non-service of refreshments at all times. The Exposition is international and strictly a financial concern. Its object is to increase trade in every possible way, and it eas no other reason for existing. We get together our exhibits, simply and absolutely with a single view to induce some one to purchase or trade for them, and on the other hand, all foreigners without exception bring their jewels to the fair for the same reason. Without that inducement the fair would be impossible; there is no sentiment in it. The large iron firms wont boast of their ability to erect a higher tower than Mons. Eiffel, but each and all of them will vigorously compete for it for so many dollars, and not one would willingly sustain a loss, even of a commercial profit. The lighting contract came very near settling the electric lighting business of America, and may do it yet. Five years ago there would have been from a dozen to twenty competitors for the lighting contract; this year, if the published accounts are reliable, the list fell off; but the object in view was money and nothing else; so it is in every case in connection with the Exposition. The church and the temperance organizations who oppose the Sunday opening and refreshment serving are not shareholders or exhibitors; their combined contributions, directly or indirectly, would not pay the expenses of the committee for a single day; as a class, they expect free or partly free passes to and into the fair, and carry their lunches with them. They have no expectation or intention of purchasing any of the exhibits or trading with the exhibitors. What possible chance, for instance, has the General Electric or the Equitable Manufacturing and Electric, or the Electric Bath, or even the Electrical Age Publishing Company to make a profit through their exhibits from either or both organizations? And further, if the government permits it to be known as an international or world's fair, and first withholds its financial assistance, next rules against the exhibitors' time, pleasure and hoped-for profit, where is the inducement for Europe, Asia, Africa, Australia, or even South America or Canada to spread out their goods? This exhibition is not a Wanamaker's store, where people are desired to haul over and criticise for their pleasure and pastime, but the hard, wearily-drawn-out labor of men's muscle and brains, exhibited for the single purpose of reaping a cash reward. The exhibitors no doubt would be better pleased if every opponent of the Sunday opening, with refreshments, would remain away and make more room for business people to consummate their published desires, which is to trade and be traded with.

PAMPHLET.

We have just received from Mr. F. R. Chinnock, 18 Cortlandt street, New York, selling agent for The Ball Engine Co., Erie, Pa., a copy of a very interesting illustrated pamphlet descriptive of the latest improved heavy-duty engines, simple, tandem-compound, cross-compound and triple-expansion, for electric railways, made by this company.

"BEST COIL ON THE MARKET."

Dr. N. B. Lewis, of Troy, New York, writes, Feb. 19, 1892, to Jerome Kidder Manufacturing Co., 820 Broadway, New York city: "I think you have the best coil on the market to-day;" and Dr. C. H. Hassall, of Farnsworth, Manchester Co., England, writes, March 15, 1892, to the same firm: "I have tried your medical apparatus and proved its power to cure catarrh, sore eyes, short sight, throat diseases, deafness, etc."

OPPOSED THE FRANCHISE.

President Richardson of the Atlantic Avenue Railroad Company, Brooklyn, recently appeared before Mayor Boody in argument against the franchises granted by the common council to the Coney Island, Fort Hamilton and Brooklyn Railroad Company to construct and operate a surface road on Fifth avenue from Thirty-sixth street to the city line. This franchise was subsequently vetoed by the mayor.

The statement made by Mr. Richardson to the mayor was briefly that he opposed the granting of the franchise on the ground that the law required that the consent of the property owners must first be obtained, and then the common council's. The company which was granted the franchise has not secured the consent of the property owners, whereas his company has the consent by a decided majority of over one-half of the property owners on Fifth avenue.

BALL ENGINES.

Mr. F. R. Chinnock, the popular sales agent of the Ball Engine Co., of Erie, Pa., has in the past six weeks made the following sales of the celebrated engines made by his company:

Prohibition Park Ry. Co., Port Richmond, one 150 H. P. engine; F. O. Mathiessen, chairman Mfg. Committee

Amer. Sugar Refining Co., two 100 H. P. engines for Baltimore; Baltimore Traction Co., Baltimore, Md., two 130 H. P. heavy-duty engines; F. H. Leggett & Co., New York city, one 50 H. P. engine; Metropolitan Telephone and Telegraph Co., New York city, one 50 H. P. engine; Brokaw Bros., New York city, two 150 H. P. and one 80 H. P. engines; H. Ward Leonard & Co., New York city, one 150 H. P. engine; Curtis & Dean, New York city, one 50 H. P. engine; Royal Light, Heat and Power Co., Front Royal, one complete steam-plant, 100 H. P. engine and 125 H. P. boiler; Hot Springs Electric Co., Hot Springs, Va., one complete steam-plant, 100 H. P. engine and two 80 H. P. boilers; Buffalo Board of Trade, Buffalo, N. Y., one 60 H. P. engine; Wm. Kynoch, Guantanamo, Cuba, two 80 H. P. engines; C. S. Furst, Newark av., Jersey City, N. J., one 50 H. P. engine, one 80 H. P. boiler; Navy Yard, Brooklyn, N. Y., two 80 H. P. engines.

In regard to the engines for the Navy Yard we learn that the commandant thereof, after a critical inspection of the different engines in the market, decided to adopt the Ball engine, of Erie, as being in his opinion superior to all other engines.

A PROSPEROUS COMPANY.

The Crocker-Wheel Electric Company, New York, has been in operation a little over two years. Last winter it paid a dividend of 5 %. We have just learned that it paid an extra dividend of 3 % July 1 out of the earnings. Its business has increased so rapidly that it was compelled last year to increase its capital stock from $100,000 to $200,000. The new stock was quickly sold for cash at par.

The officers of the company are: President, S. S. Wheeler; vice-president, F. B. Crocker; secretary and treasurer, D. H. Jeffery.

The business this year has averaged several times as much as last year, and notwithstanding the company's largely increased plant it has been compelled to run nights to keep up with the orders. It makes only high-class goods, the aim being to have its machines the standard of their class. The Crocker-Wheeler people guarantee all of their goods, and thus gain the confidence of the purchaser, as he knows that if there is any defect in the motor it will be replaced free of charge.

KERITE WIRES AND CABLES ARE POPULAR.

That Day's Kerite wires and cables are popular and give every satisfaction is evidenced by the large number of orders which are constantly being received.

A recent order was for three hundred miles of aerial cable, containing eight conductors, to be used in conjunction with the signal system adopted by the New York Central and Hudson River Railroad Co., between Albany and Buffalo.

On Saturday, July 16, 5,300 feet of armored submarine cable, containing 18 conductors, ordered by the Metropolitan Telegraph and Telephone Company, was successfully laid between New York and New Jersey. A similar cable for the same company will be laid in a few days.

An interesting proof of the reliability of Day's Kerite wires and cables was recently received by Mr. F. W. Cushing, of Chicago, general western agent for these goods, from a local lighting company. It consisted of a section of marine cable which had been in constant use for over four years carrying a pressure of 2,400 volts, without any fault being developed, and was in as perfect condition as when first laid. Surely no better testimonial than this could be desired.

A STRONG ENDORSEMENT.

WALKER & KEPLER, 531 CHESTNUT STREET.
PHILADELPHIA, June 25, 1892.

ELECTRIC CONSTRUCTION SUPPLY CO.,
18 CORTLANDT STREET, NEW YORK.

GENTLEMEN: Replying to yours of the 24th, we desire to say we have been using your lamps for the past year, and during this time we have not had trouble with one lamp. We know of no better lamp in the market today, and we certainly would recommend them to any one who desires to use arc lamps on incandescent currents.

Yours respectfully,
WALKER & KEPLER.

"HONOR TO WHOM HONOR IS DUE."

We are requested by Queen & Co., of Philadelphia, to mention that the cable-testing keys illustrated in our issue of the 2d inst. were suggested to them by E. W. Stevenson, electrician of the Brush Electric Illuminating Co., New York.

Mr. Stevenson has had wide experience in such matters and hence knows probably as well as any one what the actual requirements are. He has used a set of keys similar to those Queen & Co. make for some time past, with very satisfactory results.

SPRING HAMMER.

The Hercules Iron Works, of Chicago, Ill., has added to its already extensive line of ice machinery and other specialties the manufacture of a new line of forging and bending machines for forging and forming iron and steel to any desired shape. One special feature of its machine is the rapid manufacture of turn buckles of all sizes. The company has also begun the manufacture and already placed on the market a new design of a light spring hammer which takes the place of more expensive tools where a hammer with a blow ranging from fifteen to thirty pounds is needed. The hammer is so arranged that one or more can be operated with a single belt. They are to be attached to posts or the side of the shop. Circulars will be sent on application.

The Electrical Age's Illustrated Patent Record.

Issued July 19, 1892.

479,007. Electric-Arc Lamp. Maurice S. Logan, Otterville, assignor of one-half to James H. Barley, Sedalia, Mo. Filed Aug. 29, 1891.

479,017. Hanger for Electric-Arc Lamps. Charles A Pfluger, Chicago, Ill., assignor, by mesne assignments, of one-half to the Standard Electric Company, of Illinois. Filed Jan. 23, 1891.

479,020. Incandescent Electric Lamp. Max A. Richter and James G. Nolen, Chicago, Ill., assignors to the Illinois Electric Lamp Company, same place. Filed Feb. 10, 1892.

479,029. Electric-Arc Lamp. Elmer A. Sperry, Chicago, Ill., assignor to the Sperry Electric Company, same place. Filed April 18, 1890.

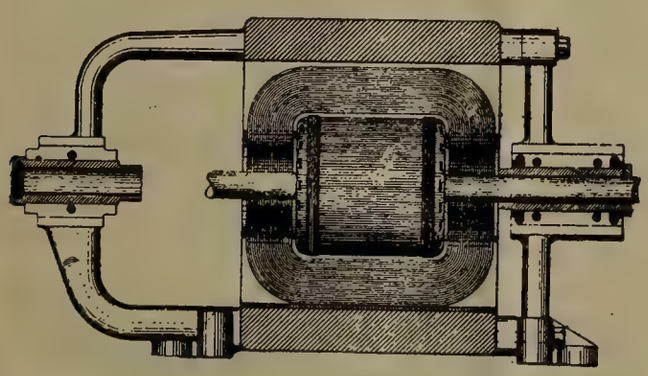
479,030. Armature for Electric Machines. Elmer A. Sperry, Chicago, Ill., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 17, 1891.

479,035. Safety Device for Electric Circuits. Mandeville Thum, Louisville, Ky. Filed June 5, 1891.

479,046. Electric Signal for Mine-Shafts. Frederick W. Bacorn, Marysville, Mont. Filed Feb. 27, 1892.

479,052. Electric-Wire Support. William D. Bragdon, Cumberland Mills, Me. Filed March 4, 1892.

479,062. Speaking Attachment for Telephones. Daniel Eldredge, Boston, Mass. Filed Feb. 26, 1892.



479,118—DYNAMO-ELECTRIC MACHINE.

479,101. Rheostat. John Waring, Manchester, Conn. Filed April 28, 1892.

479,107. Telephone-Switchboard. Wilhelm Oesterreich, Berlin, Germany, assignor to Mix & Genest, same place. Filed Aug. 7, 1889. Patented in Germany, in Austria-Hungary and in Italy.

479,118. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed Dec. 21, 1889.

479,121. Electric-Arc Lamp. William E. Irish, Chicago, Ill. Filed Jan. 2, 1892.

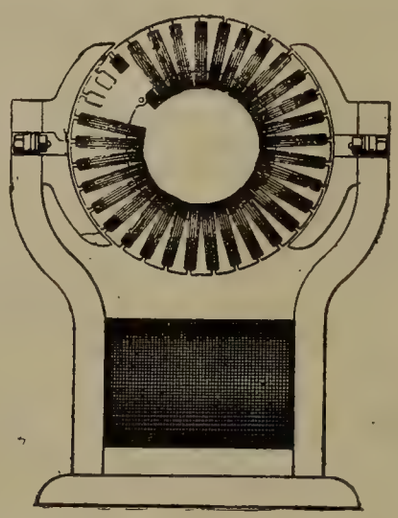
479,134. Insulator. Chauncey E. Conover, Cincinnati, Ohio. Filed Jan. 20, 1892.

479,138. Signal for Electric Railways. Frank F. Loomis, Akron, Ohio. Filed April 8, 1892.

479,147. Electric Belt. Duane P. Andrus, St. Louis, Mo. Filed Dec. 14, 1891.

479,167. Electrical Meter. Arthur E. Kennelly, Orange, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Oct. 17, 1891.

479,168. Electrical Meter for Three-Wire Systems. Arthur E. Kennelly and John F. Ott, Orange, N. J., assignors to the Edison General Electric Company, New York, N. Y. Filed Oct. 21, 1891.



479,169.—ELECTRO-MAGNETIC MACHINE.

479,169. Electro-Magnetic Machine. Arthur E. Kennelly and John F. Ott, Orange, N. J., assignors to the Edison General Electric Company, New York, N. Y. Filed Oct 21, 1891.

479,170. Compound-Wound Alternating-Current Dynamo. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Oct. 17, 1889.

479,171. Electric Meter. John F. Ott and Arthur E. Kennelly, Orange, N. J., assignors to the Edison General Electric Company, New York, N. Y. Filed Sept. 7, 1891.

THE
"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

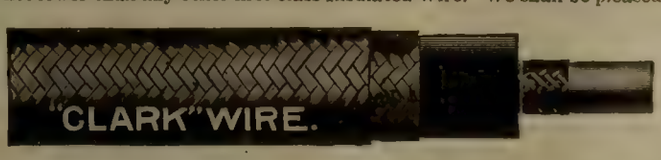
"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.





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61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

479,172. Electric-Current Meter. John F. Ott and Arthur E. Kennelly, Orange, N. J., assignors to the Edison General Electric Company, New York, N. Y. Filed Nov. 30, 1891.

479,178. Telegraphic Repeater. Roderick H. Weiny, New York, N. Y. Filed Feb. 8, 1892.

479,179. Armature for Dynamo-Electric Machines. Merle J. Wightman, Scranton, Pa. Filed Oct. 28, 1891.

479,183. Reflector for Arc Lights. Robert S. Dobbie, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed April 8, 1891.

479,184. Fac-Simile Telegraph. Thomas A. Edison, Menlo Park, N. J., and Patrick Kenny, New York, N. Y. Filed Dec. 6, 1881. Patented in England, in Belgium, in Canada, and in France.

479,187. Alternating-Current Motor. Thomas H. Hicks, Detroit, Mich., assignor of one-half to H. L. Obetz, same place. Filed March 9, 1891.

479,207. Shade for Incandescent Electric Lamps. William J. Edmond and Thomas J. Keon, Philadelphia, Pa. Filed Feb. 29, 1892.

479,216. Clamp for Electric Conductors. John Ingmanson and Rudolph Lorang, Chicago, Ill., assignors to said Lorang, John A. Ingmanson and Emil N. Ingmanson, all of same place. Filed July 13, 1891.

479,226. Telephone. George F. Shaver, Yonkers, N. Y., assignor of one-half to Stephen F. Sherman, New York, N. Y. Filed March 2, 1892.

479,227. Telephony. George F. Shaver, Yonkers, N. Y. Filed April 8, 1892.

479,282. Electric Alarm. Robert L. Keith, Brazil, Ind. Filed May 26, 1892.

479,308. Individual Alarm Signal Apparatus. Paul Seiler, San Francisco, Cal. Filed Aug. 1, 1891.

479,321. Electric Brush. Robert E. Williams, Dallas, Tex., assignor of two-thirds to Val. E. Winston, same place, and Drew Ferguson, Homer, La. Filed Jan. 2, 1892.

479,322. Connector for Electric Circuits. John F. Wollensak, Chicago, Ill. Filed April 26, 1892.

479,325. Connector for Electric Circuits. William E. Gill, Chicago, Ill., assignor to John F. Wollensak, same place. Filed April 26, 1892.

479,333. Electric Railway-Signal. Theodore A. B. Putnam, New York, N. Y., assignor to Ella Sarah Webster, same place. Filed April 15, 1889.

479,358. Electric Stop-Motion for Textile Machinery. Samuel L. Foster, Wilmington, Del., assignor to John T. Ahrens, same place. Filed July 29, 1891.

479,359. Incandescent Lamp Socket. Isaac Goldkind, New York, N. Y., assignor to Louis Stirn and Julius Somborn, same place. Filed Dec. 15, 1891.

479,360. Incandescent Electric Lamp. Henry Green, Hartford, Conn., assignor of one-half to F. C. Rockwell, same place. Filed Sept. 2, 1891.

BATTERY ZINCS

RODS AND PLATES FOR BATTERIES.

CROW FOOT ZINCS.

E. LAMARCHE'S SONS, 83 JOHN ST., N. Y.

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Indentical in Cost and Efficiency

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SIMPLER TO OPERATE.

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CHARLESTOWN, W. VA., June 18, 1892.

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136 LIBERTY STREET, NEW YORK.

GENTLEMEN: The central station plant, which you installed for us here, under your new patented 3-wire system, has given entire satisfaction ever since it started, which was about six months ago.

The operation of the plant is quite simple and economical, and as a result the plant is making very satisfactory earnings, although our town is rather small, having only about 3,000 inhabitants.

Yours very truly,
(Signed) CITY ELECTRIC LIGHT CO.,
WM. CAMPBELL, *Sec'y*

For bids for complete plants, or conductors only, address

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ELECTRIC FIRE HAZARDS.

Some interesting questions are asked by one of the officers of a prominent insurance company in this city with reference to the condition of old wiring for electric lighting and the possibility of rendering new perfectly safe. The gentleman asserts that fire underwriters are greatly disturbed by the increased fire loss, due, it is said, to the electrical hazard. He asks if old wiring is unsafe and likely to cause fires, and if it is possible to so wire a building that it will be perfectly safe, from the standpoint of the fire underwriter.

We submitted the questions to certain parties engaged in that line of business for their views, and one has so far replied. On another page will be found a statement of the facts and the reply referred to. They are full of interest, and will be of especial value to insurance and practical electrical men alike.

There is no doubt whatever that electric wiring can be accomplished in a manner that will render it free from all the elements of danger. The experience of years has brought about this desirable state of affairs.

One thing should be borne in mind, however; in order to avoid this element of danger the work of wiring should be done by a first-class workman, and none but the best of materials and appliances should be used. Electric wiring is a trade, and like any other trade cheap work and materials are available to those who are not over-particular as to results.

The one thing insurance companies can do to minimize the electric hazard is to insist that wiring shall be done in accordance with well-established rules. The course is plain enough. Electricity is no more dangerous than gas, when properly handled.

"HONOR TO WHOM HONOR IS DUE."

Mr. Allen R. Foote, special agent of the Eleventh Census, is again to the front with a suggestion that cannot help arousing deep interest and commanding the active co-operation of the electrical fraternity.

In these days of rapid expansion of electrical industries little thought is given to the pioneers and those who laid the foundations of the various branches of this vast business. Indeed, it may safely be said that comparatively few persons engaged in electrical pursuits know who are the inventors of many of the instruments and pieces of apparatus that they handle daily in the fulfilment of their duties.

Every instrument and every method had an origin. They represent the patient toil, skill and knowledge of many minds, and it is but fair to those who are entitled to the honor of being the inventors of the various devices that it should be accorded to them. But how shall it be done?

Mr. Foote suggests that in whatever publication of electrical invention and development shall be undertaken by the United States Census Office, official recognition be given to those justly entitled to the honor of having been the first to invent or to bring into practical commercial use the various electrical inventions and engineering methods that are marked features of the present condition of electrical science and art.

On another page will be found Mr. Foote's communication on this interesting subject, which, we think, should receive the earnest attention of all electrical people. Besides being a matter of justice to those who are entitled to the honors, the historical data thus acquired will be of extreme value to the practical electrician.

Mr. Foote not only makes the suggestion, but provides a way for carrying it into execution, and we see no reason why success should not attend his efforts.

THE CLAM-EATERS.

Those who had the good fortune to be present at the fourteenth annual clam-bake given by the American Electrical Works, Providence, R. I., to the electrical fraternity, on July 23 last, will at once recognize the view presented in the accompanying illustration.

As a rule it is not considered "good form" for gentlemen to be photographed in their shirt sleeves, but on this occasion circumstances justified a complete suspension of the rule. The main idea of the affair was to have a jolly good time, and how a good time can be had on a hot summer day without laying aside coats, vests, etc., is a problem that has not yet been solved.

The straw hats with expansive brims were supplied for the occasion, but only a few of the good-looking gentlemen in the crowd wore them at the moment the photo-



GROUP OF CLAM-EATERS AT CLAM-BAKE, HAUTE REIVE, JULY 23.

graph was taken, presumably to heighten the artistic effect and set their classical heads off to the best advantage.

The cherubim on the roof of the veranda are conspicuous features of the scene.

TURNS IN ARMATURES.

Armatures intended for low-resistance work, as for incandescent lighting or for electro-metallurgy, are usually constructed so that their own resistance is inappreciable. This is effected by making each section of the armature essentially in the form of a copper bar, the area of which occupies the whole of the space available for each section. But the substitution of solid copper conductors of large cross-section has been found to present, in practice, certain disadvantages. The practice of lamination must, in short, be carried even into the conductors themselves. They consist, therefore, of a number of copper ribbons, slightly insulated from each other. In many cases the strap copper is merely varnished. In the larger dynamos it is covered with a single layer of cotton.

In addition to the electrical advantages of lamination, there are certain mechanical advantages. It is more easy to manipulate conductors subdivided, and to wind or bend them to the required form. But armatures that are wire-wound in many turns may be converted into low-resistance armatures by the simple method of connecting the turns in multiple arc. Suppose a section having eight turns of wire. If it be desired to halve its resistance, that may be accomplished if the wires are connected across in four pairs. The resistance might be again halved by again cross-connecting the four pairs, having two turns only. To illustrate what is meant, suppose, in the first case, we were to solder a wire or short junction across the first two turns, these two would act as one turn only. Similarly with the next two turns, and so on. If a wire were soldered across, touching all the wires, bringing them electrically together, the whole of the turns would act as one turn only. Any junctions made in this way, in practice, must be very substantial, and the bridging wire must be of large cross-section. Many low-resistance armatures are cross-connected (wound in multiple arc), but it may be pointed out that the practice of dynamo-builders is decidedly in favor of economizing space by using, when possible, lightly separated copper strap. The desired end is thus secured without the waste of space inseparable from the employment of ordinary round insulated wire. In any case round wire is not so effective in a given space as square wire—a greater cross-section of the latter is easily obtained.

THE torrid weather during the past week has been particularly severe on street-car horses. It was a common sight to see the poor brutes drop dead in their tracks, delaying traffic on the line until their carcasses could be removed. Electricity never drops dead. The weather has no effect on it, and it is always ready for work.

NOTE ON SOME EXPERIMENTS WITH ALTERNATING CURRENTS.*

BY DR. LOUIS DUNCAN,
Assisted by Mr. E. R. Carichoff and Messrs. R. H. and G. E. Hutton.

The first real representation of an alternating-current curve was made by Joubert, who employed a contact-piece rotating with the armature of a dynamo, touching a fixed brush at a point of the revolution determined by the position of the brush with relation to the dynamo poles. He obtained a curve for current which was approximately a sine curve. Later, in 1888, Messrs. Wilkes, Hutchinson and myself modified the method to obtain the curves for E. M. F. and current in the primaries and secondaries of induction coils. This modification was used afterward at Cornell, where Professor Ryan and others made valuable experiments, and it has been more or less generally employed. The principal difficulties lie in the fact that with a single commutating arrangement but one curve can be taken at a time, and as an experiment involving four curves takes something like 45 minutes, the condition may seriously change; while the whole voltage of the dynamo is at times on the commutator. It is at best rather a tedious method. In our work referred to above, and in the work at Cornell, E. M. F.'s were measured by an electrometer, and currents were obtained by getting potential differences at the terminals of a non-inductive resistance through which the current passed. Lately, in France, two commutating arrangements have been used to give two curves at once, with a condenser charged through the contact and discharged through a d'Arsonval galvanometer.

By the method which I described last fall, any number of curves may be obtained simultaneously, with only a few volts on the commutator and with a rapidity and accuracy much greater than by the other methods. Briefly, a number of dynamometers are used equal to the number of simultaneous curves to be obtained. These dynamometers are very cheap and convenient. The first ones used were made by Mr. Carichoff and myself, and were quite satisfactory, but experience having suggested some improvement, and our time being fully occupied, Messrs. E. S. Ritchie & Sons made four of them. I will describe them more minutely below.

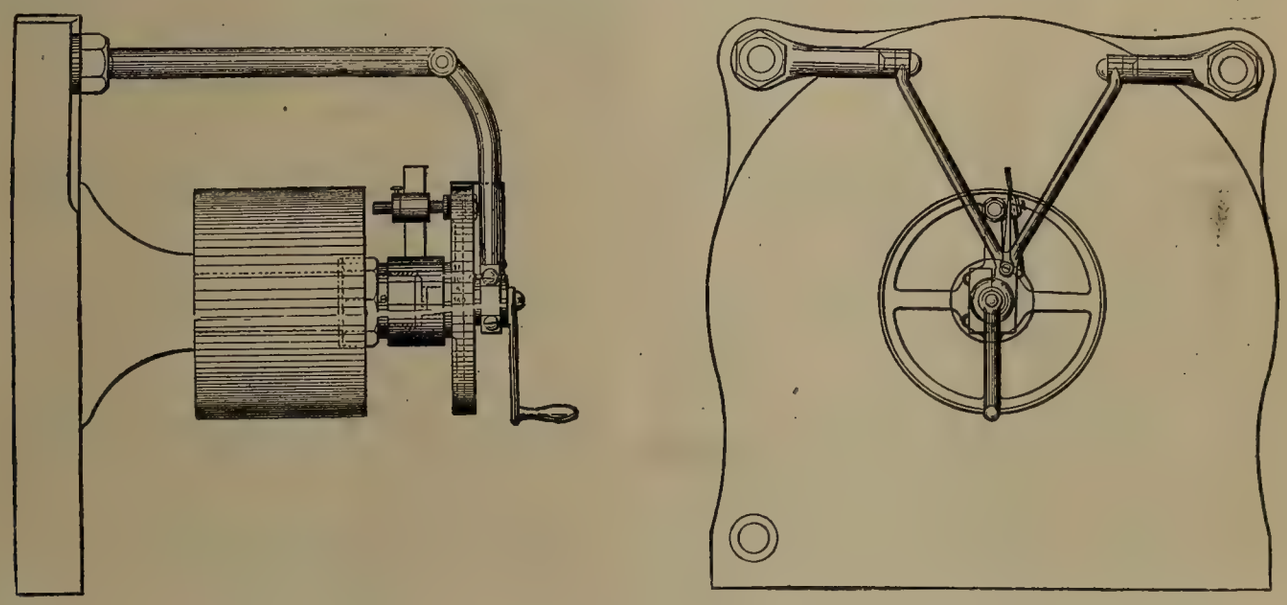


FIG. 1.

The four dynamometers have their stationary coils wound for, say, primary current, primary E. M. F., secondary current and secondary E. M. F. The movable coils are wound with fine wire, and are all connected in series. The E. M. F. instruments are made exceedingly sensitive so their self-induction may be made a minimum, and in series with them is placed a large non-inductive resistance, the relation of the self-induction and resistance being made such that the former may be neglected. The circuit of the movable coils is through a battery of a few storage cells to a brush which may be moved by hand through the arc of a circle, and which touches a contact-piece on the dynamo-shaft once every revolution. The other end of the circuit being joined by a sliding connection with the contact-piece, the circuit is closed through the cells and coils for a short period once every revolution. The instant of closing this circuit is determined by the position of the movable brush with respect to the dynamo poles. Now suppose an alternating current is sent through the stationary coil of one of the dynamometers. If an instantaneous current be sent through the movable coil, an impulse will be given it dependent on the value of its current and on the instantaneous value of the current in the stationary coil; as the period of the coil is great compared with the period of the dynamo, we will get a steady deflection dependent on this product. If now we move our contact-brush, the instantaneous current will pass at some other point on the alternating-current wave, and our deflection will be proportional to the value of the current at this point; by moving the brush through an angle corresponding to a complete wave we can plot the wave exactly, providing we have properly calibrated our dynamometer.

It is apparent that in order to attain accuracy our instantaneous current must be very brief and very steady, and its value must be the same in actual work as in calibrating. A d'Arsonval galvanometer in the circuit allows us to judge the two last points, and we found that when a high resistance was used in the circuit so that any variation in the contact resistance was eliminated, almost absolute steadiness was obtained. It was also assured by using a condenser charged during part of the revolution and then discharged by the contact-brush through the circuit. To give an idea of the current in this circuit, an ordinary arrangement, when the condenser was not used, was 12 volts through 1000 ohms, and it must be remembered that this current only passes an exceedingly small part of the time.

* Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 1892.

Dynamometers.—The dynamometers were made of wood, mounted on a revolving base, so they could be adjusted with respect to the meridian. It will be seen on looking at the picture that one side is made removable to facilitate adjustments. The fixed coils are wound in two cylinders which move in and out through holes in the sides, and whose distance apart is adjusted when the instrument is calibrated, so the scale divisions read

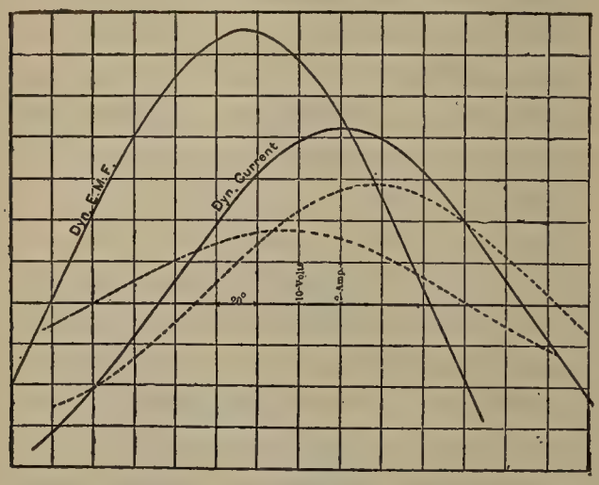


FIG. 2.—TESLA FAN-MOTOR. PERIOD $\frac{1}{160}$.

directly in volts or ampères, or fractions of them. The movable coil is suspended by a silk fibre, which gives it no directive force, but which sustains it. Directive force is given the coil and current is introduced to it through two palladium hair-springs which are fastened to stiff brass wires, which serve as the axis of the coil. A vane in a beaker filled with glycerine damps the swinging and makes the instrument absolutely aperiodic. I have rarely used instruments which give more satisfactory results; the zero is invariable, readings may be taken with great ease and rapidity, while a reversal of the current gives equal readings on the two sides of the zero. To show the rapidity of the readings, six curves, representing different quantities in a step-up-and-down transmission, were taken in a little over five minutes, and in this case two instruments were used for four curves—those at the sending and receiving ends of the plant—and therefore had to be switched from one side to the other at every reading. Twenty points were usually taken for each wave. The curves could, of course, be photographed instead of observed, but the latter is so much simpler and more satisfactory that—especially in a lab-

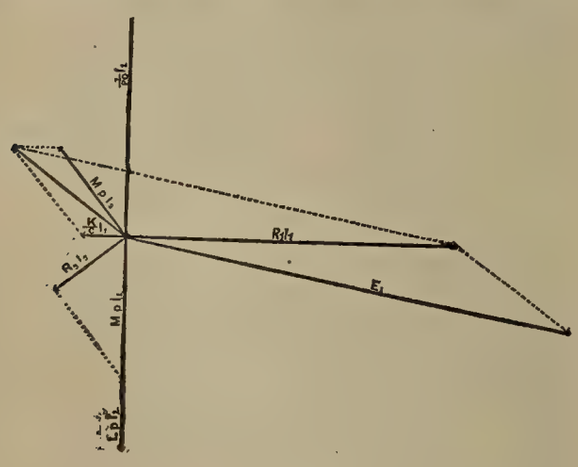


FIG. 4.

oratory where there are plenty of observers—I much prefer it.

Contact Arrangement.—This is shown in Fig. 1. As it comes outside of the belt, and as it was often necessary to remove the latter, the swinging arrangement shown was designed and constructed by the Messrs. Hutton. On the shaft was a hard-rubber cylinder with the brass contact almost flush with its surface. The whole arrangement worked admirably. The results of our work will have to be another story. I will simply give a few to illustrate the method.

We have a small Tesla fan-motor intended to work on an ordinary incandescent circuit. There are eight poles, the alternate ones having their windings in different circuits—one set of poles having a few turns of coarse wire, the others having a greater number of fine wire turns. The curves in Fig. 2 show the condition of affairs when the motor was working; in Fig. 3 where the armature was held. In the second case the energy represented corresponds, of course, only to the losses. It seems to be the general impression, by the way, that a rotating field-motor starts up with the same torque as a corresponding continuous-current machine. I have shown, however, that a two-phase motor corresponds exactly to a converter—or rather two converters—in which the secondary has an outside resistance of $\frac{p^1}{p-p^1}$, where p^1 is the angular velocity of the armature and p that of the field. When p^1 is 0—that is, when the motor is at rest—it will be seen that the current is in the worst possible condition for starting and the torque for a given current is small. It is like starting a continuous-current motor with the brushes almost ninety degrees from the proper position.

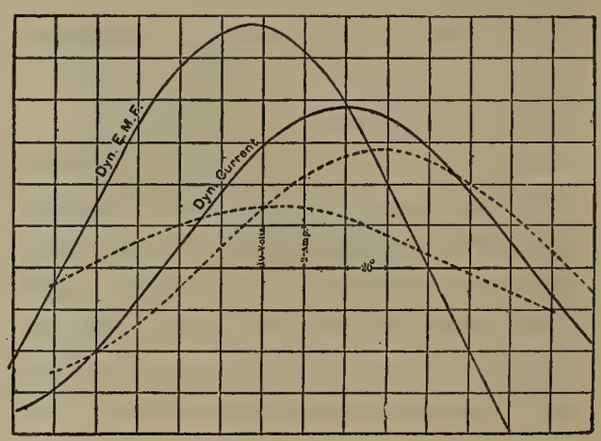


FIG. 3.—TESLA FAN MOTOR—HELD. PERIOD $\frac{1}{160}$ SECOND

But most of our work has been with circuits in which both self-induction and capacity have been introduced. It is a well-known fact that circuits carrying alternating currents may be given the same period of vibration as the current, or to put it another way, circuits may be so arranged that with currents of a given period the sum of the energies stored up in the circuit and given out by it is zero. With a condenser and self-induction properly adjusted, if energy from the current is being stored up in the condenser an equal quantity is being given to the current by virtue of the self-induction; that is, we can neutralize our self-induction by a capacity. I can hardly think of any fact more likely to play an important part in the future of alternating-current work. For instance, if a circuit has in it a periodic current consisting of a number of sine curves of different periods—one-third, one-fifth, one-seventh, etc., the period of the fundamental wave; then if we put in inductive relation to this circuit another circuit whose period is, say, one-third that of the fundamental wave, this current will pick out the one-third period waves in the primary.

An ordinary sine curve E. M. F. may be made to give a periodic-current wave with these higher harmonics in several ways—by having in the circuit a self-induction coil whose iron core is saturated when the current nears

a maximum, or by using the same coil with a capacity which neutralizes one of the value of the varying self-induction; so we can produce these higher harmonics and we can pick them out. But it is a complex subject not to be treated here. In all such experiments, however, there are several points which must be carefully attended to, or there will be very unsatisfactory results. If the iron core of the induction coil—provided such a core is used—is not properly laminated and annealed, or if there are considerable losses in the condenser, the results will be disappointing. Take the case, for example, where there are eddy currents in the core and there is loss in the condenser. The first effect corresponds to a short-circuited secondary near the coil; the loss in the dielectric of the condenser means that energy is taken from the current, and this energy must be represented by the product of the current into the E. M. F., e corresponding to the transfer of energy, or it is $e.\ i.$ The value of e is a maximum when the displacement is greatest—that is, when the current is greatest, and for a given current and dielectric varies as $\frac{1}{c}$. If we represent these effects by a revolving diagram as is ordinarily done, and suppose we have neutralized the self-induction by a capacity, we get something like the figure [Fig. 4]. The result is that the relation between R. I. and E., instead of being 1 to 1, as would be the case were there no disturbing causes, is 1 to 1+; that is, for a given E. M. F. the current is less than it should be, and a glance at the figure will show that it is thrown ahead of the E. M. F. No possible change in our self-induction and capacity can remedy this decrease in the current, although we may, of course, make the phase angle zero if we wish.

LOCAL THUNDER-STORMS—LARROQUE'S EXPERIMENT.*

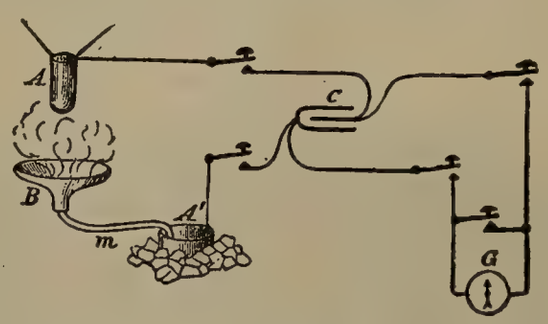
The origin of local thunder-storms in summer may be thus explained: In any region strongly heated by the sun's rays there arises an active evaporation, and in consequence a strong ascending current of air saturated with watery vapor. On entering the higher and colder regions of the atmosphere the watery vapor is condensed, and the heat thus liberated accelerates the upward current. The small drops are rapidly borne upward to a considerable height, and as a result of friction become charged with positive electricity, while the surroundings are negatively electric. The ascent of the water-drops continues until their weight is sufficient to overcome the pressure of the ascending current of air.

As this process is continuous for long periods, the frequently great number of lightning discharges is not to be wondered at. It may also be remarked that Hoppe's hypothesis, that the planting of forests would tend to moderate electric conditions, is borne out by Bezold's observations, that deforested or swampy lands are most favorable to the generation of electric disturbances. In the first place, the forest shelters the floor from the sun's rays, arrests the evaporation due to a heated surface, and, consequently, the formation of ascending currents of vapor-laden air, which are precisely the phenomena which the conditions of deforested or swampy lands are designed to promote.

A reconciliation between the respective followers of the evaporation and frictional theories has been effected by Firmin Larroque through his recently published experiments. He points out that, in order to trace atmospheric electricity to its source, it is useless to speculate on whether it would be generated by the evaporation of pure distilled water carefully guarded from friction. There is nothing like this in nature to investigate; our proper course is rather to study evaporation under the conditions most nearly resembling those which attend the process of evaporation in nature.

In so far as concerns the surface of the dry land, the surface water penetrates to a greater or less extent into the subsoil strata. Similarly the strata are penetrated by the warmth of the sun's rays. It follows, then, that in notably damp earth vapor is formed, not merely at the earth's surface, but also at greater or less depths below it, and cannot escape into the air until after its passage through strata of prescribed thickness. One need hardly remark that in this way the vapor has abundant opportunity for friction. And here two possibilities have to be kept in mind: (1) The evaporation of water follows as a simple consequence of a pure mechanical separation of the water from neutral earthy substances; or (2), of a separation of the water from chemical combinations. It is consequently a matter for experiment whether the vapor thus evolved is electric or not.

Larroque's experimental appliances are illustrated in the accompanying figure. A is an insulated pendant platina vessel filled with ice or water at 1 or 2° Cent. B represents an insulated glass evaporating vessel. The



LARROQUE'S EXPERIMENTAL APPARATUS.

heating of this pan, usually to 30° Cent., is provided for by any source of heat the rays of which are thrown by a reflector on B. This pan is provided below with a sort of pipe attachment through which, by means of a cork, the cotton wick m is introduced. Inside the pan, the wick end is drawn up, while the other end extends to the platina vessel A' which is kept cool by ice or cold water, whichever is employed in A. The wick m is saturated with pure distilled water, of which a few drops are conveyed to the vessel A' to maintain the continuity of the circuit. A and A' are respectively provided with keyed wire connections leading to the condenser C. The condenser attachments, on the other hand, are attached to the supports of a galvanometer G. By this arrangement there is no need to fear that the experiment will be influenced by any deposition of water from the surrounding atmosphere, for this vapor would be precipitated at A under precisely the same conditions as at A'; hence A and A' would at the most be laden with electricity of equal power. The condenser C would receive a like current of electricity from both, and, in consequence, as is well known, could not be charged. Instead, vapor would be first disengaged from the pan B, after which the condenser could be charged with electricity.

The first series of investigations on these lines were confined to evaporation from mechanical admixtures. To this end the pan B was filled with neutral substances, such as powdered brick, glass, broken marble, granite, sand, etc., saturated with distilled water. Only brick and granite gave positive results. With these the galvanometer indicated from 1 to 2 millimeters, and rendered the condensed vapor recognizable as positively electric. The indication of the galvanometer, in fact, increased to 5 millimeters when the moist brick mass in pan B was heated to 60°.

* Der Stein der Weisen, Vienna.

Still more decisive results were secured by the evaporation of water from chemical combinations. For example, the employment of common, in the place of the distilled water, and heating to 30°, caused the galvanometer to indicate 6 millimeters. If sea water was employed, the condenser was so strongly charged that it was not safe to discharge it in full force through the galvanometer without interrupting the observation. The charge was, therefore, reduced one-half by the interpolation of a subsidiary condenser. Nevertheless, Larroque obtained discharges up to 37 millimeters. The electricity of the condensed vapor showed itself positive. In fact, the watery vapor separated from almost all earthy substances, showed itself positive. Mixed sands and clays gave the best results. The galvanometer indicated from 15 to 39 millimeters without any weakening of the condenser charge.

Larroque, therefore, holds it demonstrated by these experiments that water liberated by evaporation from chemical combinations is electric; that water evaporated from the ocean is equally electric, and that the vapors from this source are, ordinarily, positively electric.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Candle-Power.

THE illuminating power of electric lamps, both arc and incandescent, is measured by comparison with a recognized standard. In other words, the light is measured so that we know with a given lamp we can depend upon a definite amount of light with a definite value of current.

If electric lamps were not rated as to their power of illumination the consumer might be required to pay for more light than he was getting; or it might happen, in rare instances, that he was getting more than he paid for. Therefore in justice, both to the producer and consumer of electricity for lighting purposes, the lamps are rated by their illuminating power, just as cloth is measured by the yard. The standard of illumination is the "candle." But candles are made in all sizes and shapes and of many kinds of material, so there must necessarily be a standard candle.

The definition of the standard candle given in Prof. Houston's new "Dictionary of Electrical Words, Terms and Phrases,"* is that it is "a candle of definite composition which, with a given consumption in a given time, will produce a light of a fixed and definite brightness."

Now what is the practical standard? The practical standard candle is that which burns 120 grains of spermaceti wax per hour, or 2 grains per minute. When we have a candle that will burn that much wax in the time given we have a standard candle.

Standard candles can be purchased. They vary slightly in size with different makers, ranging from 8¼ to 9 inches in length, measured from the shoulder, where the diameter is about .8 inch, the diameter at the bottom increasing to .85 or .9 inch.

Standard candles are greatly affected by slight differences of treatment and composition. A candle which gives a certain amount of light under certain conditions may give widely different results under slightly changed conditions. An absolute standard therefore does not yet exist. The French standard is more reliable and nearer to being absolute than that used by the English and American lamp-makers.

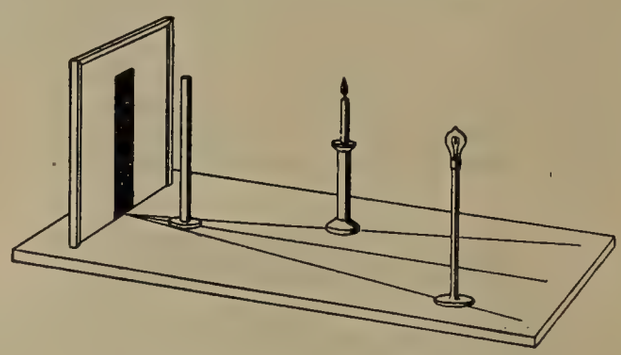
The determination of the candle-power of lamps, however, is the question that concerns us more at the moment than the standard candle itself, although the latter is essential to get at the result.

The instrument used to measure the candle-power of an electric lamp, or any other source of light, is known as a "photometer." The word "photometer" means light meter, or an instrument to measure light.

There are various forms of photometers in use, but they are all based on the fundamental law that the intensity of illumination on a given surface varies inversely as the square of its distance from the source of light; and upon the fact that the distances of two independent sources of light can be so adjusted that their illumination of the given surface is equal.

The instrument that is most frequently employed for the determination of light values is the Bunsen photometer. This apparatus is often called the "grease spot" photometer, because a spot of grease is employed in the manner described further on.

The Bunsen instrument is very simple and gives accurate results. A screen of paper, with a spot of grease at the centre, is stretched on a metallic ring which is mounted on a stand, movable along a graduated scale on the top of the stand.



RUMFORD, OR "SHADOW" PHOTOMETER.

These constitute the apparatus. Now to measure light the standard candle is placed at one end of the scale and the lamp to be measured is placed at the other. The height of the two lights should correspond with that of the grease spot.

When the paper screen is moved along the scale it will reach a point when the grease spot becomes invisible, and the whole of the screen appears to be uniformly illuminated. When the grease spot apparently disappears it is because the intensity of both lights is the same at that particular point, and by ascertaining on the scale the relative distances of the lights from the screen, their luminosities is easily calculated by squaring these distances.

Another form of photometer is the Rumford or "shadow" photometer. The accompanying figure will give an idea of this apparatus. It consists of an upright ground-glass screen, having fixed in front of it a small vertical rod.

The standard lamp is placed at such a distance from the rod as to project a shadow on the screen, and the lamp to be measured is placed in a position so that it will cast a second shadow of the rod on the screen. By moving the lamp which we are measuring along the base line until the shadow cast by it on the screen equals in intensity that produced by the standard lamp, and by measuring the distances of both lights from the screen, we can arrive at the value of the light of the lamp by the application of the law of inverse squares.

For example, suppose the distance of the standard light from the screen to be 12 inches, and that of the lamp being measured, when the two shadows are equal,

* Price, $5. For sale by the Electrical Age Publishing Co., New York.

3 feet, then according to the rule the lumonisity would be as 1 is to 9—in other words the electric lamp would have an illuminating power of 9 candles. If the lamp were 4 feet away from the screen, it would be of 16 candle-power, and so on.

Practical photometers are made in a variety of forms, but all are based on the laws already referred to. The differences relate entirely to methods of construction and facility of arriving at results.

TRANSMISSION OF POWER.

A new method of transmitting power from engines to electric generators has recently been introduced by A. L. Ide & Son, of Springfield, Ill., the well-known builders of the "Ideal" engines.

The apparatus is extremely simple, and will be particularly valuable in situations where space is limited, although it is of advantage wherever a belt is used for power transmission.

The feature consists of a pulley supported by a stud which is secured to the engine base. It is so simple that it hardly requires any explanation.

The accompanying illustrations show the application of the device, Figure 1 showing an end view of an Ide

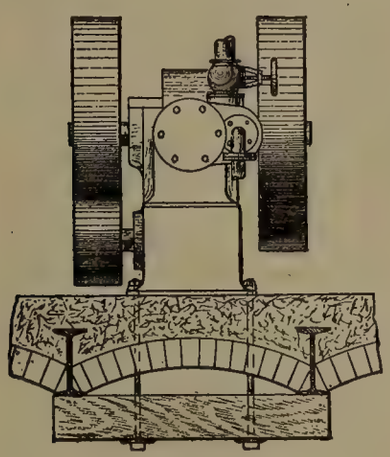


FIG. 1.

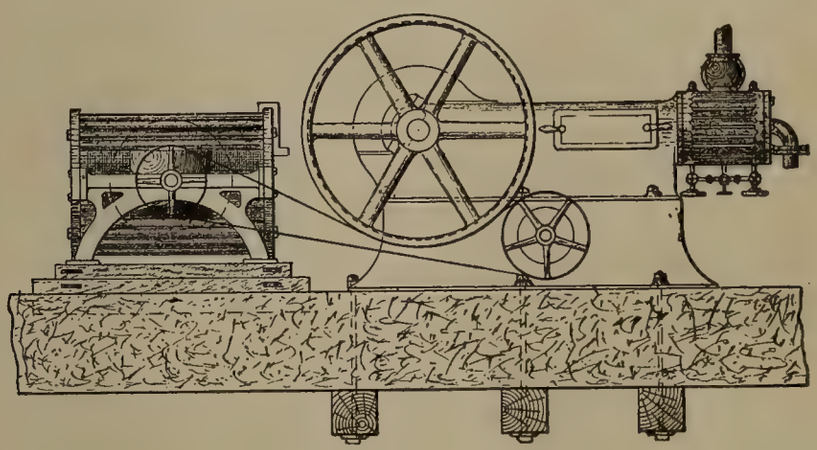


FIG. 2.

engine, with a pulley underneath one fly-wheel, and Figure 2 a longitudinal view of the same, with a dynamo connected.

If desired two generators or dynamos may be run from one engine by placing a pulley on each side, and in case it is necessary to operate but one generator the other can be stopped by sliding it on its base so as to cause the belt to slacken sufficiently. In this way either machine may be stopped or started without interfering with the other.

A 35 H. P. "Ideal" engine with this transmitting apparatus and a Thomson-Houston 250 incandescent-light dynamo have recently been installed in the brewery of the Keeley Brewing Company, Chicago. The engine is placed on the floor, and has no other means of support, yet it runs so noiselessly that there is an entire absence of vibration of the floor or building.

ELECTRIC RAILWAYS IN MONTREAL.

The Royal Electric Company, of Montreal, has secured through Mr. C. W. Hagar an order to equip 80 cars with motors for the Montreal Passenger Railway. Twenty of the motors are to be ready by August 15 next. They will be of 25 H. P. each. The American Electrical Works secured the contract through Mr. John Carroll, of the Montreal factory, to put in all the trolley and feeder wire.

NON-MAGNETIZABLE STEEL.

It is interesting to notice that specimens of steel have been made containing 12 per cent. of manganese, which it has been found practically impossible to magnetize even under the influence of a very powerful field. Probably the magnetic reluctance, molecular rigidity, magnetic inertia, or whatever else we may choose to call that property of steel which our forefathers knew as coercive force, is so great that to overcome it is impossible. Similar results follow when the proportion of carbon, phosphorus, sulphur, etc., mixed with the iron, exceeds a certain small limit, while the admixture of even the smallest percentage of antimony suffices, it is alleged, to destroy all trace of magnetic properties. There should certainly be a large field of practical utility open to the economical manufacture of unmagnetizable iron. For example, the bed-plates of dynamos are sometimes—and used to be more extensively than now—separated from the field-magnets by huge slabs of zinc, because otherwise they would form what may be called a magnetic short circuit between the poles of the field-magnets. Zinc is mechanically much weaker than iron, and this, added to its very much higher price, renders its use highly objectionable. To avoid the difficulty dynamos are rarely designed now with their pole-pieces downwards, but are turned about so that the bed-plate is connected to the yokes or magnetically neutral portions of the field-magnets. Under such circumstances only a very few of the lines are wasted by passing through the bed-plates.

IMPORTANT DECISION.

A decision of great importance was recently rendered by the United States Circuit Court of Appeals in the case of the Brush Electric Company *et al. vs.* the San José Improvement Company.

A motion to be dismissed from the action as a co-plaintiff made by the Brush company on the ground that the California company had no right without the consent of the owners of the patent to use its name in the suit was denied by the lower court.

An appeal was made from this order by the Brush Company. The California company then moved to dismiss the appeal, and this motion was elaborately argued by counsel for both sides. The court in deciding in favor of the Brush company filed a lengthy opinion, in which it was held that such an order was a final order or decree upon the merits of a collateral issue between the co-plaintiffs, and was, under the Act creating the Circuit Court of Appeals, a final decision of the particular controversy, and therefore appealable. All of the judges concurred in the decision.

AUTHORITATIVE CREDIT AND DATES FOR PRINCIPAL ELECTRICAL INVENTIONS AND ENGINEERING METHODS.

EDITOR ELECTRICAL AGE: It seems to me desirable that whatever publication may be made by the United States Census Office, pertaining to electrical invention and development, shall, whenever practicable, give official recognition to those justly entitled to the honor of having been the first to invent or to bring into practical commercial use the various electrical inventions and engineering methods that are marked features of the present condition of electrical science and art. This is due to those entitled to the credit, as the judgment of their contemporaries. It is due to our successors, who are entitled to correct records made for the present date. It is due to the enterprise and skill of the American people, who need no greater praise than proper historical statements of their achievements in peace or in war.

That it may be demonstrated whether or not this idea can be practically carried out at the present time, I desire to invite through your journal persons having knowledge of the subjects to advise me, giving full name and date, who first invented or used commercially in America continuous-current, constant-voltage and variable-ampèreage dynamos, lamps and motors; continuous-current, variable-voltage and constant-ampèreage; dynamos, lamps and motors; alternating-current, constant-voltage and variable-ampèreage dynamos, lamps and motors; and alternating-current, variable-voltage and constant-ampèreage dynamos, lamps and motors; also trolley contacts, single or double.

In addition to this information, similar credit and dates for the following engineering methods would be of great present interest and of increasing value, following which should be a description of the first isolated and general station plants and electric railroad:

BY WHOM AND DATE WHEN FIRST COMMERCIAL USE WAS MADE IN UNITED STATES OF:

INCANDESCENT LAMPS.—Operated by continuous currents, operated by alternating currents, wired in multiple, wired in series, wired to converters, wired to accumulators, wired on arc-lamp circuits, wired on power circuits.

ARC LAMPS, SINGLE CARBON.—Operated by continuous currents, operated by alternating currents, wired in multiple, wired in series, wired to converters, wired to accumulators, wired on incandescent-lamp circuits, wired on power circuits.

ARC LAMPS, DOUBLE CARBON.—Operated by continuous currents, operated by alternating currents, wired in multiple, wired in series, wired to converters, wired to accumulators, wired on incandescent-lamp circuits, wired on power circuits.

STATIONARY MOTORS.—Operated by continuous currents, operated by alternating currents, wired in multiple, wired in series, wired to converters, wired to accumulators, wired on incandescent-lamp circuits, wired on arc-lamp circuits, wired on power circuits.

ELECTRIC LOCOMOTIVES.—Operated by continuous currents, operated by alternating currents, wired in multiple, wired in series, wired to converters, wired to accumulators, wired on incandescent-lamp circuits, wired on arc-lamp circuits, wired on power circuits.

CONVERTERS.—Used for incandescent lighting, used for arc lighting, used for stationary power, used for locomotive power.

ACCUMULATORS.—Used for incandescent lighting, used for arc lighting, used for stationary power, used for locomotive power.

I shall be glad to receive suggestions pertaining to this subject from those who have given it thought or are interested in it.

Respectfully, ALLEN R. FOOTE,
Special Agent, Eleventh Census.

DESCRIPTION OF THE RAILROAD SIGNAL OF THE FUTURE.

BY R. J. SHEEHY.

In order that trains may safely and practically run at speeds of 100 or more miles per hour, the signalling arrangements on the roads would have to be as near perfect as they could be made, and kept in proper order at all times. The only persons connected with railroads who require to see the signals and for whose guidance they are erected are the locomotive engineers, and therefore the proper place for the signals is where they can be seen by them at all times, whether by day or by night, and this place is in the engine cab, and nowhere else. When the signalling devices are placed in the cab there will be no excuse for their not being seen, but where they are at present placed, namely, along the sides of the tracks, the engineers should not be held responsible for not seeing them. There are at times conditions of weather that wholly obscure them from view; this even occurs in day time, but more generally at night, and in tunnels they seem to be almost useless.

The writer many years ago recognized this fact, and set about devising an automatic system of signalling that would unerringly indicate to the engineers in the cabs of the engines the condition of the road ahead of them, whether the obstruction is that of a train on the section ahead, a misplaced switch, broken rail, or an open drawbridge. These are the four essential elements of danger, to be visually and audibly indicated to the engineers, and may be divided into two classes, namely, first, condition of the track on the section ahead, and second, obstructions, which may be a moving train or standing cars. Each class is indicated so that the engineers can instantly tell the nature of the danger ahead.

Two signals are provided to do this, the one goes to danger for a broken rail or a misplaced switch, the other goes to danger for a train or car on the section. In the latter case the engineer waits until the section shows clear before going on to it; in the former case he moves up on the section slowly and looks for the break, misplaced switch, or open draws, having no care for the train approaching from the rear, the engineer of which is automatically notified of the position of the train ahead, and comes to a stop before reaching the section, and remains there until the section is cleared.

To accomplish this but few changes are needed on existing roads. The tracks are divided into sections of any desired length, each section being electrically independent of the others—that is, insulated by wood fibre or other insulating material, the rails on the sections being connected at the ends by metal contacts so that they become one continuous conductor for the entire length of the section. At the further ends of each section the two rails are connected together through a suitable resistance coil, which coil is properly encased in a water-tight vessel permanently imbedded in the ground. Attached to the other ends of the rails of each section are contact-plates (preferably of L shaped iron to permit of their ready fastening to the cross-ties), and of a height to be a trifle above the track rails. These plates or bars may be placed a few inches from the rails on either the inside or on the outside of the track as may be desired, and extend back parallel with the track rails of the preceding section, say 3,000 feet, which distance is deemed to be sufficient to enable all trains to be stopped before reaching the ends of the sections they are on. Now, each section of the track beginning with the contact-plates at their forward end would give a metallic conductor or loop of 16,560 feet, exclusive of the resistance coils, which may in themselves be 1,000 or 2,000 feet of small conductor, having a resistance of one or two hundred times that of the section of rails and contact-plates mentioned. To illustrate, allow that we have in the 16,560 feet of rails, plates, etc.,

mentioned a resistance of 5 ohms, there would be in the loop with the resistance coil 500 or 1,000 ohms.

The appliances on the locomotive consist of, first, a battery—primary, secondary, or a dynamo machine—to produce the currents required to operate the signals; second, the contact strips or trolley wheels secured to the frame for making contact with the extension strips or plates named; third, the two arrangements of visual and audible signals in the cab of the engine, all being under the supervision of the engineer, who being familiarized with the working of the apparatus can keep the same in proper order. This he will do, because it is, as it were, his pilot, the thing through whose invisible force he is warned of dangers ahead, and this in an unerring manner becomes not only his friend, but the friend of the company in whose employ he is, as well as the friend of all of those on the train that his locomotive is drawing.

The action of this system is as follows: The trailing or trolley wheels attached to the frame of the locomotive are hinged thereto, insulated from the frames, and pressed down by powerful springs. Under these contact arms are placed stops, also insulated from the frame and having between them an artificial resistance equivalent to the section of the track including the resistance coils placed at the forward ends, or in, as it were, the bight of the loop. These contact arms when resting on their stops are connected through the two signalling devices in the cab with the battery or current-producing appliance, forming a complete metallic circuit, having a resistance, as stated, equivalent to the section of the track named. Thus, when the said contact arms are in contact with their stops the current flows through a resistance equal to that of the track section; and, the train in its motion forward, reaching the ends of the subsidiary rails or plates, the contact arms come in contact with them and are raised from their normal stops, substituting the track section for the artificial resistance carried on the engine, which both being the same no change takes place in the signalling devices. Should, however, a rail be broken, a switch misplaced, or a drawbridge be open, the circuit of that section would be broken, and there being no metallic circuit for the current to flow through the "incomplete track" signal would drop and show to the engineer that he must stop. If on the other hand a moving train or a car stood on the section ahead, the resistance spoken of at the forward end of the section would be cut out, and we would have what is called a short circuit. This would result in an excess of current through the signal devices and cause the obstruction signal to be shown, the engineer being thereby, as it were, told that a train was on the track ahead, in which case his duty would be to stop on the section he was on and remain there until the signal notified him that the section ahead was clear.

With this system there would be no necessity of sending a flagman back to flag a train approaching from the rear, because the fact of his train being on the section or block, gives the danger signal to the approaching train, and so on for the entire length of the road.

The sections or blocks can be arranged of any length desired on that portion of the road close to cities, and on curves they can be short, but on that part of a road running through unsettled portions of the country they can be a mile or more in length. The rail or track connections being but little more expensive for short sections or blocks than for long ones, justifies the sections being made of any length to suit the condition of traffic on all parts of the road. The length of the extensions of the rails is put at 3,000 feet from the end of the section, but this length would only be needed for very fast trains, or on down grades. They should be, however, of sufficient length to insure the signal being given to the engineer in time to enable him to stop the train before entering the section ahead.

A very important feature of this method of signalling is one that commends it from the standpoint of first cost to the railroads, in that the number of locomotives running over the road determines the number of signals to be employed. For instance, if a railroad has but 50 locomotives, they have but 50 signalling appliances for the entire road, no matter what its length may be. Supposing that the railroad is double tracked, 200 miles in length, and that the present style of signals are placed at every mile of the road, not including switches, there would be for the two tracks two hundred semaphores or signals against 50 on the automatic system described. Therefore, it will be seen that the automatic system, aside from its extraordinary features of advantage, would be cheaper to install. In the case of a three or four track road, its advantages are much greater than for a double-track road, on account of the difficulty and expense of arranging ordinary signals for the inner track.

With this automatic signalling system the current-producing devices, gongs, semaphores and lamps are placed on the engine. The currents can be obtained from secondary batteries or from a small dynamo placed on the engine, but until electric brakes are generally employed on trains the battery would be entirely satisfactory, as it would relieve the engineers of the care of small engines and generators. These batteries could be charged while the engines are in the round-house, from a small generating plant.

In addition to giving the signals in or on the engine, an alarm could be sounded at all grade crossings, giving notice of the approach of the train by simply connecting the alarm apparatus into the rail circuit; or a separate subsidiary rail could be employed for this purpose, taking current from the battery on the locomotive.

The two rails of the track are spoken of as having subsidiary extensions back from their ends, but this was mentioned to make the description more clear. In practice, however, but one rail needs to be divided into the desired length of sections or blocks, and provided with the extension named, the other rail being continuous the entire length of the road, thus lessening the first cost very much without impairing the efficiency in the least.

Means are also provided to enable the engineers of two trains on adjoining sections or blocks to communicate with each other, so that the train ahead being obliged from any cause to back at the same time that there is a train on the block behind, the engineer of the former can give notice to the one in the rear that he is backing. There would be times when this is desirable. As this feature is not deemed essential to the signalling proper, it is not necessary to go into a description of its special arrangements; to apply it, however, requires but little additional appliance.

THE LAW OF INCORPORATED COMPANIES.

We have received from Mr. Allen R. Foote advance sheets of his new book on the subject of "Economic Legislation of all the States, or the Law of Incorporated Companies operating under Municipal Franchises."

The title of this book shows at once the important and valuable character of the work.

The book gives the law of incorporated companies operating under municipal franchises as it is found written in the constitutions, the enactments of legislatures and the court decisions of the several States and Territories, and the decisions of the Circuit Courts and the Supreme Court of the United States. The companies to which the book relates are such as illuminating gas companies, fuel gas companies, electric central station companies, telephone companies, street-railway companies, water companies, etc.

The book begins with an exhaustive discussion of the

economic principles involved in the operation, control and service of such companies, and contains over 500 references to constitutional provisions, over 4,500 references to statutes, and over 2,500 references to decisions of the courts.

Mr. Charles E. Everett is editing attorney of the work, and a resident attorney has been appointed in each State who will act as co-editor.

From these few points it is evident that the work will be of inestimable value to corporations. Mr. Foote's chief object is to show how the interests of the users of the services referred to are affected by economic legislation, with the view of causing them to demand such changes as will cause all laws to conform to the requirements of sound economic principles.

Mr. Foote is too well known among the electrical fraternity to require any special attention from us. He is the author of "Economic Value of Electric Light and Power," which was issued a few years ago, and possesses the entire confidence of the electrical trade at large. He is meeting with most satisfactory encouragement and success with his new book.

FIRE HAZARDS FROM ELECTRIC WIRES.

We recently received a communication from an officer of a prominent fire insurance company in this city, in which that gentleman states that "fire underwriters are greatly disturbed by the increased fire loss, due, as is held by many, to the electrical hazard," and suggested that, for the benefit of insurance people, we give special attention in our columns to the following points:

"1. Is all, or nearly all, of the old wiring unsafe and likely to cause fires?

"2. Can buildings be so wired as to be perfectly safe, from the standpoint of the fire underwriter? and if so, how?

"3. Assuming that to be safe wires must be inserted in some kind of tubing, what shall it be, considering the question first from the standpoint of absolute safety, and next from the standpoint of economy?"

These being questions of vast importance, we submitted them to several prominent individuals practically engaged in this line of business for their views.

We give herewith the reply of Mr. H. Ward Leonard, the well-known electrical engineer and contractor, which will no doubt prove of exceeding interest to our insurance friends as well as those of our readers engaged in the wiring business:

NEW YORK, July 22, 1892.

THE ELECTRICAL AGE PUBLISHING CO.:

I have your circular letter of July 20, asking certain questions about fire hazards. I beg to reply to your questions as follows:

1. I think the large portion of the old wiring—that is, wiring done more than four years ago, and done more recently by those not entirely familiar with the requirements and best practice—is unsafe and likely to cause fire.

2. Buildings can be so wired as to be perfectly safe from the standpoint of the fire underwriters by the use of high-grade, rubber-covered wire, so placed as to be protected from materials which will have a deleterious effect upon the insulation.

3. The tubing should be of some material mechanically strong and which is a fair insulator of electricity. It is not, however, necessary that the tube should be a high insulator of electricity, and since it is difficult to secure insulating materials which are tough, strong and lasting, it is better to have first-class mechanical qualities with fair insulation rather than high insulation with poor mechanical qualities. In other words, the tubing should preserve a permanent, reliable duct in the wall, but high-grade wire should be used in this tube under all circumstances. In the case of the circuits which are run below the plastering, and which ordinarily carry less than five ampères, it is best to place two conductors close together in a single tube. Under such conditions if any original defects exist in the wire it would rapidly and safely blow the safety fuse on that circuit, instead of causing an electrolysis which will gradually make a very dangerous arc and fire without blowing the fuse, as would be the case if single wires were used in tubes separated from each other. Furthermore, should single wires be in a single tube any breakdown of any nature must necessarily be between the two wires and inside of the tubes, so that the duct is not permanently injured, and the old conductors can be readily pulled out and new ones put in, whereas if a single wire be placed in a single tube, and for any reason a defect should occur, the wall of the tubing itself, being in the path of the current, would be destroyed and it would be very much more difficult to rectify the trouble.

From the standpoint of the fire underwriters I consider it of the utmost importance that the two wires of the tap-circuit be placed in a single tube, and under such conditions I think the fire risk would be reduced to a minimum.

In the case of a three-wire tap-circuit the same argument applies to the use of three conductors inside of a single tube.

Yours very truly,

H. WARD LEONARD.

CONVENTION OF THE EDISON ILLUMINATING COMPANIES.

The convention of the Association of Edison Illuminating Companies will be held in Toronto, Canada, on Tuesday, August 9 next, and will probably continue during the 10th and possibly the 11th.

The business of the association at this meeting promises to include several features of special interest. One or more of the officers of the General Electric Co. will undoubtedly be present, with the view of becoming personally acquainted with the members of the association, and of discussing, if opportunity offers, matters of general interest.

Arrangements are being made for several papers of practical importance, and reports of committees chosen at the meeting of last year.

The headquarters of the association at Toronto will be at the Rossin House, where arrangements have been made for the entertainment of delegates at the following prices: For board and room *without* bath, $3 per day. For board and room *with* bath, $4 per day. These rates entitle the members to the choicest accommodations in the house, if engaged a reasonable time ahead, and a desirable room will be provided in the hotel for the association meetings.

The Toronto Incandescent Electric Light Company (Frederic Nicholls, Esq., manager and secretary) has arranged an attractive programme for the entertainment of the delegates in the form of a moonlight sail on Toronto Bay, calling at Toronto Island, where refreshments will be provided for the delegates at Hanlan's Hotel, the home of the ex-champion oarsman; also a drive in carriages around the principal parts of the city.

It is probable that a trip to Peterborough, where the shops of the Canadian department are located, may be made by those in attendance at the convention who may desire to visit them. It is feasible to make such an excursion in one day, leaving Toronto at 9 A.M., arriving in Peterborough at 11:45, taking lunch at the Oriental and spending the afternoon at the works, leaving at 5:45 and arriving in Toronto at 8:10 P.M.

It now seems probable that the programme for the convention will be substantially as follows:

TUESDAY, AUGUST 9.

First Session—11 A.M.

Organization by presentation of credentials and choice of officers for the coming year. Reports of committees.

Second Session—2 P.M.

Papers contributed by members, and discussions.

Evening.

Moonlight sail.

WEDNESDAY, AUGUST 10.

Early Morning.

Drive about Toronto,

Third Session—11 A.M.

Addresses.

Fourth Session—2 P.M.

Closing papers and discussions.

THURSDAY, AUGUST 11.

Entertainment of delegates by trip to Peterborough or some other point of interest.

There are within easy distance of Toronto and on the shores of the lake, a large number of summer resorts, to which passenger steamers are running constantly each day. The readiness with which the delegates may thus combine enjoyment of the coolness of a Canadian city with the business of the convention, will, it is hoped, influence a large number to attend.

The members are especially urged by the secretary to prepare themselves to contribute to the interest of this meeting by bringing with them papers to be read or some facts regarding their own business to be given to the association, or some question to be proposed, calculated to stimulate discussion. Any member thus disposed will confer a favor upon the other members by sending to the secretary a memorandum of what he will be likely to present, and a supplementary circular may be issued within a week or ten days of the meeting, giving an order of exercises more in detail.

Mr. W. J. Jenks, 44 Broad street, New York city, is the secretary of the association.

CORRESPONDENCE.

EARTH-CURRENTS.

EDITOR ELECTRICAL AGE: The demoralizing effects upon the telegraph service of the country during the progress of such intense magnetic storms as those recently described in your journal are so great that any simple device for maintaining the working of circuits at such times cannot fail to be regarded as possessing considerable value and importance.

It is interesting, therefore, to learn that your correspondent, Mr. W. J. Camp, not only succeeded in operating simplex, but also duplex and quadruplex circuits during the recent disturbances, by using a return wire in place of the usual ground connections.

This method, as applied to single working in which an intermediate battery can be employed in the metallic loop, has long been known and resorted to under similar conditions; but its application to multiplex working involved other considerations which apparently rendered the use of the return wire ineffectual in such cases.

The problem has been considered all the more difficult from the fact that at many large offices dynamo currents are used, and it is quite impracticable to disconnect the ground connections of those machines for the purpose of securing both poles for use as intermediate batteries.

Line condensers and other arrangements have been tried with but little success, and it appeared well-nigh impossible to conveniently and effectually exclude abnormal earth-currents and maintain the normal working conditions.

Your readers who are interested in the subject will therefore await with considerable interest some further details from Mr. Camp regarding the remedy applied by him.

WILLIAM FINN.

NEW YORK, July 29, 1892.

ELECTRICAL SOCIETIES.

THE ELECTRIC CLUB.

At a meeting of the board of managers of the Electric Club, New York, held at the club-house July 21, the following were elected members: J. F. Hughes, D. A. Patten, Alex. H. Bauer, H. J. Stanbaugh, E. H. Enholm, Harry S. Marlor, W. S. Hine, Edward Peck, Leonard F. Requa, J. H. Long, George E. Kent, A. G. Greenburg, F. H. Leonard, Jr., E. W. Seymour.

THE MAGNETIC CLUB.

About 125 members of the Magnetic Club attended the midsummer meeting of the club at College Point, L. I., Wednesday evening, July 27. The steamer "Western Union" was placed at the disposal of the members by the Western Union Telegraph Co., and a large number availed themselves of the opportunity to enjoy the ride down the East river, through Hell Gate and into the Sound.

After the boat arrived at College Point two ball nines were organized and played a game before the dinner was served.

At seven o'clock the party sat down to the banquet, at the conclusion of which speeches and recitations were made, and vocal and instrumental music rendered with excellent effect.

The company returned home by midnight after having spent the evening in a most pleasant manner.

ORGANIZED.

A meeting of the Canadian Niagara Power Company incorporators was held at the Clifton House, Niagara Falls, Ont., last week, to organize. Edward D. Adams, Francis L. Stetson, Edward A. Wickes, T. R. Chaney, Edward Winslow and Wm. B. Rankine, of New York; Col. A. D. Shaw, of Watertown, N. Y.; John G. Scott, I. D. Irwin and C. J. Elliott, of Toronto, were present. Colonel A. D. Shaw was elected president, Francis Lynde Stetson, vice-president; Wm. B. Rankin, secretary and treasurer. They will also constitute the executive committee of the directors.

The directors elected were Col. Shaw, F. L. Stetson, W. B. Rankine, I. D. Irwin and Mr. Holman. The company acquired by purchase the lease from the Canadian Park commissioners of the right to construct a tunnel under it. All future meetings will be held at the company's headquarters at Niagara Falls, Ont.

There is no prospect of any work being done on the tunnel this fall. The meeting adjourned subject to the call of the president.

NEW PUBLICATIONS.

POPULAR ELECTRIC MONTHLY is the title of a new monthly journal which has just made its appearance in Chicago. Its evident mission is to make electrical problems understandable to those who have not had the advantage of previous technical training. Mr. George O. McKibben is the business manager, and the publication office is at 1522 Monadnock Building, Chicago.

HOW ELECTRIC-LIGHT CARBONS ARE MADE.

The subject of making electric-light carbons is one that is little understood, and while there is nothing about their manufacture that is a trade secret, little publicity has been given to the general processes. All manufacturers of carbons differ from each other slightly in their methods. One maker may use more of one ingredient or less of another than other manufacturers, but in the main the process and the materials used are much the same.

At the meeting of the Canadian Electrical Society, held in Hamilton, Ontario, last June, a paper was read by Mr. H. O. Fisk on the subject of carbon-making, which contained much of interest. The following is an abstract of this paper:

"Twenty-five per cent. of gas coke mixed with 75 per cent. of petroleum coke is said to make a good carbon for low-tension work. Another variety of this material is obtained from the oil regions, commonly known as petroleum coke. This is a by-product of the oil stills, and is the only kind used to any great extent in the manufacture of carbon points for the electrical industry. It is of primary importance that the coke, and, in fact, all the ingredients used, be absolutely free from impurities. The other constituent of our carbon is pitch. This is made from coal tar, which is a by-product of the gas-retorts. It may also be obtained from blast-furnaces, but this kind is more or less contaminated with iron, and therefore is unfit for this class of work. Pitch for this particular purpose is difficult to obtain, as the makers do not care to expose their still to the high temperature necessary to drive out all of the oil and reduce it to the proper specific gravity, and as the men in the factory say, 'it is more or less wet.'

"The first step in the process of manufacture is that of crushing the coke. This is accomplished by means of a machine somewhat in appearance like a mammoth coffee-mill. The coke comes from this crushed to about the size of coarse gravel; it is then automatically elevated to a large bin in the upper part of the factory, and from there it is conveyed to a large iron hopper situated directly over the calcining retorts. Into these the granulated coke is conducted by means of spouts with gates arranged to control the flow of material into the several aforementioned retorts. They are then sealed up, thereby preventing combustion, with the exception of a few vents to allow of the escape of gas, arising from the heating of the coke to a state of incandescence, which point is reached in from twenty-four to forty-eight hours after firing. After this if the coke is not pure it will be found to have caked, necessitating in some cases the use of bars to break it up sufficiently to allow of its being drawn from the retorts. If pure it will appear crisp and dry and to have suffered a loss in weight of about 30 per cent. After the retorts have been drawn sufficiently long to allow of cooling, their contents are elevated to the milling department and run through a set of French burr stones incased in iron, very similar to the grist-mill chop stones; then through a silk bolter separating the coarse from the fine, the former returning to the milling machine, the latter being conveyed to bins with suitably arranged spouts over scales, from which it may be drawn and weighed as required by the mixing department. We will leave the coke here for the present and return to the other ingredient, namely, the pitch. This is dense, hard, solid, very brittle and dry, and in appearance somewhat resembling gutta percha. This material, when it reaches the factory, is incased in casks, holding about 600 lbs. each. It is then broken up by the men into a convenient size for handling, and subjected to a granulating process similar to that of the coke; finally we find it at a spout close beside the one from which the coke can be drawn.

"We have now followed the two principal ingredients through the various processes which were necessary to prepare them for the mixing-room. The other ingredients, if any, we shall not be able to elaborate upon until we have reached a more confidential relationship with the carbon-makers. However, upon the manipulation of the materials at this stage, I am told, the success of the future carbon greatly depends; in fact, the great secret lies in the mixing. We can better understand the skill and care required to properly amalgamate the mixture, when we learn that each particle or grain of coke must have its individual coating of pitch, and it may be interesting to learn that this coke is ground so fine that a grain magnified a thousand times would only appear the size of a shot. To obtain these results the materials are carefully proportioned by weight, and placed in a mixing barrel. This is a rotating cast-iron cylinder within which in the same direction revolves an independent shaft, twice as fast as the cylinder, to which are attached arms, so arranged that every part of the barrel is covered or swept in each revolution. This is attached to a furnace in such a way that the flues follow the whole circumference of this barrel, maintaining a uniform temperature of about 300° F., which is necessary to bring the pitch to a state sufficiently plastic for amalgamation; thirty minutes is the time required for each batch, which would make about 1,600 carbons. From this machine it is taken to the cooling-room and spread out for ten or twelve hours to cool. Here the mixture solidifies to such an extent that it becomes necessary to pulverize it again, to perfect it for the moulds. This end is attained by means of a mill, the pulverizing feature of which is two discs thirty inches in diameter, with corrugated face plates revolving in opposite directions at the rate of fifteen hundred revolutions per minute (about one one-hundreth of an inch apart). From this it is once more passed through a bolting machine, and then finding its way down gravity tubes to a bin on the floor below (which is the moulding-room) it is carefully weighed out by the workmen on peculiar little scales with clock-like dials, in quantities just sufficient to fill each mould as it comes hot from the oven.

"The mould, having been previously lubricated with some heavy oil, is now ready for its charge, which the operator places in it and works evenly over the whole surface with a spatula, to insure uniformity of density. The cover or top half is placed in position and the mould and its contents pass for a few moments into an oven, the temperature of which is about 300° F. As soon as the mixture has become quite adhesive the mould is placed in the hydraulic press, and subjected to a pressure of several hundred tons. The mould is now removed and opened, and we have a corrugated card containing sixteen or eighteen carbons, each one being joined to its neighbor by a fin which is inevitably formed when subjected to the enormous pressure before mentioned. These cards are placed on plates which are fitted to receive them perfectly. These plates with their contents are piled up and weights placed thereon to prevent warping. When cool they are broken apart, gauged for size, culled and the fin scraped off. They are then laid in the furnace for baking. This furnace is rectangular in shape, 34 by 11, four feet deep and made of fire-brick, and is similar to a large vat set about two-thirds below the surface of the earth. Over this when filled is placed a dome-shaped cover, sufficiently high above the sand and tile which covers the carbon to allow of a free passage of the flames, and which is continued by flues back through the sides and also underneath, thus completely enveloping the body of the furnace in flames. The carbons are carefully placed in the furnace and separated from each other with washed sand, which is brought from the shores of Lake Ontario. Some days are required to completely load a furnace, as each section will hold about seventy-five thousand carbons.

"The cover having been placed in position and sealed

with fire-clay, the fire is now started, crude oil being the fuel used, as well as in the case of the retorts and moulders' oven. This fire is continued moderately for forty-eight hours, to allow of the gas escaping without blistering the carbon ; it is then forced to its utmost for from forty-eight to sixty hours longer, then shut off and the whole allowed to cool for forty-eight hours before uncovering. The top, which is mounted on wheels, is then rolled off and a few carbons taken from various parts of the furnace and tested by a Wheatstone bridge and galvanometer for resistance, as this at once determines if the baking has been carried sufficiently far. If the measurements of all the samples exceed four-tenths of an ohm, the furnace is re-covered and fired for some hours longer ; but this very rarely has to be done. The writer recently tested samples from the north and south ends and centre of a furnace, and they measured 23, 22 and 24 one-hundredths of an ohm respectively. Some difficulty was at first experienced in attaching carbons to the bridge, for the resistance of this substance varies considerably with the pressure of contact, and the same carbon measured at different times would often vary several one-hundredths of an ohm. But an instrument was designed by the writer which obviated to a great extent, if not wholly, this trouble. The pressure brought to bear on the sample undergoing test by this instrument is determined by small weights suspended from levers attached to holders so arranged that exactly the same pressure and contact is formed on different samples of the same size. If the resistance of the samples, as before mentioned, shows that the contents of the furnace have been sufficiently baked, it is unloaded, the hot carbon being handled with forks.

"When cold they are sorted, the first and seconds being easily determined by rolling on level steel plates. After this inspection they are ready for the plating-room, where they receive their copper coat by being hung in leaden vats containing a saturated solution of sulphate of copper. These vats, of which there are several dozen, are connected in series with a twenty-ampère constant-current dynamo. Twenty minutes to half an hour is the time required to complete this plating process. They are then washed in hot and cold water and placed on racks to dry, after which they go to the packing department to be rolled in paper and boxed for shipment."

CHARGING AND DISCHARGING STORAGE BATTERIES.

As both the charge and discharge of a storage battery result in different forms of chemical reaction, it is obvious that ample time should be allowed for this reaction to produce the required chemical changes; the normal rate under varying conditions being ascertained better by practical experience than by arbitrary rule.

Charging is always accompanied by the evolution of gas, which is chiefly absorbed, while a certain percentage escapes; hence if the rate of charging is excessive, there is an abnormal escape of gas and useless consumption of current; there is also an abnormal development of heat, which may result in destruction of the plates.

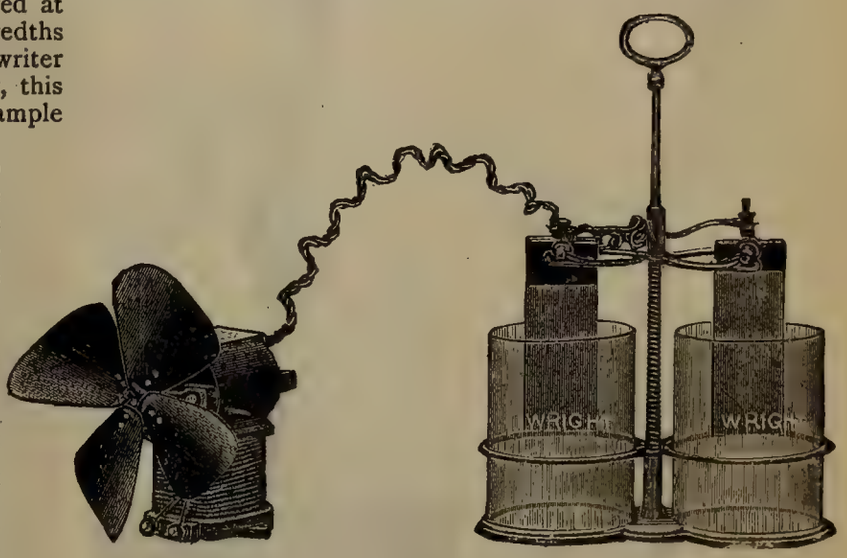
As there can be no further absorption of gas when the chemical reaction of charging is completed, its abnormal escape with a normal current indicates an overcharge, resulting as before in waste of current, but not in injury to the plates.

But as the chemical reaction of the discharge results in the absorption of sulphuric acid and the formation of lead sulphate, a hard, unyielding substance in considerable quantity on both plates and in excess of the material which it replaces, due to the absorption of acid, it is evident that if the action is too rapid, the plugs on the surfaces most exposed to the chemical and electric action will become sulphated to a greater degree than on the opposite surfaces, producing unequal expansion, with warping or buckling of the plates as a result; the same result also occurring from an excessive formation of sulphate if the discharge is continued too long.

The E. M. F. during the first half-hour of discharge is about 2.25 volts, being slightly increased by the supplementary reaction of a small amount of gas, which adheres to the plates after charging; it then drops to about 2.4 volts, remaining nearly constant, with a slight decline to 2 volts or less, till the dioxide is mostly reduced to sulphate, when it begins to decline rapidly; which indicates that the discharge should cease, to prevent injury to the plates.

NEW PRIMARY BATTERY.

A representative of the ELECTRICAL AGE a few days ago witnessed an interesting test of the primary battery of the Wright Universal Electric Co., 26 Whitehall street,



WRIGHT PRIMARY BATTERY OPERATING FAN-MOTOR.

New York. Power for the operation of fan-motors and lighting some 16 C. P. lamps was supplied by one of these batteries. The company has what it calls "electric sand," which is dissolved and used as the solution of the battery. It appears to be powerful in its action and produces a strong current, while, at the same time, very little odor is given off.

Two ordinary size cells containing this solution, it is said, will run a No. 3 fan-motor very vigorously for fourteen or sixteen hours.

Twenty-one 16 C. P. lamps were distributed about the company's office and lighted by 14 large cells of its battery, giving a brilliant and satisfactory light.

Various tests with fan-motors were made, showing how well adapted the battery is for work of this sort.

The company is about to manufacture a small cell for physicians' use, for such purposes as cauterizing, etc. The size of this cell will be $5\frac{1}{2}$ x $4\frac{1}{2}$ x 1 inches, and will give sufficient current to render a $\frac{1}{6}$ C. P. lamp incandescent. Its small size will commend it to the use of physicians.

The Wright Company is fitting up some cars for the street railway in Mount Vernon, N. Y., with storage batteries, and claims that it can provide sufficient power to operate a car from a battery weight of but 850 lbs.

The accompanying illustration gives an idea of the giant-like power produced in a small cell of this battery. The source of power and the work performed appear to be disproportionate, but it indicates that the battery is powerful.

LOW-WATER ALARM FOR BOILERS.

A low-water alarm for boilers, which seems to be free from all the weak points of other methods and devices for giving notice to the attendant when the water in the boiler is getting dangerously low, is the one illustrated herewith.

Fusible metal plugs in boilers are generally used for the same purpose, but when they become scaled, as they are very liable to, they become practically useless. A scale one-sixteenth of an ich thick over a half-inch hole will resist a steam-pressure of seventy pounds, hence it is evident that perfect dependence on fusible plugs alone cannot be placed with safety.

Fig. 1 shows how this indicator or alarm is constructed.

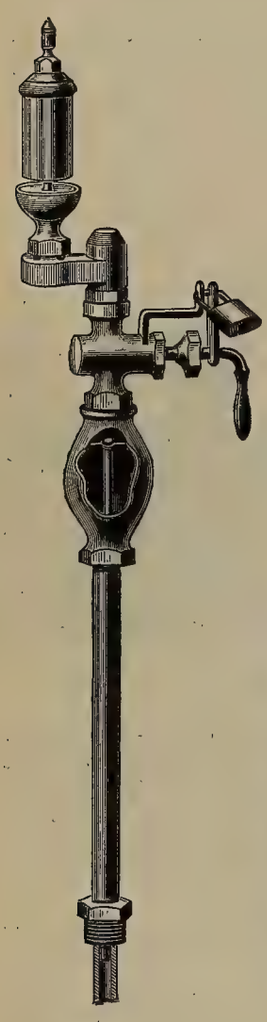


FIG. 1.

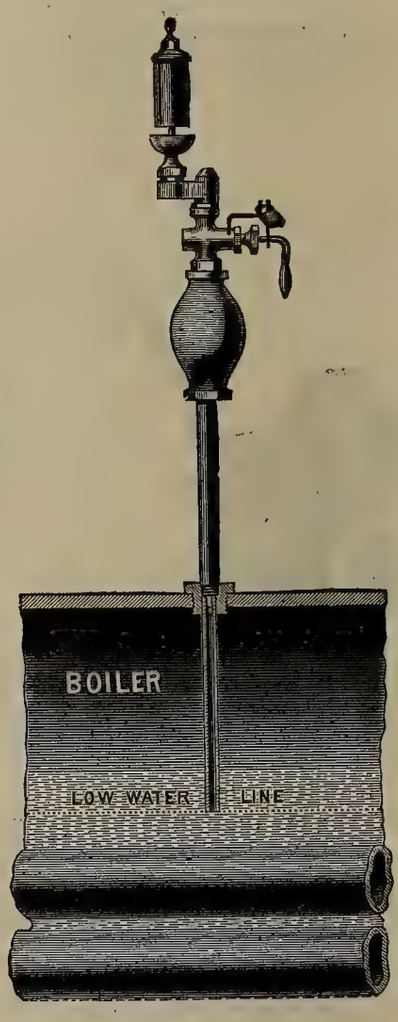


FIG. 2.

The central pipe, which is made of brass, runs from the point where the alarm is inserted in the boiler to the top of the air-chamber above. When the water in the boiler falls below the safety line an immediate circulation of live steam in this pipe and air-chamber results.

An improved stop-cock is used, it will not set or expand, and can be easily closed or opened.

A lock is provided for the purpose of locking the stop-cock. It is always locked open, so that in case the water gets below the pipe the whistle immediately sounds an alarm which cannot be stopped until the stop-cock is unlocked and closed.

The fusible metal is held in a brass plug connecting the offset and stop-cock. When the metal fuses it is forced by the pressure of the escaping steam into the upper part of the offset, and the steam, having direct access to the whistle, sounds the same.

The great value of this apparatus may be appreciated when it is remembered that with the old style of plugs it is necessary to draw the fires before a plug can be changed after having been fused. With this new device burning of the tubes is absolutely prevented.

Fig. 2 shows the low-water alarm as it is attached to a boiler. Its operation will be readily understood by all interested in steam-boilers.

Messrs. James B. Clow & Son, Lake and Franklin streets, Chicago, have recently put this invention on the market.

MANCHESTER ELECTRIC CLUB.

A new electric club, known as the Manchester Electric Club, was recently organized in Manchester, N. H., its principal object being the improvement of its members in the study of electrical science and in the knowledge of its practical applications. Practical talks on electrical topics will be given by the president, and prominent electricians will be secured to deliver lectures before the members. The officers are: President, G. I. Hopkins; vice-president, J. Brodie Smith; treasurer, E. J. Burnham; secretary, Herbert W. Eastman. Executive committee: E. M. Bryant, George A. Corson, W. H. Fairchild, and the president *ex-officio*.

NEW INCORPORATIONS.

Nanticoke and Newport Railway Company, Nanticoke, Pa., incorporated July 20, with a capital stock of $50,000. Incorporators: John B. Reynolds, John T. Lenshan, John Smoulter, Jr.

Diamond Light and Power Company, Sheldon, Ia., incorporated July 20, with a capital stock of $50,000. Incorporators: W. D. Boies, F. C. Turner, Momer N. Conant, Sheldon, Ia.

Orange Ice, Light and Waterworks Company, Orange Tex., incorporated July 18, with a capital stock of $60,000. Incorporators: L. Miller, P. B. Curry, Alex. Gilmer, W. H. Stark, F. W. Brown, Orange, Tex.

Applegate Electric Light and Power Company, Chicago, Ill., incorporated July 21, with a capital stock of $1,000,000, to manufacture, buy and sell electric-lighting devices, machinery, apparatus, etc. Incorporators: George W. La Rue, Eugene W. Applegate, Elisha R. Nichols, J. S. Palmer, R. B. Gillies.

Otis Electric Company, Yonkers, N. Y., incorporated July 18, with a capital stock of $350,000, to manufacture and sell electric motors. Incorporators: Norton P. Otis, William D. Baldwin, Yonkers, N. Y.; Samuel Dana Greene, New York, N. Y.

Orange City Electric Light Company, Orange City, Ia., incorporated July 22, with a capital stock of $10,000, to erect a system for furnishing electric light and power for hire. Incorporators: M. E. Lewis, E. H. Casjens, A. Vandermeide, John Vandesteey, Jerome Fisher, M. Rhynsburger, Orange City, Ia.

Overhead Cable Traction Company (incorporated in W. Va.), New York, N. Y., incorporated July 22, with a capital stock of $1,000,000, to build, operate, sell and lease overhead cables for railroad cars, canal-boats and other purposes. Incorporators: I. H. Haar, W. A. Butler, Dennis O'Donoghue, New York, N. Y.

Alton and Suburban Electric Railway Company, Alton, Ill., incorporated July 23, with a capital stock of $50,000. Incorporators: Manning Mayfield, Henry S. Swift, E. G. Webster.

Capital Land Company, Deer Lodge, Mont., incorpo-

rated July 19, with a capital stock of $100,000; among other things it will deal in electricity. Incorporators: Annistead H. Mitchell, Samuel E. Larabie, Conrad Kohrs, Henry S. Reed, Nicholas Bielenberg, Samuel Beaumont, W. N. Aylesworth, Frank Conely, J. E. Van Gundy, William Coleman, J. F. Brazelton, Peter Lansing, H. H. Zenor, James B. McMaster, Carlin D. Joslyn, Henry B. Davis, Deer Lodge, Mont.

Howe Electrical Concern of New Jersey, Newark, N. J., incorporated July 22, with a capital stock of $100,000, to manufacture and sell all kinds of electrical and mechanical devices, etc. Incorporators: E. Ellery, Brooklyn, N. Y.; M. Rubens, New York, N. Y.; T. C. Barr, Orange, N. J.

The Oro Town and Improvement Company, Ruby, Wash., incorporated July 22, with a capital stock of $300,000. Among other things it will operate and own electric light, gas and water works. Incorporators: Robert Allison, S. C. Stanton, Henry Carr, Robert Hunter, Charles E. Laughton.

Lemont Electric Light and Power Company, Lemont, Ill., incorporated July 26, with a capital stock of $20,000. Incorporators: J. G. Bodenschatz, H. S. Norton, A. P. Nelson, F. J. Huston, Hubert Sauber.

Tihuron Point Villa Association, San Francisco, Cal, incorporated July 23, with a capital stock of $250,000. Among other things it will operate railroads, electric power, telegraph and telephone lines. Incorporators: Thomas B. Gardner, P. T. M. Wade, Arthur M. Hill, Edward W. Hill, Walter K. Freeman, all of San Francisco, Cal.

The Sandusky, Milan and Huron Electric Railway Company, Sandusky, O., incorporated July 25, with a capital stock of $100,000. Incorporators: W. H. Gilcher, Thomas Wood, George H. De Witt, John T. Mack, T. B. Taylor.

Central Electric Company of Peoria, Peoria, Ill., incorporated July 25, with a capital stock of $5,000. Incorporators: Grin H. Norton, A. E. Norton, Z. E. Waugh, Charles E. Stapp, John E. Hamm.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 30, 1892.

THE C. McINTIRE CO., 13 and 15 Franklin street, Newark, N. J., manufacturers of the well-known McIntire patent connectors, terminals, and other specialties, continue to do a large trade in these goods. The connectors are made of the best lake copper, and were awarded the John Scott medal by the Franklin Institute of Pennsylvania. This company's metal terminals for fuse wire are excellent devices, and the fact that they are in active demand indicates that they are giving satisfaction.

THE NEW YORK EXHAUST AND BLOW PIPE COMPANY'S fan ranks among the first where an exhaust fan is required for heating or ventilating, or for the removal of shavings dust, lint and odors. Messrs. A. C. Lynch and C. W. Christoph, the managers of this company, have had years of practical experience in this particular line, and every firm who have had dealings with them recommend them in the highest terms. The address is 136 Liberty street, New York city.

THE WILDER DUPLEX ELECTRIC BURGLAR ALARM AND MESSENGER CO., 165 and 167 Broadway, New York, is now making arrangements to introduce its system, for the protection of bank-vaults, storehouses, safes, etc., also its fire-alarm system for cities.

THE TYPEWRITER EXCHANGE, 10 Barclay street, George A. Hill, manager, established only fourteen months, is to-day the largest of its kind in the world. No matter what make of a typewriter you may desire, or the price you can afford to pay, you can be suited by calling or writing to the address as above.

THE following-named gentlemen were in town during the present week: George F. Durant, general manager Bell Telephone Co. of Missouri, St. Louis; C. H. Wilson, general manager Chicago Telephone Co., and H. S. Stone, president Bell Telephone Co. of Maryland.

H. DURANT CHEEVER, manager of the Okonite Co., Limited, well-known manufacturers of Okonite insulated wires and cables, has gone to Europe on a well-earned vacation and generally in the business interests of the company. Mr. Cheever will inspect the London factories of the company, and besides make a circuit of the Continental cities. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	157 50
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	114 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*103
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	94 00
Edison General	15,000,000	100 00	109 00
Edison General Receipts		100 00	109 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	109 00
General Electric Co., 5s	4,000,000		*101
General Electric pref.		100 00	119 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	19 50
Laclede Gas pref.	2,500,000	100 00	60 75
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00

North American Railway Co.	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	63 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	66 75
Thomson-Houston pref.	4,000,000	25 00	29 75
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	97 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	28 25
Westinghouse Elec. Co. pref. 7s.	4,000,000	50 00	46 50
Westinghouse Ass. Rects.		50 00	19 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Although the majority of the speculative and investing capitalists are practically out of business during this heated term, there are still enough of them left to keep the ball rolling and prices firm. Any desire shown on the part of the bear element to break prices of stocks is quickly met by purchasers. The one feature of the market in connection with electrical securities is the advent as a prime factor of the dealing, both on the New York and Boston Exchanges, of the General Electric Company's bonds and stocks. All three classes are well received, and dealings are not only of satisfactory volume but the prices are steadily advancing and all above par—the five per cent. bonds selling at 100½ with 101 asked. The preference shares are selling readily at 120, and the common or ordinary shares at 108 to 110 per share. The earnings of the company are increasing rapidly, while at the same time the consolidation of the interests controlled or absolutely owned by the various concerns amalgamated with one management, and a single set of executive officers as well as head of departments, have reduced expenses to a liberal business minimum. The question remains undecided yet as to whether the Westinghouse Company, with its many absorptions, will discover a method under which, to the mutual satisfaction of both contracting parties, they can join the General Electric or be joined by them. By referring to the list it will be seen that the Westinghouse securities do, and have for a considerable period remained nearly dormant. The preference 7 per cents. are a good purchase, but for some reason or other a large block of them remains in the treasury when they should be in the hands of investors. There will probably be no change in the situation so far as further consolidation is concerned until late in the fall, or possibly until after the close of the Chicago Exposition. The investment in either or both companies is strongly recommended. I think the full amount will be doubled within five years, beside the interest on your money; but when the price does double, then I advise realizing, for the securities will become speculative, and in that field no one can predict with any real hope of being correct. It becomes a gamble, and the man behind the table always wins in gambling; buy the securities now with the intention, or at least desire, to hold them for several years. The Edison Electric Illuminating Company, of New York, is also rapidly increasing of late, having raised in the past three months from $80 to $94 per share, the bonds being firm at 102. There is no doubt as to the position this company will eventually attain on the incandescent and the Brush Illuminating of New York on the arc system of illumination. Another large source of income to the Edison Illuminating Co. is from power for fans and many other small motors, which can be used by removing a lamp and using the current at the same price. Both securities are very safe investments for cautious people, and both are separate or independent corporations.

The Edison of Brooklyn is another safe thing, as the grand expense of getting underground all over its territory has been paid. Of the out-of-town solid investments the best at the moment are Detroit Light and Power six per cents., $150,000 of which can be had; Chattanooga Electric Co. six per cents., $80,000 of which are in the market. This company has a perpetual franchise, and has the entire lighting of the city.—the city contract being $2,000 and the commercial business $4,000 per month. The gross expenses are less than $4,000 per month, with a large plant perfect in every way and increasing business with reduced expenses. For a whole business the Hickory Electric Company, of North Carolina, one of the growing health resorts as well as a railroad and manufacturing centre, with a thirty years' franchise for all electric business and now earning 8 per cent. net on the price asked for it ($13,000), offers to a man who has, say, $20,000, an opportunity to retire from active business and settle down with this plant to enjoy a regal life as the electric monarch of his vicinity. The Fremont, Ohio, Electric and Gas Company can also be had; the net income is $10,000 per year. Either of these two complete plants can be had at once free and clear, with fullest examination. Don't wait too long!

BOSTON NOTES.

Mr. T. P. Lennox, 8 Oliver street, manager Boston office of the National Pipe Bending Co., has been most successful in introducing this company's feed water-heaters.

W. S. Hill Co., 133 Oliver street, manufacturer of the popular Hill quick break switches, is kept constantly busy. The company is completing arrangements to push its dynamos and motors.

The Gould & Watson Company, 35 Hartford street, is meeting with excellent results in the sale of the Whitney voltmeters and ammeters. These instruments are accurate, direct reading, reliable, sensitive, portable and low-priced.

The F. E. Belding Mica Mining Co., 28 School street, furnish mica plain or cut to suit the requirements of customers and have a large trade. The superior advantages of mica for all electrical purposes have been thoroughly proven by very severe tests. W. T. H.

"A MODERN TRIUMVIRATE."

Bartlett & Co., designers, engravers and printers, 21 and 23 Rose st., New York, have just issued a brochure describing their establishment, which for artistic conception and execution it would be hard to surpass. It represents the highest degree of development in the arts of designing, engraving and printing, and is altogether a most beautiful piece of work. A few testimonials given at the back show that the work of Bartlett & Co. is uniformly satisfactory. The work of the concern is certainly in keeping with its reputation.

THEY COME UP TO THE MARK.

The following is a copy of a letter which shows the value of arc lamps in establishments where silks and colored goods are handled:

NEW YORK, June 25, 1892.

THE ELECTRIC CONSTRUCTION AND SUPPLY CO., 18 Cortlandt st., N. Y.:

GENTLEMEN: It is now three months since we installed your system of arc-lighting, and we take great pleasure in saying that the lamps have come up to the mark in every point. The plant works beautifully so far as has been installed, and after the alterations now contemplated in our building are completed, can only say that we will have the entire house installed.

We are also pleased to announce that for a brilliant, constant light, and not a harsh one, we have failed to find an equal of it, and in our silk and dress-goods department, where good light is very necessary, we have been able to use them with success in distinguishing colors, etc.

We trust we may be of some service to you as a reference, if necessary, and you are at liberty to use this letter, if you please.

We can heartily recommend your lamps to any person using the old style of incandescent lamps, and they are, we consider, superior to the old style of "High Potential."

Respectfully yours,
C. B. ROUSS.

The Electrical Age's Illustrated Patent Record.

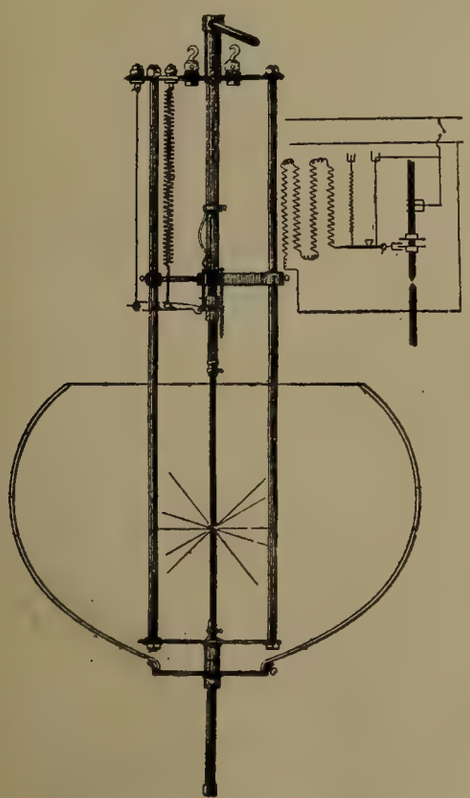
Issued July 26, 1892.

479,397. Cord-Carrier for Underground Conduits. Stephen R. Bradley, Nyack, N. Y. Filed Jan. 27, 1892.

479,410. Electric Belt. Andrew M. Eklund, Minneapolis, Minn. Filed May 2, 1892.

479,469. Motor-Frame for Electric Locomotives. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Oct. 29, 1889.

479,493. Electric Railway. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed July 24, 1891.



479,510.—ELECTRIC-ARC LAMP

479,509. Cord-Adjuster for Electric Lamps. John W. Heaphy, Jr., Rochester, N. Y., assignor to Fred G. Kimman, same place. Filed Nov. 11, 1891.

479,510. Electric-Arc Lamp. William E. Irish, Cleveland, O. Filed May 4, 1892.

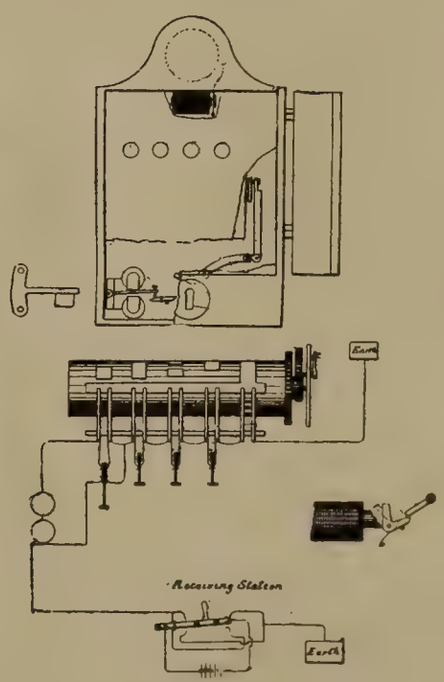
479,520. Electric Self-Winding Clock. Malcolm MacKellar and George D. Weaver, Reading, Pa. Filed Aug. 12, 1891.

479,525. Electric Conductor. Frederic A. C. Perrine, Trenton, N. J., assignor to John A. Roebling's Sons Company, same place. Filed Sept. 23, 1891.

479,539. Matrix-Making Machine. Charles L. Tiavis, Minneapolis, Minn., assignor to the Minneapolis-Electro Matrix Company, same place. Filed Jan. 16, 1890.

479,540. Electric Signalling Device for Fire-Hose. John C. Wharton and James W. Braid, Nashville, Tenn. Filed Nov. 11, 1891.

479,541. Sealed Battery-Cell or Similar Articles. Charles Willms, Baltimore, Md. Filed April 30, 1892.



479,715.—KEY-CONTROLLER AND SIGNAL-TRANSMITTER.

479,557. Electroplating Toy Apparatus. Edward A. Clark, Boston, Mass. Filed March 16, 1892.

479,596. Thermo-Electric Element. Charles W. Iden, New York, N. Y., assignor to the Thermo-Electric Company, same place. Filed Nov. 11, 1889.

479,608. Trolley, Frederick F. Poole, Newark, N. J. Filed May 11, 1892.

479,659. Electric-Arc Lamp. Jonathan A. Pierce, Austin, Minn. Filed Oct 15, 1891.

PATENTS.—Continued.

479,666. Switch and Signal Apparatus. Jens G. L. Schreuder, Edgewood, Pa. Filed June 10, 1891.

479,675. Alternating-Current Motor. William Stanley, Jr., Pittsfield, Mass., and John F. Kelly, New York, N. Y. Filed Nov. 14, 1891.

479,676. Alternating-Current Motor. William Stanley, Jr., and John F. Kelly, Pittsfield, Mass. Filed March 5, 1892.

479,715. Key-Controller and Signal Transmitter. Morris Martin, Malden, assignor to John C. Wilson, Boston, Mass. Filed July 16, 1889.

479,726. Acoustic Telephone. Alfred L. Simpson, New York, N. Y. Filed Feb. 24, 1892.

479,727. Alternating-Current Motor. William Stanley, Jr., and John F. Kelly, Pittsfield, Mass. Filed March 8, 1892.

479,746. Electro-Magnetic Motor. John F. Kelly, New York, N. Y., and William Stanley, Jr., Pittsfield, Mass. Filed May 29, 1891. Renewed March 5, 1892.

479,753. Secondary Battery. Arthur E. Colgate, New York, N. Y., assignor of one-half to Lowell Mason, same place. Filed April 26, 1892.

479,772. Matrix-Making Machine. George A. Goodson and Alexander S. Capehart, Minneapolis, Minn., assignors, by mesne assignments, to Thomas S. Bassford, New York, N. Y., receiver of the Minneapolis, Electro-Matrix Company. Filed May 31, 1887.

479,773. Matrix-Making Machine. George A. Goodson, Minneapolis, Minn., assignor, by mesne assignments, to Thomas S. Bassford, New York, N. Y., receiver of the Minneapolis Electro-Matrix Company. Filed March 20, 1888.

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HOW TO MEASURE EARTH-CURRENTS.

On several occasions lately we have published communications from Mr. William Finn regarding the phenomena of earth-currents, and the consequent disturbances on telegraph lines. The subject has acquired extraordinary prominence during the past few weeks on account of the remarkable electrical storm of July 16 last, which was so brilliant in its natural manifestations and so violently aggressive to the equanimity of the telegraph service.

In these various communications Mr. Finn told our readers all about the size of the fickle currents in milliampères and their force in watts, but not in one did he give any intimation as to how he determined all these facts. At last he has come to the relief of those thirsting for knowledge regarding the measurement of elusive earth-currents, and in this issue presents an interesting article on this subject.

Hundreds of our readers will be glad to learn how to measure these currents, and will probably be surprised to know how easily it is done.

Mr. Finn's article this week will no doubt be marked and filed away for future reference by hundreds of electricians and students of electricity.

A STRANGE CASE.

The award to a New York company by the executive committee of the World's Fair of the right to run electric launches in the lagoons within the exhibition grounds, contrary to the recommendations of Chief of Construction Burnham, who reported in favor of the boats of a Chicago company, reveals a rather peculiar case.

From all the reports that have reached us concerning the competitive tests of electric launches for the right to carry on this service, it seems that the boat of the New York company proved to be superior in all respects to that of the Chicago company, and yet in the face of these facts Chief Burnham recommended that the Chicago company be awarded the right. When the executive committee took the matter up for action, however, they evidently looked into the facts themselves, and rendered their decision accordingly.

We think that all fair-minded persons will approve of the manner in which this matter has been settled, as it will leave no room for suspicion or criticism.

Apart from the equities in the case, it will be a decided novelty to the thousands who will attend the fair to ride about the water-ways in handsomely furnished boats propelled by electric power.

ELECTRIC POWER ON SUGAR PLANTATIONS.

In looking over the ground there does not seem to be much more area left for electricity to conquer. There is one line, however, which, as far as we know, it has not yet invaded, and in which pecuniary reward awaits the person who can adapt electric power to fulfil all the requirements.

In Louisiana and other sugar-growing sections the sugar-cane after it is cut is loaded on to wagons for transportation to the mills by a very laborious and slow process.

An enterprising sugar-cane grower in Louisiana has asked us if electric power cannot be used to do this work, which is now performed by negroes. An electric motor placed on the wagon and fed from a trolley line would no doubt in some instances answer the purpose; but here a difficulty arises. Suppose the plantation is several hundred acres in extent, how then can an electric motor be supplied with current in an economical manner, so that it will be practicable to reach the furthermost edges and corners? This is a problem that we think is worth trying to solve, as we understand there is a great desire among planters for something of the sort. Any one caring to compete for the reward which will surely follow a successful solution of this problem may learn more about the requirements by addressing C. S. Palm, North Bend Plantation, Foster P. O., La. This gentleman is anxious to introduce electric power,

THE GERMANIA DYNAMO.

In 1888 the Continental Dynamo Company, of New York, commenced the manufacture of the Lahmeyer dynamo, having purchased the rights and designs for the same from the European inventors. Working along continental lines the machines were not well adapted to the American trade, and after a year or two of rather unsuccessful efforts to put the machines on the market, the company determined to give up the attempt and go out of the business. Recognizing the general excellence of the fundamental designs of the machine, the rights were purchased by the Germania Electric Co., of Boston, and the whole matter of the mechanical and electrical construction carefully gone over with the result of producing a self-regulating machine of slow speed and most compact construction.

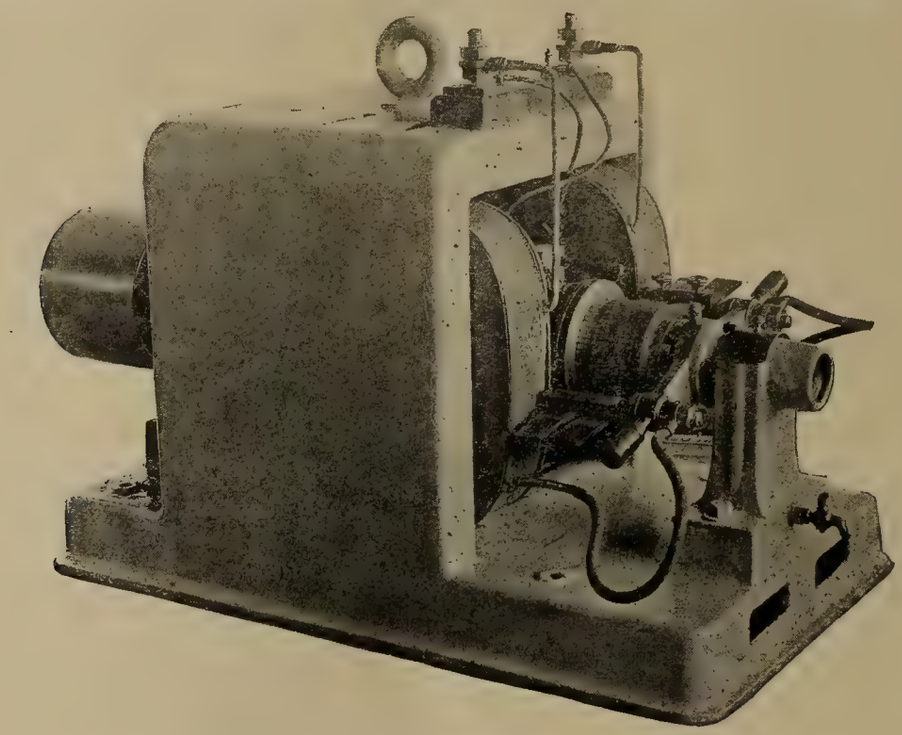
The machine here represented is compound-wound of seven kilowatts capacity, and is the type adopted for all sizes from three to thirty-three kilowatts at all voltages. It has been found, however, that for machines smaller than three kilowatts as well as for the larger sizes a four-pole type is both more efficient and cheaper in construction, and has been accordingly adopted. The field-magnets are of one heavy piece laminated in the casting with the bearings bolted to surfaces which are bored concentric with the journal and armature, thereby securing perfect alignment together with an exceedingly stiff construction. The bearings themselves are of the self-oiling, loose-ring type, and are cored large enough to contain a plentiful supply of oil and allow a deep settling space for all dirt or grit.

No gauges are provided on these oil-chambers since it is believed to be the better plan to require a certain amount of attention to the bearings from the dynamo-tender, who will never otherwise give them the slightest thought until he feels they are getting hot, when it is already too late to apply moderate remedies.

In the four-pole motors and dynamos smaller than three kilowatts the journals are not babbited, but are of cast-brass bored and reamed to a standard size, making a more perfectly interchangeable fit and giving durable bearings even under great speeds, which are often required for special service. In all types the boxes are long and the shaft large and hung low, making the dynamo free from annoying and destructive vibration in running, which is in accordance with the exceedingly simple and stiff general design at once apparent from an inspection of the cuts.

The commutator is large and heavy, of pure copper, and the wires leading into it are neatly laid down to the surface of the winding. There is, therefore, no accessible space for the accumulation of dirt, and the wires, being supported, are not subject to becoming loose from their fastenings by the vibration in running, as is often the case where the wires are led straight across from the periphery of the armature to the commutator-bars. The brush-holders have great carrying capacity and are provided with heavy copper brushes in all the larger machines—carbon under heavy constant loads having been found to increase the heating at the commutator and connections by reason of the increased resistance.

In either the compound-wound or plain shunt machines the magnetism of the field is carried to such a point that but one or at most two layers of wire are necessary on the armature, which in consequence is of very low resistance, and by thus reducing the air-space the permeability of the magnetic circuit is increased; and while the fields are of great magnetic power they are still kept far from the saturation point of the iron This construction of a few layers of wire on the armature not only makes it more perfectly balanced, but also facilitates any repairs either to the commutator or the winding of the armature, while the field-magnets may be easily removed on the spools in a few minutes after the armature has been taken out.



THE GERMANIA DYNAMO.

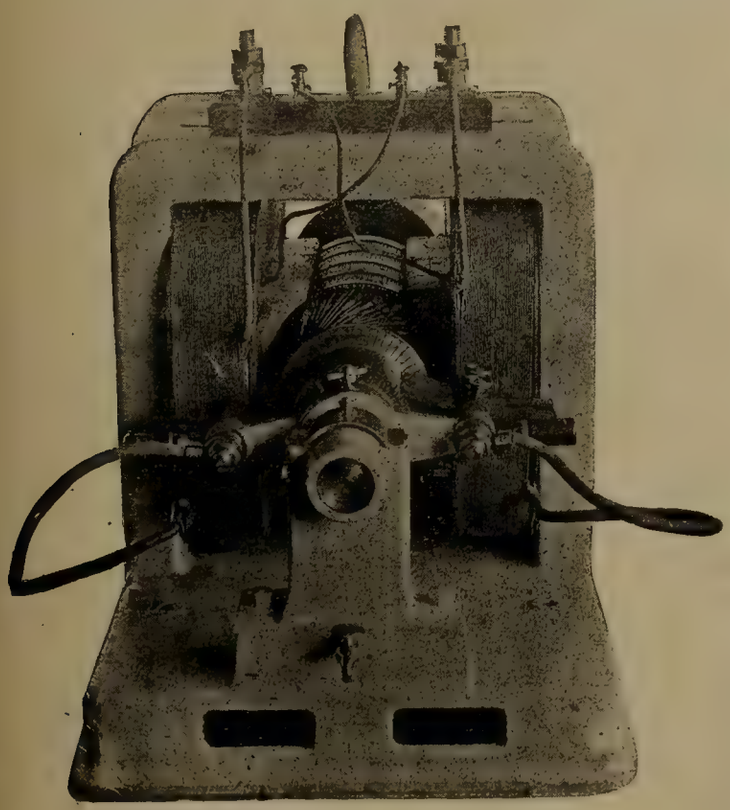
The sliding base provided with these machines allows the screws either to push or pull against the belt, which is an important consideration wherever the machines are placed side by side in a confined space.

While not being, therefore, an entirely new design, having been built upon the Lahmeyer type, the machine both in appearance and construction has been brought up to the highest standard of American engineering, going beyond our general practice in the matter of speed, requiring for the eleven kilowatt dynamo nine hundred revolutions, falling to six hundred for a thirty-three kilowatt machine. In this form the old Lahmeyer machine has become a part of the de Khotinsky system which is fast being completed by the Germania Electric Company, and which comprises a system of lamps, dynamos and secondary generators of new design already proved successful in Europe.

AMPEREMETERS AND VOLTMETERS, AND THEIR USES.*

BY FRANK KITTON.

From a business standpoint it is very desirable that we should be able to calculate the cost of producing electric light and power, and in order to do this we must first ascertain the energy required to operate the lamp or other device. This is accomplished with the aid of the ammeter and the voltmeter, and applying the law for determining electric power. This law is closely allied to Ohm's law, and is expressed in algebraic formula thus: $W : C \times E$. W is the symbol used to denote "watts," which is the unit of electric power, sometimes called the volt-



END VIEW OF GERMANIA DYNAMO.

ampère, because the E. M. F. in volts multiplied by the current in ampères equals in watts the energy developed in an electric circuit.

Power is the rate of doing work. The watt is the power developed in a circuit, in a unit of time, when one ampère of current flows through it under a pressure of one volt E. M. F., and is capable of performing 10,000,000 ergs of work per second. The erg is the C. G. S. unit of work—*i.e.*, the work done when unit force is overcome through unit distance.

By combining this and Ohm's law several formulas are obtained, which may be stated concisely as follows:

1st. The electric power in any circuit is proportional to the product of the quantity of electricity per second that passes, in ampères, and the difference of electric potential, in volts. $W = C \times E$.

2d. The electric power varies directly as the resistance when the current is constant, or as the square of the current if the resistance is constant. $W = C^2 \times R$.

3d. The electric power is inversely as the resistance when the E. M. F. is constant. $W = \frac{E^2}{R}$.

Therefore, if we know the value of any two of the properties of an electric circuit, we can by this law calculate its power.

The energy in watts required to operate a lamp under the conditions where $C = .5$ ampères and $E = 110$ volts, is $W = C \times E = .5 \times 110 = 55$ watts. It is further necessary that we should know what is received in return for the 55 watts of energy expended; or, in other words, the amount of light given by the lamp when that energy is supplied to it. Other measurements are therefore necessary. For this purpose the photometer, an apparatus for comparing the intensity of the light given with some standard light, is employed.

This is said to be determining its candle-power.

A standard candle is one of definite composition, which with a given consumption, in a given time, produces a light of fixed and definite brightness. Such a candle is one burning 120 grains of spermaceti wax in one hour, or two grains in a minute.

There are various ways of comparing a light with a standard candle. The apparatus here this evening is known as the Bunsen photometer, in which a vertical piece of paper, with a grease spot at its centre, is placed inside a dark box provided with two mirrors, placed at such an angle to the paper that both sides of the paper can readily be seen at the same time. The paper is exposed to the illumination of the standard light on one side and the light to be measured on the other. By sliding the box along the graded scale it is finally brought to a position in which the grease spot appears equally bright on both sides. This is the position in which it is equally illumined by both lights, and their respective intensities are then directly as the square of their distances from the sheet of paper, and may be determined as follows: The unknown light is to standard light as their respective distances from the paper are to each other; or, $X : L :: Xd^2 : Ld^2$.

If we find the intensity of the light to be 16 C. P., the lamp is said to have an efficiency of $\frac{55\ W}{16\ C.P.} = 3.4$ watts per candle-power.

Having arrived at the intensity of the light by this means, ascertained the energy in watts required to produce it by means of the ammeter, which gives the strength of current flowing through the lamp in ampères, and from the voltmeter reading its E. M. F., it requires but little calculation to show how much light may be obtained from a generator of given capacity. By means of suitable test instruments this investigation may be carried down, step by step, from the generator to the engine, thence to the boiler and furnace, and we finally arrive at the quantity of coal which must be consumed by combustion to produce a light equal in intensity to one candle-power; or, if you please, the cost of that light in dollars and cents.

*Abstract of paper read before the Buffalo Electrical Society.

OLD-TIME AND MILITARY TELEGRAPHERS.

The Society of the United States Military Telegraph Corps and Old-Time Telegraphers' Association will hold their twelfth reunion in Omaha, Neb., September 14 and 15 next. The headquarters will be the Bee Building. The business meeting of the Old-Time Telegraphers' Association will be held at 10 A.M. September 14, and that of the United States Military Telegraph Corps at 2 P.M. on the same date. A banquet will be given at the Millard Hotel, and an excursion to Denver will be made. Special hotel rates have been secured in Omaha for the delegates and their families.

EARTH-CURRENT MEASUREMENTS.

BY WILLIAM FINN.

The very interesting account by Mr. J. W. Camp of the effects of the recent magnetic storm upon some of the Canadian lines, which appeared in the ELECTRICAL AGE of July 30, would have possessed greater scientific value had some more precise observations been made of the strength of the currents and the value of the electromotive forces developed in the wires on that occasion. The writer is aware that comparatively few offices possess the necessary facilities for making these tests, which probably accounts for the absence of such data in this particular case. It is probably safe to say, however, that even where the apparatus is available, its use is not generally understood, and he is therefore induced to briefly describe the *modus operandi* and explain the principles involved in measurements of this kind for the benefit of those who desire such information.

The tangent galvanometer is probably the most convenient and suitable instrument for that particular purpose, as it undoubtedly is for the general study of earth-current phenomena.

The principle of the tangent galvanometer depends upon the fact that the value of the current circulating through its coils is proportional to the tangent of the angle through which the needle is deflected. In order that this value may be expressed in suitable units, the "constant" of the galvanometer must first be obtained. This is simply a process for ascertaining to what extent the needle will be deflected by a unit amount of current. The unit current employed in this case is the milliampère which is the $\frac{1}{1000}$ part of an ampère.

In taking the "constant" of the galvanometer an ordinary gravity cell, regarded as a standard, whose electromotive force and resistance may be taken as 1.07 volts and 2 ohms respectively, can be placed in circuit with, say, the 200 ohms coil of the galvanometer, and as much additional resistance as will make a total resistance in the circuit of 1070 ohms, thus :



TAKING THE "CONSTANT" OF THE GALVANOMETER.

Then by Ohm's Law ($C = \frac{E}{R}$) the currrent flowing through the galvanometer will be

$$\frac{1.07 \text{ volts}}{1070 \text{ ohms}} = .001 \text{ ampère},$$

or

$$\frac{1.07 \times 1000}{1070} = \frac{1070 \text{ millivolts}}{1070 \text{ ohms}} = 1 \text{ milliampère},$$

and the tangent equivalent of the deflection obtained in degrees will represent the constant divisor to be used in all subsequent measurements. Suppose, for instance, the "constant" obtained under the above conditions is 22° the tangent equivalent of which is .404, and an earth-current of unknown strength deflects the needle to 7°, the tangent of which is .123, the value of the unknown current will be as tan. 23° : tan. 7°, that is

$$\frac{.123}{.404} = .3 \text{ milliampère, nearly.}$$

The *normal* earth-currents seldom exceed this figure, but the abnormal ones give deflections either entirely beyond the range of the galvanometer, or so inconveniently high as to necessitate the use of a shunt across the terminals of the galvanometer in order that a portion only of the current may traverse the instrument coils.

The amount of resistance required in a shunt of any value is determined by the formula

$$\text{Shunt} = \frac{G}{n-1},$$

where G represents the galvanometer resistance and n the ratio desired. If, for example, a tenth shunt is needed for the purpose of securing a readable deflection, the resistance of the shunt must be

$$\frac{200}{10-1} = 22.2 \text{ ohms.}$$

In that case, of course, the true value of the received current will be ten times that measured by the deflection of the needle, since a tenth part only of the current strength is exerted upon the needle.

The difference of potential between the opposite ends of a grounded wire upon which a reading has been taken is determined by multiplying the strength of the current into the resistance of the wire (CR=E) and dividing the product by 1000, which will then express in volts the electromotive force developed in the wire at the time of observation.

The following actual test made with a galvanometer whose constant is 22° and which was provided with a tenth shunt will perhaps convey a clearer idea of the methods adopted in arriving at the above results :

At 12:09 P.M. on the day of the great storm an earth-current in a wire measuring 2700 ohms gave a reading of 44 on the degree scale, the tenth shunt being in circuit at the time. Now the tan. of 44° is .965 and the tan. of 22° is .404, so that the strength of the current—allowing for the use of the shunt—was

$$\frac{.965}{.404} \times 10, \text{ or } 24 \text{ milliampères,}$$

and the difference of potential between the distant grounds, according to the formula (CR=E) was $24 \times 2700 = 64800$ millivolts, or

$$\frac{64800}{1000} = 64.8 \text{ volts.}$$

It will be evident that this system of measurement may also be applied to the determination of similar quantities in the case of regular telegraphic currents as well as in a variety of other cases.

The following additional information regarding the electric storm of July 16 will be read with interest. The appearance of the great sun-spot on that day coincided exactly with the period of maximum disturbance noted in telegraph lines all over this continent.

The most intense current obtained was on an eastern wire at 12:29 P.M., when the strength attained a momentary value of 280 milliampères, there being at that moment a potential difference of 644 volts between the opposite ends of the wire.

The direction of minimum disturbance was approximately north and south, which corresponds with the result of all previous observations, and also coincides with the line of least intensity of the normal earth-currents.

NOTE ON SOME EXPERIMENTS WITH ALTERNATING CURRENTS.*

BY DR. LOUIS DUNCAN,

Assisted by Mr. E. R. Carichoff and Messrs. R. H. and G. E. Hutton.

(*Continued from page* 463.)

An excellent way to make an iron core, by the way, is to shellac fine, well-annealed wires, spread them along a piece of thin paper, brush them over with shellac and

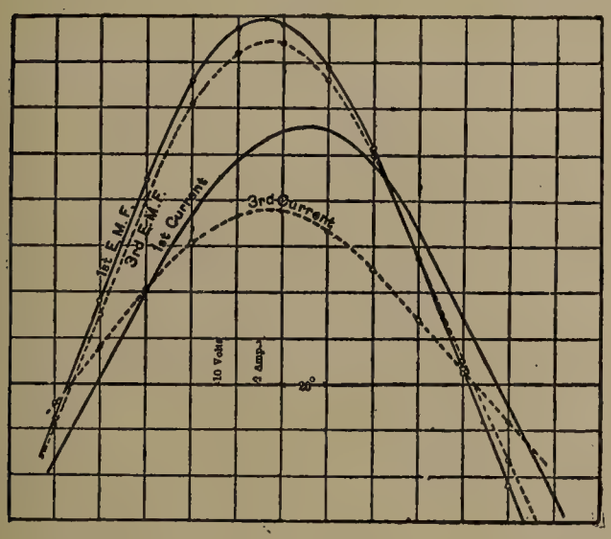


FIG. 4.

then roll the mat so formed into a cylinder. The losses in a condenser are usually small. They are discussed in a paper of Messrs. Hutin and Leblanc, published last spring in *La Lumière Electrique*. We find, however, that if the condenser is made of very thin tin-foil and has a large area, then for heavy currents it may considerably decrease in capacity and offer a definite resistance to the current.

The curves given have been selected almost at random from a mass of data. We have not the time to discuss

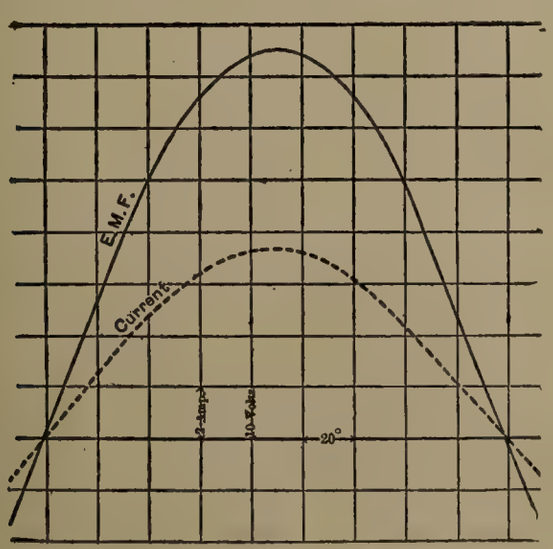


FIG. 5.—DYNAMO DIRECT ON LAMPS.

the results, which are hardly within the scope of this paper. Figure 4 gives the curves at the two ends of a transmission plant where the voltage was raised from 50 to 1,000 volts and reduced again. Fig. 5 gives the curves for the dynamo directly on the same lamps. It is seen that the transmission decreases the E. M. F. and current, and increases the lag of the dynamo current.

Figs. 6, 7, 8 and 9 give curves taken from the dynamo circuit when self-induction and capacities were inserted. In Fig. 6 the core of the induction coil was only fairly well laminated, and a condenser with copper sheets between paraffined paper was used. The maximum current is a little over 1.2 ampères, while it should have been about four ampères if there were no losses in the circuit. The second point of crossing is thrown out by a change in speed of the dynamo. Fig. 7 shows the result of substituting a tin-foil condenser of the same capacity in place of the copper one. In Fig. 8 both condensers were used and a considerable part of the wire core was withdrawn.

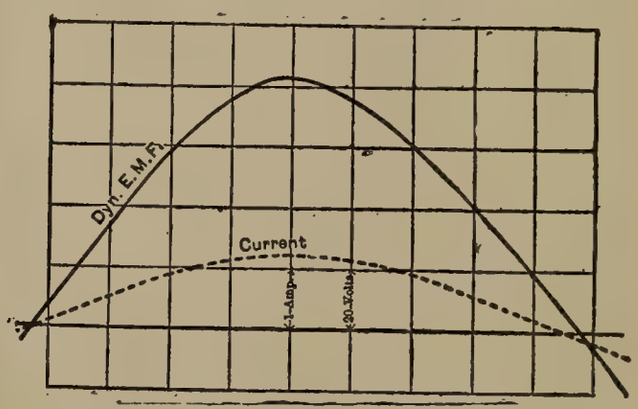


FIG. 6.

In Fig. 9, with the same two condensers, a solid iron bar was used as the core of the induction coil.

Fig. 10 gives the curves obtained in the circuit of a dynamo connected to a transformer whose secondary circuit was open.

Discussion.

Prof. Henry S. Carhart: Mr. Chairman, I wish to say a word, not at all in criticism of Dr. Duncan's paper, but rather to give some of my own experience in this matter. We have succeeded, by a very simple means, in getting these curves with only two observers, taking 20 points in five minutes. I have written off a few of the curves, but they are on a small scale. The apparatus is in general similar to that used in the older method, connected to the end of the shaft of the armature, with sliding contact.

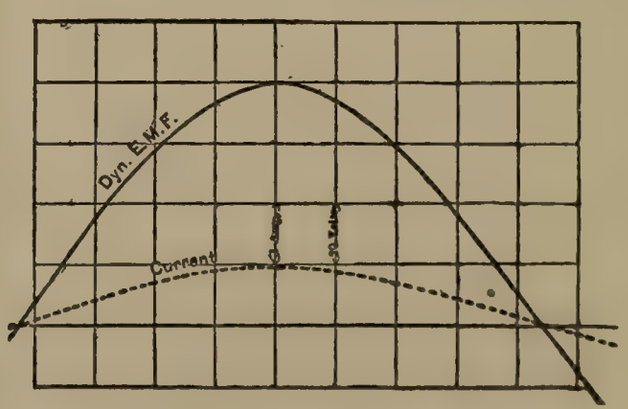


FIG. 7.

The instrument is well made and has worked perfectly from the start. The shunt is taken off from a single lamp of non-inductive resistance, 24 lamps across the primary. The current was 10,000 volts. I am not certain yet whether the lag between the current and the electromotive force comes out properly or not. In that case we use a galvanometer. In another instance the same apparatus is used, except that we use an electrometer. They

*Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6, 1892.

came out better and faster, and are very satisfactory. The calibration was what I was about to speak of. An instrument made under precisely the same conditions with saturated paper, was put in place of the shunt around the lamp, and then run through the machine in exactly the same way, and through a commutating arrangement on the machine. We run this with precisely the same

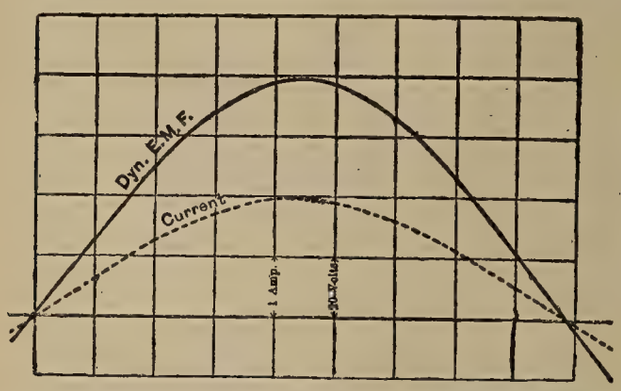


FIG. 8.—TINFOIL IN PARALLEL WITH COPPER CONDENSER WITH COILS. CAP. 2.675 M.F.'S. WIRE CORE.

apparatus. Dr. Duncan's method very likely worked more rapidly, but this certainly answers very well for ordinary purposes.

Dr. Edward L. Nichols: I should like to say, Mr. Chairman, that it seems to me that the paper, together with other work which we know of that is going on at the present time along these lines, goes to show what progress has been made in this kind of measurements within the last few years. We can all remember the time, when to get such curves at all was regarded as an achievement, a little later on it took an hour, then 45 minutes was boasted of as something wonderful. Now we have the statement that these simultaneous curves were obtained in five minutes. Professor Carhart tells us that he has taken them by the old method in five minutes. The world has seen great development in alternating-current measurements. It seems to me that Dr. Duncans' paper is chiefly important, therefore, not on the question of rapidity, but in the fact of getting absolutely simultaneous values for two curves, so that no change can take place between the taking of the electromotive force curve and of the current curve. There is no lapse of time during which some change of condition might occur to vitiate the result.

Prof. Carhart: I forgot to say, Mr. Chairman, that

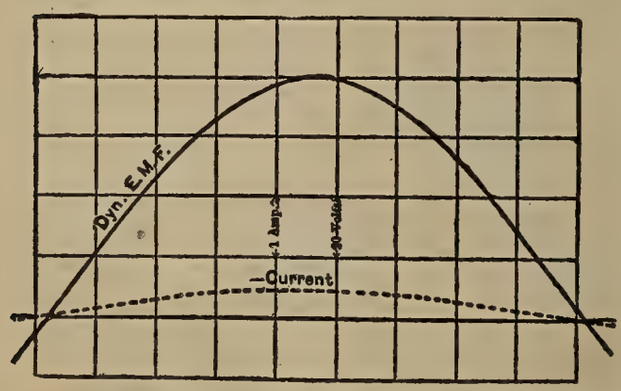


FIG. 9.—TINFOIL IN PARALLEL WITH COPPER CONDENSER. 2.675 M.F.'S. SOLID $1\frac{3}{4}$" IRON CORE. RESISTANCE OF CIRCUIT 20.3 ω.

our apparatus was provided with two discs, but we could just as well have put on four, and got three of four contacts at the same time, and measured three of four curves at the same time.

DEVELOPMENT OF THE TELEGRAPH.

The first experiments in connection with the electric telegraph were made in the last century; static electricity was employed for the transmission of signals. The first electric telegraph was constructed at Geneva by Lesage in 1774, who made use of 24 wires, each of which was connected with a separate pith-ball electroscope representing a letter of the alphabet. Lomond in 1787 and Ronalds in 1816 followed in the same track. In 1774, as a substitute for the pith-ball system of Lesage, the use of illuminated letters made with metal spangles on glass plates was suggested by Reusser.

Voltaic electricity was first brought into use for telegraphing by Sömmering in 1808, who employed 35 water voltameters, each one being connected with a separate wire and giving separate signals. Coxe, Smith, Bain and others subsequently experimented in a similar direction.

The use of 24 galvanometer needles connected to separate wires was proposed by Ampère in 1820. Then came Schilling in 1832, and Weber and Gauss in 1833, who used a single needle, the alphabetic signals being indicated by deflections of the needle to the right or left. This system was greatly improved by Steinheil, who employed two needles, one affected by the positive and the other by the negative current, and both deflected in the same direction, the alphabetic signals being produced by bells

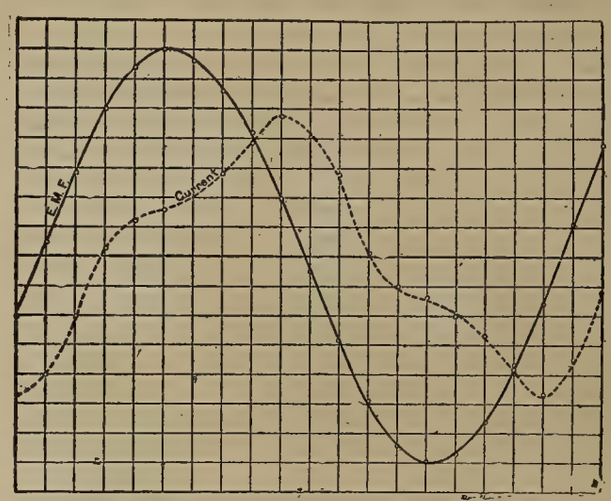


FIG. 10.—SIEMENS DYNAMO ON TRANSFORMER; SECONDARY OPEN. CURVES TAKEN WITH EXPERIMENTAL DYNAMOMETERS.

struck by the needles, also by dots made with ink on a moving strip of paper, and by observing the movements of the needle with the eye.

Steinheil, in 1838, also discovered that the current could be carried with a single wire, the earth being employed for the return circuit.

The needle telegraph was introduced into England by Cooke and Wheatstone, in 1837, and the first telegraph line ever used for commercial purposes was constructed by them on the system of the London and Birmingham Railway. It originally consisted of five underground wires connected with five separate needles. This system was afterwards modified; two wires connected with two needles in one method, and a single wire and needle in another method, being employed.

Signals by sound produced by the movements of the armature of an electro-magnet were transmitted by Henry, in 1831; and in 1835 Morse gave to the world his telegraph system, operated in a like manner. The alphabetical signals, which consisted of dots and dashes, were reproduced on a moving strip of paper, at first by a pencil but afterwards by a steel point, which embossed them

on a grooved roller over which the paper was moved by clock-work operated by a weight.

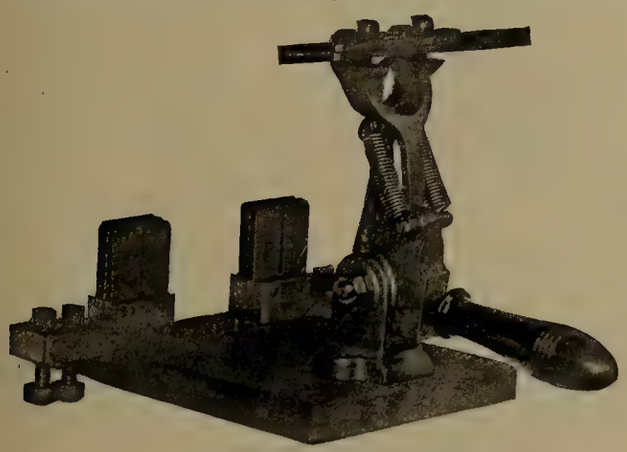
The first telegraph line built in the United States was by Morse, between Baltimore and Washington, the first message being sent on May 27, 1844.

The subsequent development, improvement and rapid growth of the telegraph system and the important part it played in the late war is contemporaneous history, and does not need any further description.

NEW INSTANTANEOUS SWITCHES.

The need of an effective instantaneous switch for use on railway and high-tension circuits, and one which can be relied upon to respond immediately to the desire of the station operator and break the circuit instantly while avoiding the dangerous and costly arc, has been long felt in all the numerous stations in this country. Many expedients have been tried, and the number of different types of switches which have, more or less speedily, found their way to the scrap heap is already sufficiently large to elicit admiration at the expense of ingenuity of conception. But these transitory and experimental devices have served to crystallize the idea of what a perfect snap-switch should be to fulfil the requirements of the station.

The cross-bar instantaneous switch, the invention of the General Electric Company, is the latest high-voltage instantaneous snap-switch, and appears to be the most perfect device yet produced. As its name indicates, it is



CROSS-BAR SWITCH OPEN.

a switch having its contact-blade at right angles to the actuating lever. The terminal clips are placed opposite each other, but widely separated, and as soon as the cross-bar simultaneously enters both clips the circuit is closed. This cross-bar is loosely supported in the paws of the lever by two steel pins, and a small steel spring serves to press the bar against the lever so that it will enter the clips truly and make full and easy contact with both inside faces of the clips. Practical use has shown that this flexible method of mounting the cross-bar increases the durability of the switch, the alignment of the parts being rendered less liable to destruction by violent or careless handling. The snap or instantaneous action of the switch is obtained by means of two strong spiral springs, which are attached both to the handle and the lever. The movement downward of the handle distends the springs to that point of tension which compels the obedience of the lever, and the cross-bar flies out from the clips, breaking the circuit at two points, thus reducing the possibility of arcing to a minimum. When the switch is fully opened a catch-spring retains it in position, and an accidental closing of the circuit is rendered impossible; this small spring also serves to give a snap action to the switch when the circuit is established.

The principal novel points in this switch are: considerable distance between the clips, an absolutely instantaneous breaking of the circuit and a perfect flexible and frictional contact. The smaller sizes have the cross-bar



CROSS-BAR SWITCH CLOSED.

in a single piece; those of larger capacity are provided with a double parallel bar as shown in the illustrations.

SPEED AND ALARM-BELL INDICATOR.

The accompanying illustration shows one of the neatest and most useful pocket tools for electricians and others that has been lately put on the market.

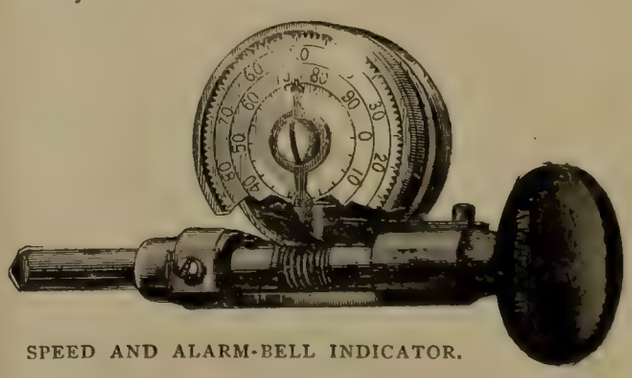
"The Gem" Double Speed Alarm Indicator implies, in the name, about all there is to be said to explain of the character of this invention.

It is a very neat combination of a speed-indicator and alarm-bell. It is nickel-plated, and in size is only $3\frac{5}{8}$x$1\frac{1}{2}$x$\frac{7}{8}$ inches and may be easily carried in the vest pocket.

To use the Gem Indicator, apply the engaging point to the shaft of the machine being tested and, with watch in hand, wait until the bell rings. Upon the ringing of the bell begin to observe the time and continue as long as may be desired, it being simply necessary to count the strokes of the bell thereafter, each stroke indicating 100 revolutions. Upon expiration of time limit remove the indicator and add any fraction of 100 that may be shown upon the dial to the full hundreds previously counted by bell strokes.

The handiness of this instrument will be readily appreciated by engineers, lathemen, dynamo-tenders and those who have to do with machinery and engines of all kinds.

Every owner of an electric fan should have one of



SPEED AND ALARM-BELL INDICATOR.

these "Gems" to test the work that their motor may be doing.

Messrs. The E. S. Greeley & Co., 5 and 7 Dey st., New York, who are placing these goods on the market, anticipate a very large sale for them.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Magnetic Effect of Electro-Magnet Cores.

Every one who knows anything at all about an electro-magnet, whether it is on a dynamo, electric motor or telegraph instrument, knows that one of its parts is called the "core."

The "core" of an electro-magnet is a very important feature. It consists, as is well known, of a short piece of an iron rod of small diameter, in the case of telegraph instruments, and in the case of dynamos solid cylinders of iron are used, the diameter varying according to the size of the machine.

In all electric machines having an electro-magnet the wire is wound around the iron core. This core is made of the softest iron obtainable, because such iron readily parts with its magnetism when the current which produces the magnetism ceases, and on the other hand, it promptly acquires magnetism when the current is caused to flow through the wire with which it is surrounded.

The important function of the core of an electro-magnet is to concentrate the magnetic lines of force.

It is well known that when an electric current passes through a wire the air immediately surrounding the wire

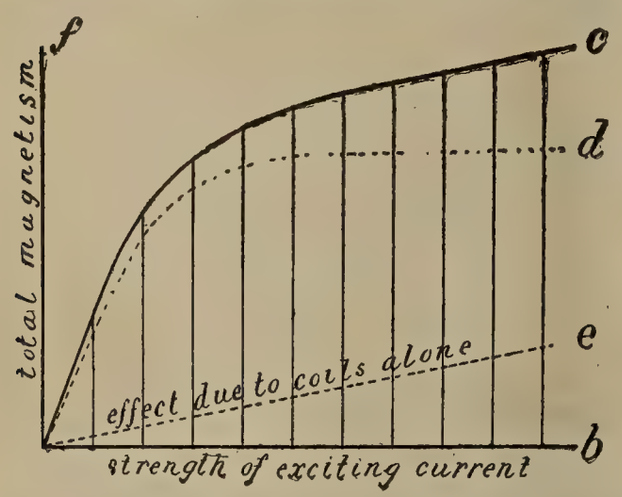


DIAGRAM SHOWING INFLUENCE OF A CORE IN AN ELECTRO-MAGNET.

becomes magnetic, which can be proved by the effect produced upon a compass-needle. The space so affected is called the magnetic field, and the magnetic influence is stronger near the wire than it is further away, the rate of decrease being as to the square of the distance.

Suppose we have a piece of wire 10 feet long, and a current is passed through it; the magnetic influence produced thereby will have a given effect on a compass-needle. Now if we take and make one turn of it around the compass the effect on the needle will be much stronger, because a greater length of the wire carrying the current is brought nearer to the needle. Take the same 10 feet of wire and make ten turns of it around the needle, the effect will be ten times greater than with one turn, because ten times as much wire surrounds the needle than before, although the original strength of the current remains unaltered.

From these considerations it will be at once understood why the wire of an electro-magnet is wound in many turns and layers. It is simply to multiply the magnetic effect of the current and concentrate it into small space.

An electro-magnet without an iron core would still be an electro-magnet, but its magnetic effect would be much weaker. The lines of force due to the current would radiate in every direction from the wire, and the magnetic field would be comparatively weak, but the moment we insert an iron core into the magnet we get vastly changed results. The core draws to itself a great part of the lines of force, thus concentrating the magnetic field, and consequently making it stronger. This property of iron is called its "permeability."

The magnetic "permeability" of any substance means the ease afforded to the passage through it of lines of magnetic force. Soft iron possesses the greatest magnetic permeability; in other words, it offers the least resistance to the passage of magnetic lines of force, and it is for this reason that these lines of force in an electro-magnet take the iron path in preference to that of the air. The magnetic resistance of air is high compared with that of iron—in other words, its permeability is low.

Although iron has great permeability, yet there is a limit to the number of lines of force that can be urged through it. There is no limit to the number of lines that can be forced through air. When iron has received all the lines that it can transmit it attains a condition that is termed "saturated," that is, it can carry no more. Its permeability decreases as the number of lines of force passing through it increase, and beyond certain limits it requires a considerable increase in current strength to effect a slight increase in the magnetic effect. It is therefore uneconomical to try to produce stronger magnetic effects by increasing the current after the iron has become saturated, or nearly so.

The accompanying diagram shows in a very clear manner the magnetic effects produced by a coil without a core, and the same coil with a core.

The horizontal line *b* represents graphically the strength of the magnetizing current. The line is divided into ten parts, each part representing one-tenth of the total strength of the current. We can now represent the magnetic effect of the coil without its core by drawing a straight line *e*.

It is evident from this that the magnetic effect increases in direct proportion to the increase of current. This can be proved by measuring the perpendicular height of the intersection of the line *e* with the upright divisions. We will find that the height of this line on the second upright is twice that of the first; that of the third three times that of the first, and so on. Now, if we draw lines from these intersecting points parallel with the line *b*, to meet *f*, we can thus represent to the eye the relative magnetic effects produced by the various strengths of current.

At this point it may be stated that the line *f* represents the magnetic strength produced under the different conditions, varying from zero to its highest point at *f*.

We have so far considered the effect of the coil without its core. Now we will put the core in and note the result. The heavy black curved line *c* represents the resulting magnetic effects. The magnetism at once is raised in value, as shown by the difference in the angles of the lines *e* and *b*. The core has concentrated the magnetism and stronger magnetic effect ensues.

After the current has attained the strength represented by the third upright division the heavy black line begins to curve. This is because the iron core is beginning to approach the condition of saturation, and a given increase of current strength does not produce a corresponding increase in magnetic effect.

The stronger the current becomes the nearer to a horizontal line does the line *e* approach, for the reasons already mentioned, and when this condition of saturation of the core is reached it is practically useless to increase the current, because we get no increase in magnetism.

The dotted line *d* represents the increase of magnetic effect due to the presence of the core, and is called the "curve of magnetization."

By adding to this line the effects produced by the coil

without its core we get the total effect, as represented by the line *c*.

A careful study of this diagram is interesting as well as instructive, as this method of illustration enables us, by the aid of our eyes, to appreciate effects that could not be otherwise comprehended. It is, besides, a valuable aid in the study of electrical problems.

THE McLEOD HEATING, COOLING AND VENTILATING SYSTEM.

It will be conceded that where there is plenty of fresh air, proper heat and good ventilation, there will also be found health and happiness.

Such a condition as this is of vital importance in all places where a number of people are congregated or employed in business or other pursuits, such as on railway cars, steamboats, in offices, public buildings, schools, factories, electric-light stations, etc.

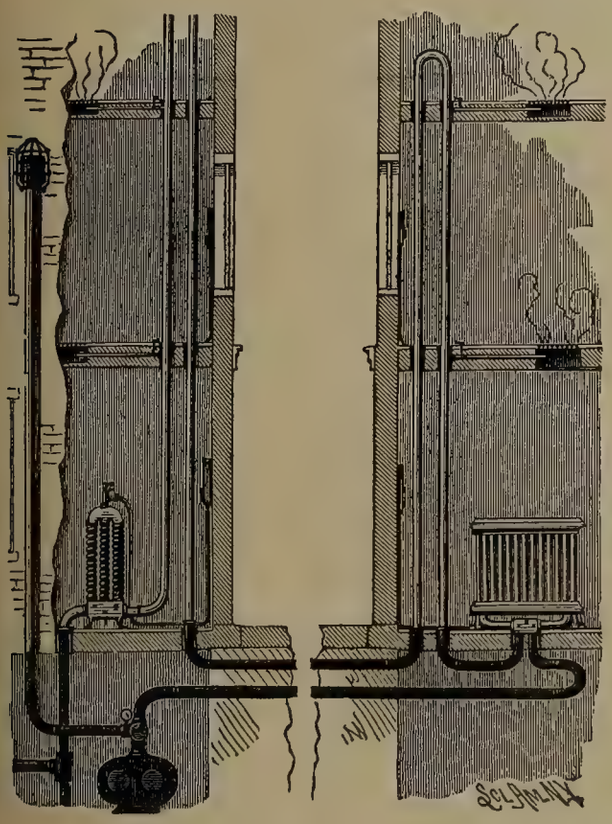


FIG. 1.

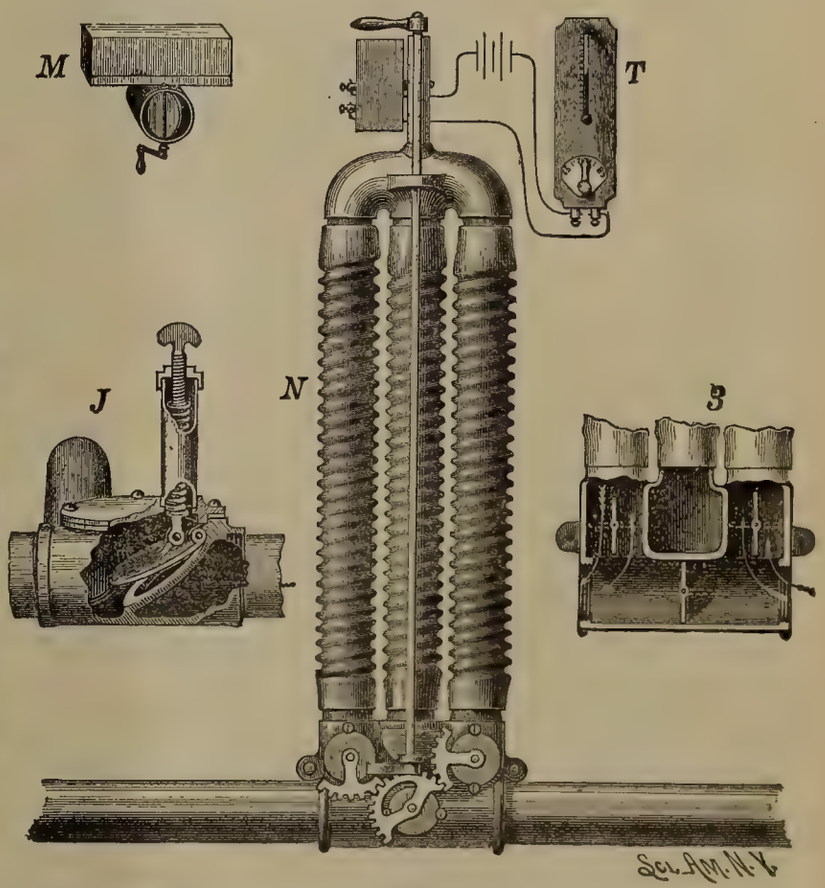


FIG. 2.

For more than twenty years experiments in pneumatics for various purposes, but especially in application to the subject of heating, cooling and ventilating buildings, railway cars, etc., has been carried on by Mr. J. S. McLeod, of Boston, who at last as a reward for his patience and perseverance has the felicity of seeing the result of his labors crowned with success.

Mr. McLeod has all along been aided in his researches by the best expert help procurable, and has succeeded in devising a method of utilizing waste heat for the purpose of heating, cooling and ventilating.

Briefly described, this system consists of circulating fresh air through interior zigzag partitioned heating-drums and coils arranged in a return zigzag flue extending for a suitable distance up the chimney, around which the escaping gases and smoke are made to pass, thus absorbing therefrom all the heat usually passing to waste out the chimney (see Fig. 3), thus utilizing all the heat possible from the burning fuel to heat the current of fresh, clean air driven through the heating apparatus and conveyed with great velocity through a circulating-pipe into as many different buildings and apartments as may be desired, thereby effecting a saving of from 70 to 90 per cent. in the cost of fuel, and furnishing a pure, wholesome heat—hot or cold air direct—so arranged by automatic thermostats that a uniform degree of temperature is obtained all over the house.

It is claimed that the McLeod system is the only one which will distribute hot or cold air as may be desired in large volumes into apartments, or through small sprayers to individuals in the office, school, sick patients, miners underground, or divers beneath the water, etc. (Fig. 6).

Its capacity is unlimited, as plants can be erected to supply any section of a city, dwellings, etc. The mechanism is simple, effective and unique.

Fig. 1 shows the method of distribution through a series of pipes, which may be applied to one or as many buildings, etc., as desired.

In Fig. 2 will be seen the various appliances for controlling the hot air in these pipes, which consist of a series of adjustable radiators, registers and open-air vents, that can be controlled by hand or automatically by thermostatic connection.

The hot air which is not used through the register passes around to the flue end of the heater, is reheated and again circulated ; it is controlled by a blower-pump and adjustable valve J, to admit fresh air through screened head G, and regulate the pressure to about one pound to force circulation through the heater and buildings.

This system is so arranged as to absorb and distribute heat during cold weather, and for cooling purposes during hot weather by forcing cold air through the same pipes.

In the construction of the zigzag furnace (Fig. 3), heating pipes and hot-air tanks, due provision was made for the utilization of all the heat of combustion, and in

combination with the pump to insure a uniform circulation.

As this system can be utilized for the heating of a number of buildings or apartments from a central point, it will be seen that there is a great economy in fuel consumption.

The circulating pipes are connected with different buildings and apartments by branch circuit-pipes provided at their junction with special damper-valves by which the air is diverted to its proper channel, and all designed to work automatically or be controlled by hand.

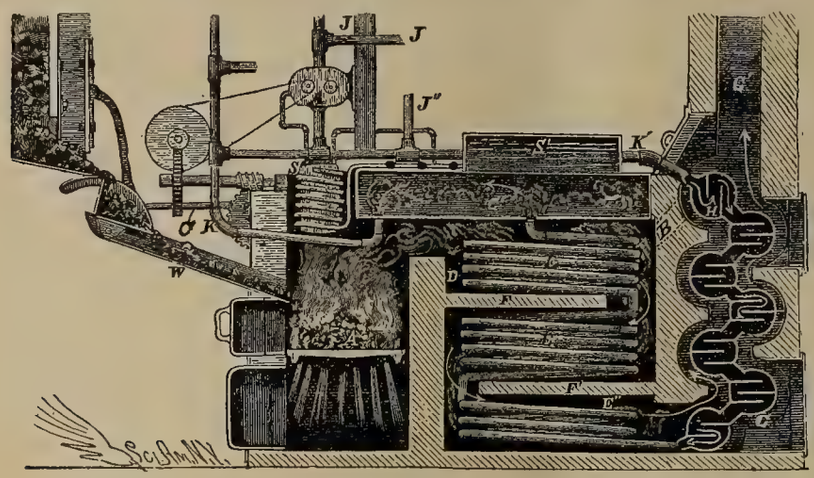


FIG. 3.

When it is desirable to supply cool air the circulating pipes may be disconnected from the furnace; or special pipes may be provided for the purpose and supplied through the register or elastic tubing and spray-jets to desks, seats, etc.

Figs. 4 and 5 show the different styles of spray-jets.

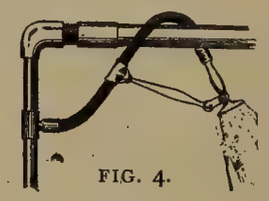


FIG. 4.

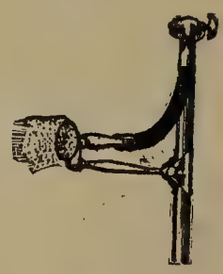


FIG. 5.

A company to be known as The McLeod American Pneumatic Company, with offices at 125–127 Worth street, New York, is being organized to introduce and develop this system; and we have no doubt but that it has a prosperous future ahead of it.



FIG. 6.

NEW BOOKS.

STREET RAILWAYS: THEIR CONSTRUCTION, OPERATION AND MAINTENANCE. By C. B. Fairchild. 434 pp. Profusely illustrated. Street Railway Publishing Company, New York.

This is a practical handbook for street-railway men, and is without doubt the most comprehensive work of its character ever published. It is surprising how much detail the book covers, and it would be hard to mention any one thing pertaining to street railroads, that is not referred to in some way.

The contents of this work, divided by chapters, are as follows: 1, Electric Traction; 2, Cable Traction; 3, Horse Traction; 4, Steam, Air and Gas Motors; 5, Inclined Planes; 6, Rack Rail Inclines; 7, Elevated Roads; 8, Car-Building; 9, Track Construction; 10, Discipline and Rules; 11, Charter Franchise, Stocks and Bonds; 12, Book-keeping and the Classification of Street-Railway Accounts; 13, Leading Types of Cars, illustrated; 14, Auxiliary Appliances, illustrated.

In an appendix to the first chapter motors, generators, electric crossing signals, lightning arresters and automatic track switches are described, and the cost of electric railway construction is given.

Electric traction (chapter 1) is considered from the first principles in electricity and magnetism down through the motor to every detail of electric railway construction and operation, and this chapter is one of the most valuable and interesting in the book, because it enables one who is in childlike ignorance regarding electricity to learn about it in an easy manner, and, step by step, attain a knowledge of electric railroading in practice and theory that will be invaluable. Many of the illustrations used are original and gotten up especially for this book. These have the excellent merit of clearness.

The chapter on cable railways will be of great value, since that system of propulsion is meeting with very extended favor. All of the systems in use are fully described and illustrated, and the designs of the various grips form a conspicuous feature of the chapter.

Elevated roads, although limited in their use to large cities, receive most careful and extended consideration, and the various air and gas motors are duly attended to.

Car-building as a subject takes up an entire chapter, and is probably the most complete matter ever published on this important topic. Every detail is explained, and there does not seem to be anything that is not properly described.

The chapter on track construction necessarily is one of the most important in the book. It is at once scientific and practical, and all forms of track, etc., receive the attention the importance of the subject warrants.

We think that this book will be of great value to every manager of a street railroad, whether it be horse, steam, cable, electric or any other kind. He will have constantly before him facts and figures concerning his own system that will be of great help to him in meeting the practical problems of operation.

Besides that, if he is disposed and has the time he can

learn all about every other system of street-car operation, and in this way broaden his knowledge on the subject in general, which increase of knowledge will tend to improvement in his particular line, to his own satisfaction and that of the stockholders and public.

The author invites criticism for the purpose of improving future editions of the book. Since he asks that errors be pointed out we will take the liberty of calling attention to one point. On page 56 the reference to "difference of potential" might, we think, be made clearer for the benefit of the student. When we speak of a difference of potential or anything else, two things or conditions are implied. In the case of electric potential two points separated by some appreciable distance is meant. If we take an electric circuit and connect therewith a source of electricity, a difference of potential will exist between any two points on that circuit, whether these points be the two ends of the wire or two intermediate points, or an intermediate point and a terminal. The potential is highest at the starting-point of the current and lowest at the point where it returns to the generator. It is evident, therefore, that the potential at two intermediate points cannot in any case be as high as that of the starting-point, and the difference between two such points must necessarily be between the highest and lowest points of potential on the circuit. Therefore we think that the statement that potential difference is "the difference between the highest and lowest points on the circuit" is not strictly correct. It might be in a given case, but for a general definition of the term we think the text could be altered with advantage.

We call attention to this point, not in the spirit of criticism, but in obedience to the author's request to have errors and omissions pointed out, so that he may be enabled to improve the future editions of the book and bring it up as near the perfection mark as possible. It is an excellent book, and the author's desire to have it correct is a laudable one.

We also notice several typographical errors, but these are concomitant, as a rule, with the first edition of a book, especially a book on a diversity of subjects, and with such a large amount of reading-matter.

A NEW ELECTRIC WIRING COMPUTER.

The application of scientific principles to practical uses involves the frequent use of formulas, and in no branch is this perhaps more exemplified than in the case of electricity, in which the constantly recurring formulas demanding solution are a continual source of drudgery to the electrician. Anything therefore which will tend to simplify necessary but unpleasant work must be hailed with delight. Diagrams have in many cases been made use of, but they require too much care in following out the various lines representing the different factors.

We present to our readers a device of another kind, compiled by William Cox, by means of which the sectional area and the number of wire suitable for lighting and other purposes are readily determined.

It consists of a suitable foundation plate, with a revolving circular disc about 8 inches in diameter, both graduated in accordance with the factors of the formula whose solution it gives. This is the well-known one

$$\text{C. M.} = \frac{l \times c \times 10.8}{v},$$

in which

l—whole length of circuit in feet,

c—current in ampères,

v—drop of potential volts,

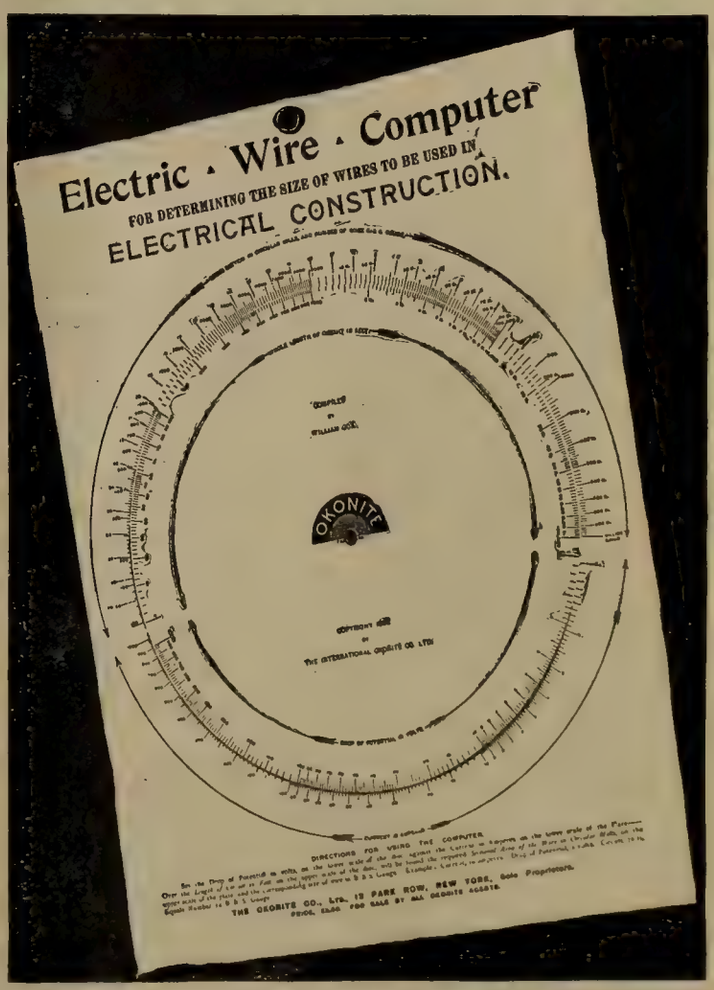
C. M.—sectional area of suitable wire in circular mils.

We will illustrate the method of using this computer by the following example, in which we have 76 feet as the whole length of circuit, current of 10 ampères and loss of 2 volts: Turn the disc round until the division representing 2 volts is opposite and coincides with the one representing 10 ampères. We shall now find on the outer upper scale 4,100 circular mils, which corresponds to No. 14 wire, B. & S. Guage. This is, therefore, the number of the wire suited to the circumstances.

We understand that Mr. Cox has sold his invention to the International Okonite Company (Limited), 13 Park Row, New York, to whom all inquiries concerning the same should be addressed.

LEAD OF BRUSHES.

The self-induction due to the armature of a generator chiefly determines the lead of the brushes. If it is great, and the field is weak, the lead will be considerable. If it is small, and the field be powerful, the lead will be small also. But in the case of a motor exactly the reverse is the case. Here the self-induction, being in the reverse sense, tends to diminish the lead. When a motor is desired to run in a particular direction the lead must be determined to give in that direction the strongest mechanical effect. If the brushes be set with no lead the armature will be apt to run in either direction, as it



ELECTRIC WIRE COMPUTER.

may happen to be started, but without exerting its maximum effect. In cases where the motor is required to reverse its direction of running, by reversing the current (as is frequently done) the brushes must not be given any lead. There is, however, an element of uncertainty that the motor shall reverse its direction of turning upon a reversal of the current. It is immaterial whether, in the case of a series motor, the current is reversed in the armature or in the field-magnet.

Although almost any type of continuous-current dynamo may be used as a motor, yet makers usually produce specially-built machines for this purpose. As a rule, motors, especially if used for propelling vehicles, must

be more heavily built than dynamos. They are subject to greater strains, and the mechanical arrangement of the induction coils, the core and the shaft of the armature must be as solidly constructed as possible. This is especially true of the connections between the coils and the core. The wires are preferably sunk permanently, with hard insulation in channels in the core. The core, if built of plates, must be properly keyed or "feathered" upon the shaft.

THE AURORA.

In all the northern regions of the earth the Aurora Borealis, or "Northern Lights," is an occasional phenomenon; and within and near the Arctic circle is of almost nightly occurrence. Similar lights are seen in the south polar regions of the earth, and are denominated Aurora Australis. As seen in European and American latitudes, the usual form assumed by the aurora is that of a number of ill-defined streaks or streamers of a pale tint (sometimes tinged with red and other colors), either radiating in a fan-like form from the horizon in the direction of the magnetic north, or forming a sort of arch across that region of the sky. A certain flickering or streaming motion is often discernible in the streaks. Under very favorable circumstances the aurora extends over the entire sky. The appearance of an aurora is usually accompanied by a magnetic storm affecting the compass-needles over whole regions of the globe. This fact, and the position of the auroral arches and streamers with respect to the magnetic meridian, directly suggest an electric origin for the light, a conjecture which is confirmed by the many analogies found between auroral phenomena and those of discharge in rarefied air. Yet the presence of an aurora does not, at least in our latitudes, affect the electrical conditions of the lower regions of the atmosphere. On September 1, 1859, a severe magnetic storm occurred, and auroræ were observed almost all over the globe; at the same time a remarkable outburst of energy took place in the photosphere of the sun; but no simultaneous development of atmospheric electricity was recorded. Auroræ appear in greater frequency in periods of about 11½ years, which agrees pretty well with the cycles of maximum of magnetic storms and of sun-spots.

The spectroscope shows the auroral light to be due to gaseous matter, its spectrum consisting of a few bright lines not referable with certainty to any known terrestrial substance, but having a general resemblance to those seen in the spectrum of the electric discharge through rarefied dry air.

The most probable theory of the aurora is that originally due to Franklin, namely, that it is due to electric discharges in the upper air, in consequence of the differing electrical conditions between the cold air of the polar regions and the warmer streams of air and vapor raised from the level of the ocean in tropical regions by the heat of the sun; for evaporation of water containing saline matter is a source of electrification, the escaping vapor becoming positively electrified.

According to Nordenskiold the terrestrial globe is perpetually surrounded at the poles with a ring or crown of light, single or double, to which he gives the name of the "aurora glory." The outer edge of this ring he estimates to be 120 miles above the earth's surface, and its diameter about 1,250 miles. The centre of the aurora glory is not quite at the magnetic pole, being in lat. 81 degrees N., long 80 degrees E. This aurora glory usually appears as a pale arc of light across the sky, and is destitute of radiating streaks, except during magnetic and auroral storms.

An artificial aurora has been produced by Lemstrom, who erected on a mountain in Lapland a network of wires presenting many points to the sky. By insulating this apparatus and connecting it by a telegraph wire with a galvanometer at the bottom of the mountain he was able to observe actual currents of electricity when the auroral beam rose above the mountain.

ORIGIN OF THE TERM "DYNAMO-ELECTRIC MACHINE."

Dr. Werner Siemens suggested that electric machines in which the self-exciting principle was employed should be known as *dynamo*-electric machines, to distinguish them from the earlier form in which the permanent magnets were used, and which still continue to be called *magneto*-electric machines.

The principle of mutual accumulation, thus brought prominently forward, does not at first appear to be in accordance with the nature of soft iron, but it may be thus concisely stated. If the soft iron field-magnet possesses the slightest magnetic polarity, in a residual form—and all iron once magnetized may be said to possess and retain it—the feeble magnetic field thus existing in the path of the armature suffices to generate in the coils of the latter a feeble current. This current, being caused to circulate around the field-magnet, quickly energizes it so as to strengthen the field; this again reacts upon the armature, causing it to yield yet stronger currents, which in turn still further strengthen the field; and so on by mutual reaction until the field-magnet is said to be "saturated," and is thus incapable of being further strengthened. On imparting rotation to the armature of such a machine on "short" circuit the resistance to motion increases rapidly, and in a few moments either the driving-band begins to slip or the coils of the machine become highly heated and may even be fused.

The enormously greater power of dynamo machines over magneto machines, weight for weight, soon caused the abandonment of the steel-magnet class except for a few special purposes.

NEW INCORPORATIONS.

The Pittsfield Electric Company, Naperville, Ill., has been incorporated, with a capital stock of $20,000. Incorporators: George E. Royce, Alvin Scott, Jr., Alvin Scott, Sr.

The Citizens' Electric Light Company, Logan, O., incorporated July 26, with a capital stock of $15,000. Incorporators: Henry Lutz, George H. Hartman, Lafayette Wamen, William H. Hartman, W. A. Lutz.

The Silver Plume Electric Light and Power Company, Silver Plume, Col., incorporated July 28, with a capital stock of $25,000. Incorporators: Ensign S. Wright, Thomas Cornish, Ernest Le Neve Foster, Silver Plume, Col.

Garvin Falls Power Company, Concord, N. H., incorporated July 27, with a capital stock of $100,000, to generate and sell electric power. Incorporators: Charles L. Fellows, Henry M. Baker, B. Frank Brown, Alonzo Elliott, William A. Russell.

Lowell Water and Light Company, Lowell, Mich., incorporated July 27, with a capital stock of $200,000, to operate water-works and furnish electricity for light and power. Incorporators: Edwin S. Sweet, A. G. Sekell, John E. More, Grand Rapids, Mich.

Mohawk Valley Electric Light and Power Company, Canajoharie, N. Y., incorporated July 29, with a capital stock of $40,000. Incorporators: George H. Smith,

Canajoharie, N. Y.; David Zieley, Jr., Brooklyn, N. Y.; Edwin N. Sanderson, Fort Edward, N. Y.

Burlington and Mount Holly Connecting Company, Burlington, N. J., incorporated July 28, with a capital stock of $100,000, to transport goods, merchandise or passengers by means of steam, electric or pneumatic system of motive-power. Incorporators: C. H. Goebel, Philadelphia, Pa.; W. H. Clough, New York, N. Y.; G. Morris, Jersey City, N. J.

GONE UP IN SMOKE.

The plant and buildings of the Toledo Electric Company, Toledo, Ohio, were destroyed by fire on the morning of July 30. Loss on buildings and machinery, $75,000, with $61,500 insurance. The fire, it is said, was caused by the defective insulation of a wire.

ELECTRIC LAUNCHES AT THE WORLD'S FAIR.

The executive committee of the World's Fair has awarded to the Electric Launch and Navigation Company, of New York, the right to run electric launches on the lagoons and water-ways at the World's Fair. This action will, no doubt, surprise many because it was currently reported that the Columbian Launch Company, of Chicago, had secured the prize. This report originated from the fact that Chief of Construction Burnham, after the test of the various craft entered for competition for the right, recommended the Columbian Launch Company boats for the service. The executive committee, however, gave the franchise to the New York company, as above stated, notwithstanding Mr. Burnham's recommendations.

The Electric Launch and Navigation Company will be required to place upward of 40 boats on the lagoons for passenger traffic, and the officers of the company are sanguine that their boats will fulfil every requirement.

In the ELECTRICAL AGE of June 11 is given a full description of the "Electra," this company's sample-boat used in the competitive tests at Chicago, and in the issue of July 23 are given the results of the official tests. The tests showed clearly that the Electric Launch and Navigation Company's boat "Electra" proved to be superior in every point to the Columbian Company's boat. General C. H. Barney is the general manager of the successful company.

SHORT RAILWAY MOTORS.

Mr. E. J. Wessels, of the New York office, has recently closed an important order for the Short Electric Railway Company, which he represents. The order covers thirty horse-power single-reduction motors and a one hundred horse-power generator for the Syracuse, Eastwood Heights and De Witt Railroad Company, of Syracuse, N. Y.

Short motors are to be used on another of the Hartford (Conn.) lines, a contract having recently been closed by the Short Company with the Hartford and Wethersfield Horse Railway Company.

The Collins Park and Belt Railroad Company, of Atlanta, Ga., is now in successful operation with two 150 H. P. generators, and ten Brill cars, equipped with 20 H. P. single-reduction motors, all of which apparatus was furnished by the Short Electric Railway Company, of Cleveland, Ohio.

The company is operating the two ends of its system, not having as yet been able to complete the line through a part of the city. The road has had unusual success from the start, and both ends are very much more than paying expenses. It is thought that it will be but a few weeks before passengers can be carried from one extreme of the city to the other.

A BRILLIANT SEARCH-LIGHT.

Not many nights ago there appeared in the clouded skies over this city a broad white light which puzzled not a few as to what it might be. It would flash from one part of the heavens to another, and seemed to be enjoying itself immensely.

A still-hunt was instituted to discover if possible the source of this wonderful light, and after much perseverance it was finally located at 26 Liberty street, and found to be an electric search-light which was being tested by Samuel W. Rushmore. It was a 9,000 candle-power lamp and made for the steamer "Olivette," which plies between Boston and Halifax. In possession of such a brilliant lamp as this dangers from collision, etc., should be greatly minimized.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, August 6, 1892.

MR. W. R. MASON, general manager of the Railway Equipment Company, Chicago, is in town.

E. A. STOREY & Co., 136 Liberty street, have lately installed two large electric-light plants in San Juan Bautista, southern part of Mexico.

THE POOLE ELECTRIC CO., of Lynchburg, Va., has been appointed agent for Truex & Vail's specialties, for Virginia, District of Columbia and Southern States.

MR. CAMPBELL SCOTT, late Edison agent for Tennessee and Kentucky, has recently been appointed selling agent for Truex & Vail's specialties, with offices at Louisville, Ky.

MR. FRANK A. MAGEE has resigned his position with the Engineering Equipment Company and become again connected with The E. S. Greely & Co., the well-known supply-house, 5 and 7 Dey street, this city.

A COMPANY to be known as the Queens County (New York) Electric Light and Power Company has been formed for the purpose of lighting the streets, stores and public buildings of Freeport, Baldwins and Rockville Centre.

THE R. L. COLEMAN CO., 35 Barclay street and 40 Park place, is the Eastern agent for the Western Wheel Works, of Chicago, Ill., and carry a full line of the celebrated safety bicycles, velocipedes, etc., manufactured by the latter concern.

F. H. LEONARD, JR., of the Electric Engineering and Supply Company, Syracuse, N. Y.; F. C. Timpson, manager of the New York office of the same company; and S. L. Phillips, eastern agent of the Meston Fan Motor Company, paid their respects to the ELECTRICAL AGE a a few days ago.

OUR old friend, Frank W. Harrington, of the New York Insulated Wire Co., 15 Cortlandt street, is happy. He has just returned from an extended trip to the Pacific Coast, and speaks in glowing terms of the excellent reception he met with from station and power-house officials and the trade generally, wherever he called. He brought home some prize orders for Grimshaw insulated wires, etc.

On August 4 a Day's Kerite 18-conductor armored submarine cable was successfully laid across the North river, between Vesey street, New York city, and Morgan street, Jersey City, for the Metropolitan Telegraph and Telephone Co. On July 16 last a similar cable, 5,300 feet long, was laid for the same company over the same route. The fact that the telephone company is using Day's Kerite cables for such important service is a silent testimonial to the excellence of these celebrated goods.

The Swinging-Ball lightning arresters are still going out as fast as they can be made. Messrs. Truex & Vail, 136 Liberty street, the manufacturers, are highly elated over the success with which these arresters are meeting. Unmistakable proof of the satisfaction they are giving is the immense number of duplicate orders which the firm is constantly receiving. Their Walker ammeter is going like hot cakes, and they are now manufacturing a number of the smaller sizes, of 25 ampères. The firm reports a bright outlook for accumulators as the season advances.

Mr. Wm. H. Truex, who was formerly in the general offices of the Metropolitan Telegraph and Telephone Co., this city, has been appointed district superintendent of the Pennsylvania Telephone Co. His district will be the Lehigh valley from Mauch Chunk, Pa., as far east as Hackettstown, N. J., with headquarters at Easton, Pa. Mr. Truex brings to his new duties an experience of four or five years gained in the service of the Metropolitan Company, and thoroughly understands all the duties pertaining to construction and maintenance of the telephone system. He is considered one of the brightest young men in the telephone field, and has a large circle of friends, all of whom wish him every success in his new position, which was unsolicited and offered in recognition of his merit. Mr. Truex is the son of Mr. C. R. Truex, formerly special agent of the American Bell Telephone Company.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age.

Names of Companies.	Capital.	Par.	Price.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	117 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*105
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	95 50
Edison General	15,000,000	100 00	109 00
Edison General Receipts		100 00	109 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	115 00
General Electric Co., 5s	4,000,000		*104
General Electric pref.		100 00	119 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	23 00
Laclede Gas pref.	2,500,000	100 00	65 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s	30,000		*99
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*104
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	14 50
Postal Telegraph	10,000,000	100 00	63 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500 000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
Thomson-Houston Electric Co	6,000,000	25 00	66 75
Thomson-Houston pref.	4,000,000	25 00	29 75
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	97 50
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	28 25
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	47 00
Westinghouse Ass. Rects.		50 00	19 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Although the present time in New York is, from a financial view, so dull that one can taste it, both current history and time speeds on and many minds are insulated on the one circuit and watching every development of it. I refer to the telephone, and the financial condition the business will be in at the end of another year. A fair basis for those of my readers to found their opinion on is the report of the National Telephone Company, of London (limited), as made to their shareholders at the twelfth ordinary general meeting of the company, held at the Cannon Street Hotel in London on the 15th ult., Mr. James Staats Forbes, the new president, in the chair.

In referring to the report he said paragraph 1 showed that the income accrued in respect to the business of the year amounted to £463,741—£32,628 more than in the preceding year. When he came to the capital account they would see that, concurrently with the income of the year, there had been a very considerable increase of expenditure, and that the net revenue had become chargeable in respect of that increase with about £18,000. The number of their subscribers had increased more or less under the impulsion of the new policy of reduction. Comparing the increase in the number of subscribers with the increase in expenses, the increase in the number of subscribers was 20 per cent. and the increase in conducting the business had been 18 per cent. The fifth paragraph stated that out of the divisible balance, after providing for interest on debenture stock, an interim dividend for the first half year had already been paid at

the rate of 6 per cent. per annum on the first and second preference shares, and 5 per cent. per annum on the ordinary shares. Out of the balance left the board recommended the payment of a further dividend for the last half year at the rate of 6 per cent. per annum on the first and second preference shares, and 7 per cent. per annum on the ordinary shares, making, with the interim dividend, 6 per cent. for the year. They proposed to appropriate £10,000 to the reserve accounts, which with £1,127 placed to the reserve during the year from premium account brought up the reserve fund to £104,627. During the year there had been sent through their company 160,000,000 communications at an average of 1½*d.* per message. The post-office was a government department, and had all the prestige of the state and could do things a private company was unable to do, and the constitution of the public was so singular that they would take from a state department what would be regarded as insufferable at the hands of a private monopoly. On reference to the last Year Book issued by the post-office it would be seen that they transmitted 66,000,000 messages, and they had been in existence for many years. They had popularized the service by sixpenny telegrams, and wiped out their revenue entirely. But then they had no shareholders. The 66,000,000 of messages sent by the post-office cost the public who made use of that means of communication, on an average, something approaching 9*d.* a message. The government policy was that all the trunk lines used for inter-town telephonic communication should become the property of and be worked by the state, the exchanges and local service remaining in the hands of the companies for the term of their present licenses.

It will be seen from this that practically the government has taken possession of all trunk or main lines and issued a peculiar license to the company under which it may continue to work for nineteen years, when the Post-office Department will take over the entire business. It rather appears that all patents now in use go with it, and no more will be granted, or if so, only to be used under this license. There is no doubt but that in time the United States Government will follow the same course. We shall see.

PHILADELPHIA NOTES.

VALLEE BROS. & Co., general electrical supplies, 17 North 6th street, report a large business in the new mica insulating joint which was described and illustrated in the ELECTRICAL AGE of July 23 last. These joints are approved by the Philadelphia Board of Fire Underwriters. They are fire proof, acid proof and water proof, and mica is the only insulation used.

THE NOVELTY ELECTRIC CO., 50–54 North Fourth street, manufactures and deals in fine electric supplies, furnishes estimates for every description of electrical work, and makes to order every kind of experimental work. The company is also agent for a number of well-known electric manufacturers. Mr. Beatty, its selling agent, is kept busy making sales of Novelty switches and American Giant mica insulating joint.

YOUR representative called at the office of the Cutter Electrical and Mfg. Co., 27 South Eleventh street, and found things active and Mr. Cutter wearing a broad-gauge smile. The Aluminum C-S. reflector shade, the C-S. portable stand and the C-S. flexible bracket continue to hold the trade. All of these goods, as well as the other specialties handled by this company, are of high standard and give general satisfaction to those who use them.

A CALL on W. H. Weston & Co. at their factory and salesroom at 12 o'clock noon on Friday, August 5, elicited the fact that their employés had just gone after having been working from 7 A.M. the previous day without a break, putting in 29 hours steady work. They had been working on a line of switches and marble switchboard work which had to be delivered on Friday. The company accepted the contract at short notice, and had to work day and night in order to get the work finished and delivered on time. They have another large order to fill for one of the prominent buildings in the city, which will keep them going at their full capacity, night and day, for a long time to come before they will be able to catch up with their orders. W. T. H.

IMPORTANT ELECTRIC RAILWAY CONTRACT.

Perhaps the most important electric railway work ever undertaken is that of the Cayadutta Electric Railway, connecting Fonda, Johnstown and Gloversville, N. Y., as it will parallel a steam road, and electric locomotives will for the first time be in direct competition with steam locomotives.

The complete construction has been undertaken by H. Ward Leonard & Co., of New York, including grading, road-bed, building, steam-plant, electric generators, electric overhead work, cars, etc. The road will be in operation about December 1.

This important contract forcibly illustrates the desire on the part of owners to deal with one contractor for the entire work, and especially with a contractor who is entirely independent of so-called "systems," and hence able to procure for such a plant the best and most recent developments in this rapidly changing industry.

ENLARGED AND NEW STEAM-PLANTS.

The Pierce & Miller Engineering Company, 42 Cortlandt street, New York, has just completed the work of increasing the plant of the Merrimac Valley Electric Railway Company, at Lawrence, Mass., from 500 to 800 H. P.; the increase in power being necessary to meet the demands of the growing traffic. The first installation of the plant was made by Pierce & Thomas last year. It now consists of three McIntosh & Seymour engines, three Babcock & Wilcox boilers, and Worthington pumps and condensers.

In a week or so the Pierce & Miller Engineering Company will have the 1,200 H. P. steam-plant which it is installing for the Globe Street Railway Company, of Fall River, Mass., completed and in running order. It will consist of a 620 H. P. McIntosh & Seymour double-compound tandem, slow speed, and one compound tandem engine, both condensing, Babcock & Wilcox boilers, Blake pumps and condensers. This installation was made with a view to doubling the capacity of the plant.

The Pierce & Miller Engineering Company has also about completed a 500 H. P. plant for the Rock Creek Railway Company, of Washington, D. C., consisting of McIntosh & Seymour compound tandem condensing engine, Babcock & Wilcox boilers, and Blake pumps and condensers.

Another installation under way by this company is an 800 H. P. compound tandem non-condensing McIntosh & Seymour engine-plant for the Central Railroad Company, of Baltimore, Md. Zell boilers are used. They are also installing two 300 H. P. McIntosh & Seymour compound tandem condensing engines in the power-house of the Rochester Street Railway Company, Rochester, N. Y., replacing another make of engine; and are also remodelling the piping system of this plant, and excavating a pit for the condenser in solid rock in the engine-room, 9 feet deep, in order to lower the present condenser into proper position.

ELECTRIC MOTORS ABROAD.

Dr. S. S. Wheeler, president of the Crocker-Wheeler Electric Company, sailed August 3 on the "Germanic" for a much-needed vacation. He has taken with him letters of introduction to the principal electrical men in Europe, and will consult with them upon matters of interest to the electrical profession. He will call upon the company's agents in London, the General Electric Co., who is selling a large number of the Crocker-Wheeler motors. He will also visit the principal central stations to gather from their experience anything that may benefit the interests of the company of which he is president.

Prof. F. B. Crocker, vice-president of the Crocker-Wheeler Electric Company, arrived in New York on the "Teutonic" August 3, after a six weeks' sojourn abroad. He has seen in this short time nearly every electrical engineer of note, has visited the principal central stations and works of Europe, and has taken a general survey of the electrical field. He says that one of the principal motor manufacturers told him with a great deal of pride that they had made as many as two hundred small motors. He also says that there are only about ten electric motors working in Vienna and but few more in Paris and Berlin. The number of motors used in London is somewhat greater, the larger part of them being Crocker-Wheeler.

When we compare this with the thousands of Crocker-Wheeler and other motors that are made and in use in this country we can see how far Europe is behind us in the motor business.

BALL ENGINES.

The Ball Engine Co., Erie, Pa., has shipped during the past three weeks the following: Compania Mexicana y Luz Electricia, City of Mexico, 2 60 H. P. engines, 2 60 H. P. heaters, etc.; Hot Springs Electric Co., Hot Springs, Va., 1 100 H. P. engine, 2 80 H. P. boilers, 1 200 H. P. heater, 1 200 H. P. pump; Ames-Bonner Co., Toledo, O., 1 80 H. P. engine; Brooklyn Navy Yard, Brooklyn, N. Y., 1 80 H. P. engine; Arnold Ore Mines, Ferrona, N. Y., 1 35 H. P. engine; Northwestern Supply Co., Tacoma, Wash., 1 25 H. P. engine; Carbon Iron Co., Pittsburg, Pa., 1 130 H. P. engine; Diamond Light and Power Co., Sheldon, Iowa, 1 80 H. P. engine; North Hudson County Railroad Co., Hoboken, N. J., 1 250 H. P. engine; Puget Sound Pulp and Paper Co., Everett, Wash., 1 25 H. P. engine; Pittsburg Iron and Steel Engineering Co., Pittsburg, Pa., 1 130 H. P. engine; Whitman and Barnes Mfg. Co., Akron, Ohio, 1 80 H. P. engine; Fort Clark Street Railway Co., Peoria, Ill., 1 130 H. P engine; Boulder Electric Light Co., Boulder, Col., 1 100 H. P. engine, 1 100 H. P. boiler, 1 150 H. P. pump, 2 100 H. P. heaters; Shamokin Elec. R'y Co., Shamokin, Pa., 1 130 H. P. engine; North Avenue Street R'y Co., Baltimore, Md., 2 130 H. P. engines; Mt. Vernon Electric Light Co., Mt. Vernon, O., 1 150 H. P. engine; H. F. Watson & Co., Erie, Pa., 1 350 H. P. Cross Compound engine; Rock Cut Clay Co., Lim., Alfred Centre, N. Y., 1 60 H. P. engine; Metropolitan Telephone Building, New York city, 1 60 H. P. engine; La Gran Fundicion Nacional Mexicana, Monterey, Mexico, 1 60 H. P. engine.

WARD LAMPS FOR PHOTO-ENGRAVERS.

The following tells its own story:

NEW YORK, June 27, 1892.

R. B. COREY, *Manager*, ELECTRIC CONSTRUCTION AND SUPPLY CO.

DEAR SIR: You ask us how we are pleased with the equipment for four focusing lamps you recently put in for us and the adaptability of the Ward lamps for photo-engraver's use.

We simply could not get along without them, and have never regretted discarding our old dynamo and lamps. The regularity of the feed, the steadiness and even distribution of light which we are enabled to concentrate upon any desired point, enables us to achieve results heretofore obtainable only in the brightest natural light. We shall be pleased to give you our personal testimony of the effectiveness of your lamps, should you see fit to refer any parties to us. Yours truly,

STEVENS & MORRIS.

The Electrical Age's Illustrated Patent Record.

Issued August 2, 1892.

479,782. Mechanical Telegraph Instrument. Benjamin F. Butler, Logansport, Ind. Filed May 16, 1892.

479,786. Galvanic Battery. Martin M. Clark, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 9, 1892.

479,791. Incandescent-Lamp Guard. George W. Demmick, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed June 22, 1889.

479,793. Commutator. William H. Elkins, Cambridge, Mass. Filed Jan. 26, 1892.

479,795. Valve-Controller. Charles L. Fortier, Milwaukee, Wis. Filed March 5, 1892.

479,802. Brush-Holder. Francis J. Haeseler, U. S. Navy. Filed Nov. 5, 1891.

479,804. Electro-Magnet Bobbin. Edward B. Hatch and Charles A. Colton, Hartford, Conn., assignors to the Johns-Pratt Company same place. Filed Jan. 13, 1892.

479,809. Closed Conduit for Electric Railways. Edward H. Johnson, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Filed Feb. 10, 1887.

479,814. Electrical Water-Heater. Rankin Kennedy, Kilmarnock, Scotland. Filed April 1, 1891.

479,821. Electric Switch. Andreas P. Lundberg, London, England. Filed Dec. 29, 1891. Patented in England.

479,828. Electric Steering-Gear. Edgar H. Mumford, Detroit, Mich. Filed Aug. 20, 1891.

479,835. Storage-Battery Plate. Harry G. Osburn, Chicago, Ill. Filed Nov. 21, 1891.

479,849. Thermostat. Thomas W. Shepherd, Peabody, Mass. Filed Aug. 6, 1891. Renewed June 27, 1892.

479,859. Telegraph-Key. Albert F. Tucker, Auburndale, Mass. Filed March 24, 1892.

479,886. Electric-Current Regulator. Alvaro S. Krotz, Defiance, Ohio, assignor of one-half to Andrew Sauer, same place. Filed March 26, 1891.

479,887. Galvanic Battery. Félix de Lalande, Paris, France. Filed June 27, 1891. Patented in France.

479,891. Mould for the Manufacture of Electrical

PATENTS.—Continued.

Switchboards. John B Lyon, Brooklyn, N. Y. Filed Jan. 19, 1891. Renewed June 16, 1892.

479,928. Electric Signalling Apparatus. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed Nov. 9, 1891.

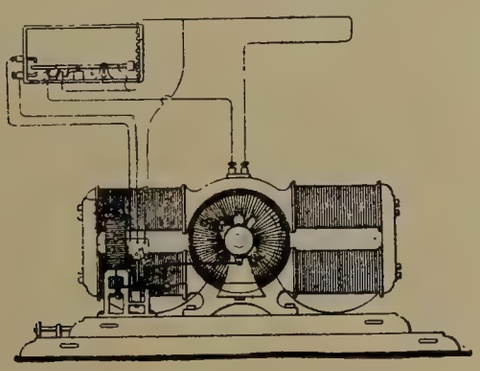
479,932. Electric Meter. Lucien V. Brillie, Paris, France, assignor to the Campagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils. Filed Oct. 2, 1891.

479,941. Influence-Generator of Electricity. William Henry, Detroit, Mich. Filed May 29, 1891.

479,948. Reciprocating Electric Drill. Frank F. Loomis, Akron, Ohio. Filed April 11, 1891.

479,949. Electric Switch. Frank F. Loomis, Akron, Ohio. Filed July 31, 1891.

479,950. Fire-alarm Telegraph Indicator. Frank F. Loomis, Akron, Ohio. Filed Dec. 1, 1891.



479,886.—ELECTRIC-CURRENT REGULATOR.

479,951. Pulsating-Current Generator. Harry N. Marvin, Schenectady, N. Y. Filed Dec. 3, 1891.

479,960. Controlling Mechanism for Reciprocating Electric Engines. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 31, 1889.

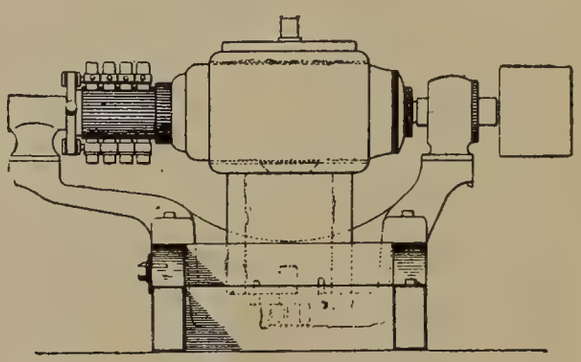
479,961. Feed Mechanism for Electric Reciprocating Engines. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed May 22, 1890.

479,962. Reciprocating Electric Engine. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed Sept. 19, 1890.

479,963. System of Supplying Currents to Reciprocating Electric Engines. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed April 11, 1891.

479,964. System of Distributing Electric Currents. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed May 20, 1891.

479,965. Reciprocating Electric Pile Driver. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl,



480,049.—FIELD-MAGNET FRAME FOR DYNAMO-ELECTRIC MACHINES.

executors of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed May 23, 1891.

479,966. Electrical Transmission of Power. Charles J. Van Depoele, Lynn; C. A. Coffin and Albert Wahl, executors of said Van Depoele, deceased, assigners to the Thomson-Houston Electric Company, Boston, Mass. Original application filed May 6, 1891. Divided and this application filed Sept. 24, 1891.

480,004. Electric Railway. Charles H. Baker, Lake Geneva, Wis. Filed Sept. 1, 1891.

THE
"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

480,009. Safety Cut-Out. Rudolph Furgang, Boston, Mass., assignor of one-half to Isaac Kaffenburgh, same place. Filed Oct. 14, 1891.

480,011. Insulator. John J. Green, Boonton, N. J., assignor to the Security Insulator Company, of New Jersey. Filed March 24, 1892.

480,033. Method of Preparing Battery Solutions. Edward Poppowitsch, Brooklyn, N. Y. Filed Feb. 6, 1892.

480,038. Testing Apparatus for Electric-Lighting Circuits. Charles H. Rudd, Evanston, assignor to the Western Electric Company, Chicago, Ill. Filed Dec. 10, 1888.

480,039. Device for Measuring Electrical Currents. Charles H. Rudd, Evanston, assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 6, 1891.

480,049. Field-Magnet Frame for Dynamo-Electric Machines. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 10, 1890.

480,050. Duplex Arc Lamp. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 24, 1891.

480,073. Train-Order Annunciator. Leonard T. Crabtree, Embarrass, Wis. Filed Oct. 15, 1891.

480,099. Electric Jail Plate. William S. Hull, Sheffield, Ala. Filed Dec. 8, 1891.

480,100. Electric Screen for Doors or Windows. William S. Hull, Sheffield, Ala. Filed Feb. 3, 1892.

480,147. Automatic Device for Electric Block-Signals. Joseph B. Stewart, Haverstraw, N. Y. Filed Jan. 26, 1892.

480,151. Rheostat. Charles W. Tobey, New Bedford, Mass., assignor to Burt & Tobey, same place. Filed July 11, 1891.

480,152. Electric-Cord Tip. Charles W. Tobey, New Bedford, Mass., assignor to Burt & Tobey, same place. Filed Nov. 24, 1891.

480,201. Reflector. Charles A. Meadows, Yonkers, N. Y. Filed Dec. 31, 1891.

480,240. Trolley for Electric Cars. George E. Purple and Charles W. Purple, Minneapolis, Minn.; said George E. Purple assignor to said Charles W. Purple. Filed Sept. 8, 1891.

BATTERY ZINCS

RODS AND PLATES FOR BATTERIES.

CROW FOOT ZINCS.

E. LAMARCHE'S SONS, 83 JOHN ST., N. Y.

LEONARD'S 3-WIRE SYSTEM.

Identical in Cost and Efficiency

WITH EDISON SYSTEM.

SIMPLER TO OPERATE.

Copper required guaranteed to be not over 30% of that required for 2-wire system, under same conditions.

Royalty, 1 cent per lb. of Copper Installed.

PATENTED JUNE 7, 1892, No 476,544

CHARLESTOWN, W. VA., June 18, 1892.

MESSRS. H. WARD LEONARD & CO.,
136 LIBERTY STREET, NEW YORK.

GENTLEMEN: The central station plant, which you installed for us here under your new patented 3-wire system, has given entire satisfaction ever since it started, which was about six months ago.

The operation of the plant is quite simple and economical, and as a result the plant is making very satisfactory earnings, although our town is rather small, having only about 3,000 inhabitants.

Yours very truly,
(Signed) CITY ELECTRIC LIGHT CO.,
WM. CAMPBELL, *Sec'y*

For bids for complete plants, or conductors only, address
H. Ward Leonard & Co., 136 Liberty St., New York City.

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Sole Manufacturers of HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

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OSCODA, MICH.

ELECTRICAL AGE

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T. R. TALTAVALL, SEC'Y AND EDITOR.
J. H. GLOVER, ASSOCIATE EDITOR.

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NEW YORK, AUGUST 20, 1892.

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MORE EARTH-CURRENTS.

Earth-currents of violent intensity had more fun with the telegraph last Friday. The telegraph service was completely paralyzed for a while during the day, and while such a state of things lasts nothing that man can do will abate the disturbance in the least. There is a chance here for some one to devise something that will neutralize the effect of earth-currents on telegraph wires. It is a serious matter to paralyze the telegraph service; the delay of a telegram under such circumstances might cause a disastrous failure or a railroad collision.

A HANDY FAN OUTFIT.

The other day an enterprising fellow was seen going along Park Row carrying a unique load. He had in his right hand a storage cell, about the size of a hand-valise, and in his left he carried a tripod on the head of which was attached a fan-motor. A flexible cord connected the motor with the battery cell. The ingenuity of this combination was striking. With such an outfit there can be no excuse in not keeping cool during hot weather. The idea of carrying a fan-motor outfit complete around with us is a novel one, and the man who originated it deserves success.

SATISFACTORY.

The convention held in Toronto last week by the Edison illuminating companies was probably the most important one ever held. It was the first one held since the consolidation of the Edison and Thomson-Houston interests, and the members came expecting to learn from some one in authority present at the meeting something about the future attitude of the consolidated interests towards their own. General Manager Coffin, of the General Electric Company, was present, and so was Major Eaton, counsel for the Edison Company. Both gentlemen had something important to tell the delegates, but as the meetings were strictly private and held behind closed doors, what transpired is known only to the delegates themselves. We have learned, however, from an authentic source that Mr. Coffin's statement produced the best of feeling, and had the effect of easing the minds of the delegates to a very satisfactory degree as to the attitude of the General Electric Company, with reference to the local illuminating companies. The relations between the two interests, we understand, are now more harmonious than they have ever been.

NEW TELEGRAPH BUILDING.

Because the telegraph is an older institution than the electric light or electric railway it is not talked about by the public as much as either of the two latter-named industries. But it is a remarkably expansive industry, nevertheless, and its business increases at a rate that creditably compares with the wonderful strides made in the introduction of electric light and electric railways. The history of the telegraph is one of continual progress and increase, and when we look back a few years and remember what the telegraph was then compared with what it is now, its enormous and rapid development becomes at once apparent.

It is but a few weeks ago that the Western Union Telegraph Company opened its new and magnificent operating-rooms in this city, which constitute the second largest telegraph office in the world; and judging from the past and reading the signs of the times, there is no doubt that even this immense establishment will, before many years shall have elapsed, reach that condition known as "cramped quarters" for the prompt handling of the telegraph business.

The Western Union's only and formidable competitor, the Postal-Telegraph Company, is enjoying proportionate prosperity, and its present quarters having long since become inadequate for the convenient handling of the business, a new building is now being erected by the company for its own use. This building, which we describe and illustrate on another page, will when completed constitute a model telegraph office, and it must be gratifying to the stockholders and officers to be able to erect such magnificent quarters. It means prosperity.

THE NEW POSTAL TELEGRAPH BUILDING.

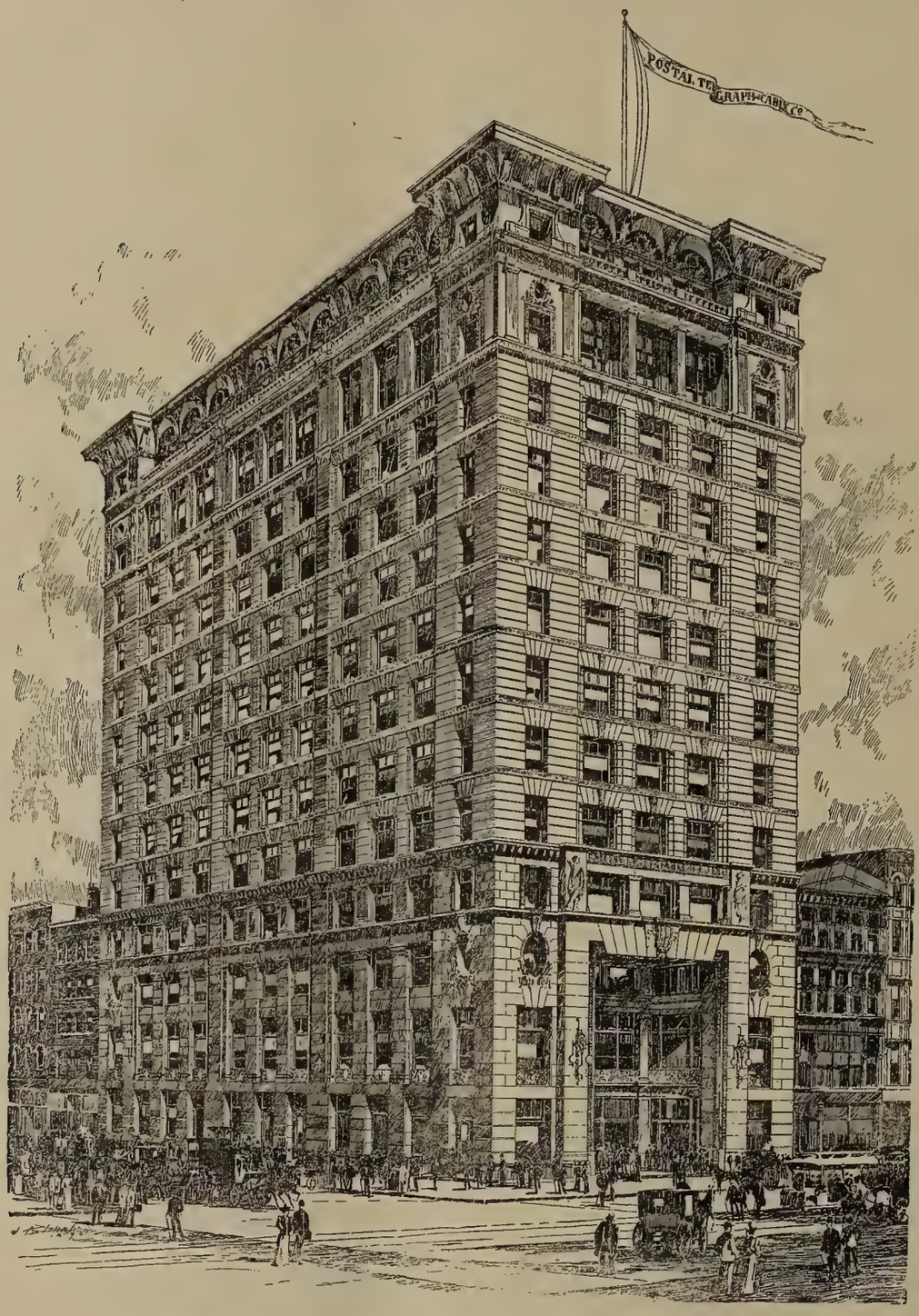
So great has been the increase in the volume of business handled by the Postal Telegraph-Cable Company, that the necessity for more commodious and convenient quarters for the executive and operating departments has become imperative, and the officials of the company have for some time past been engaged in arranging to secure to the company a building of its own.

The corner of Broadway and Murray street was selected as the best site for the purpose, it being in the centre of down-town business interests, near the newspaper offices, and convenient of access by all lines of elevated railroads, horse cars, ferries and the bridge, while the frontages on City Hall Park and Murray street insure ample light and air.

Immediately upon the selection of the location, negotiations for the purchase of the necessary ground were completed and plans for the new building prepared. Already the old buildings have been torn down and work on the foundations for the new structure is well under way and progressing rapidly.

The accompanying illustration is from the architect's drawing, and shows the building as it will be when finished.

The building will be 14 stories high and will have a frontage of about 75 feet on Broadway by 150 feet on Murray street, with an L of 30 x 50 feet at the rear end.



POSTAL TELEGRAPH COMPANY'S NEW BUILDING IN NEW YORK CITY.

The frame will be of steel, and the walls to the 5th story will be of a fine quality of Indiana limestone; the upper stories of gray brick, with terra-cotta trimmings to correspond.

The interior finish will be in keeping with the handsome exterior, and no efforts will be spared to make all of the fittings and arrangements of the latest and most improved modern design.

The sub-basement will be 12 feet deep, commodious, well lighted and artificially ventilated. Here will be located the engine and dynamo rooms; the boiler-room will be in the extension of the sub-basement, and will be 14 feet deep. The heating apparatus and the two dynamo plants for lighting the building and furnishing current for the wires will be of the latest improved designs and arranged with regard to convenience and the comfort of the men in charge. The basement will be used for the supply department of the company and for storage-rooms, and will be equipped with every facility for packing and handling material.

It is also intended to utilize a portion of the basement for safe-deposit vaults.

The first, or ground floor, will be used for the receiving and delivery departments of the company, and possibly a portion of it may be leased for business purposes.

The second floor will probably be occupied by a bank; and other floors, to and including the tenth, will be rented for offices. Applications for a large number of these offices have already been received.

The eleventh floor will be retained by the company for its executive offices and for the executive offices of the Commercial Cable Company, which is allied to the Postal Company.

The general operating department will occupy the entire twelfth floor. And here again the arrangements will be made with a view to attain the highest facilities for handling the business and to provide for the comfort of the employés.

The ceiling will be 18 feet high, and the exposure on the east, south, west and part of the north sides will insure perfect light and ventilation.

The apparatus will be new, specially designed for this office, and it is expected that the operating department will excel even the splendidly equipped operating-room of the Western Union Company, recently completed.

The thirteenth floor will be used to accommodate the general clerical force, and also for coat-rooms, lavatories, etc., for the operating and clerical departments.

It is expected that the fourteenth story will be occupied by a business men's club and restaurant for employés, but as these arrangements have not been concluded, we are unable to obtain details.

As a whole, the building will be one of the best examples of modern architecture in the city, and in convenience of arrangement, excellence of construction and beauty of appearance will be second to none.

The drawing of the plans and the work of construction and arrangement are under the supervision of Mr. A. B. Chandler, the president of the Postal Company, to whom, in great measure, credit is due, not only for the completeness of the new building, but for the success of the company which has made the erection of the building possible. Mr. Chandler is assisted in the direction of the new work by a building committee, consisting of Mr. W. H. Baker, vice-president; Mr. E. C. Platt, treasurer of the Postal Company, and Mr. George G. Ward, vice-president and general manager of the Commercial Cable Company.

Messrs. Geo. Edw. Harding and Gooch are the architects, and have charge of the details of plans and construction.

It is expected that the new quarters will be ready for occupancy in the summer of 1893, and we congratulate the company's employés on their prospects for improving their present fine service with the aid of the most perfect appliances and in the most comfortable and convenient quarters ever devoted to telegraph purposes.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Condensers.

An electrical condenser is a piece of apparatus that will accumulate an electric charge into a small space. We need not go into the history of the condenser, as these articles are designed to deal with facts; the practical condenser, therefore, is what concerns us now. Any one who cares to familiarize himself with the history of the condenser may do so at a trifling outlay for books.

The practical condenser is used very extensively in multiplex telegraphy and in submarine cable telegraphy. Although it may be constructed in different forms, the one used in this country is that shown in Fig. 1, which resembles an ordinary wooden box outwardly. The contents of the box, however, are the most interesting part, and these we will now consider.

Fig. 2 is a diagram which will aid the student in acquiring an idea as to how condensers are made.

The parallel horizontal lines represent sheets of tin-foil placed on top of one another with some insulating material between.

Thin paper saturated with paraffine or thin sheets of

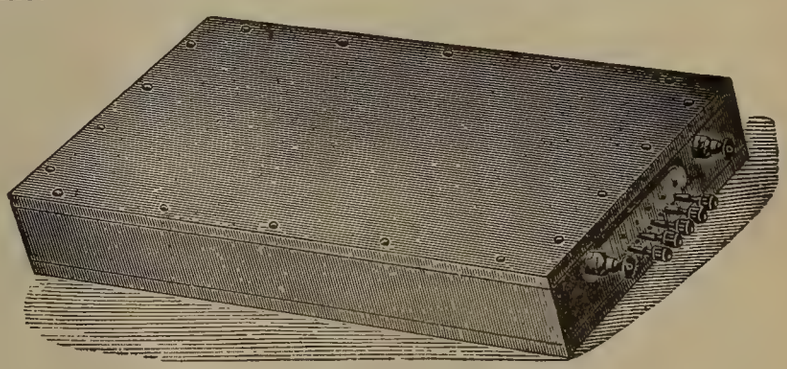


FIG. 1.—ADJUSTABLE CONDENSER.

mica are generally used for the insulation, the main object in the construction of condensers being to get the sheets of tin-foil as close together and as well insulated from one another as possible.

It will be noticed that every alternate sheet is connected with the common terminals, as shown at the right and left hand ends of the illustration. By this arrangement a large positive surface is presented to an equally large negative surface of tin-foil, and, according to the well-known law of electric attraction and repulsion, a charge of electricity in a condenser will induce an equivalent charge of opposite sign in the opposite sheets of tin-foil. If we connect one end of the condenser with one pole of a battery and the earth with the other pole of the battery, then connect the opposite end of the condenser directly with the earth, the condenser will become charged by induction, the charge from the battery inducing an opposite charge in the opposite plates of the condenser. In this condition a certain electric potential exists in the condenser, and if we discharge the condenser so charged through a proper measuring instrument it is evident that we can tell thereby the value of the charge the condenser had. This in general is the way the "capacity" of condensers is measured.

The capacity of a condenser is the quantity of electricity it will receive to raise its potential to unity. The "farad" is the unit of condenser capacity; but as a condenser of such capacity would be entirely too large for practical use, the "microfarad" is adopted as the prac-

tical unit, and represents the millionth part of one farad.

In the telegraph duplex and quadruplex and other sensitive telegraphic apparatus the condenser is a very valuable adjunct. When a charge is sent to the line by the closing of the transmitting key a return discharge takes place when the key is again opened. This discharge consists of the return of a portion of the current sent into the line by the closing of the key, and if the receiving instruments are of a sensitive nature this return discharge is liable to affect them and cause what is technically called a "kick," which, in plain English, means that the magnets of the instrument become sufficiently charged by the return current to cause a false signal. False signals are very detrimental to the successful operation of a multiplex system of telegraphy, because it is absolutely necessary that the receiving instruments be entirely unaffected by the home signals, so that the signals from the distant end may be received unimpaired.

This "kicking" is counteracted by the use of condensers, which are properly connected with the instruments. The practical effect of a condenser here is to discharge its charge through the coils of the receiving instrument at the instant the discharge from the wire takes place. The effect of the latter discharge is thus neutralized, and the instrument practically remains unaffected.

As the return charge from the line varies with the atmospheric and other conditions along the line it rarely remains constant for any length of time. To meet these

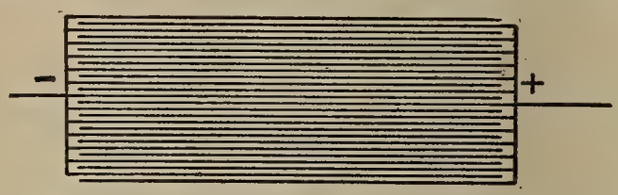


FIG. 2.—ARRANGEMENT OF SHEETS OF TIN-FOIL.

variations adjustable condensers are used, so that their charge may be increased or decreased at will, in order to balance the discharge from the line.

The condenser illustrated in Fig. 1 is of the adjustable class. The tin-foil plates are divided into groups, and the groups are cut out and in by means of the plugs shown at the right-hand end of the illustration.

Submarine cables act as condensers of great length. The charge of electricity in the wire induces a charge on the outside of the insulation, which has a retarding effect on the working current. In order to overcome the effects of retardation a charge from a condenser is sent into the cable immediately after each signal.

An Atlantic cable condenser is a huge affair. One was made by Messrs. Muirhead, of England, for duplexing one of the Atlantic cables, which contained a tin-foil surface of over 2 acres, or 100,000 square feet.

FRICTIONAL AND GALVANIC ELECTRICITY.

Speaking generally, it may be said that when any two bodies are rubbed together electricity is produced, although it frequently happens that the amount is so small as to render its detection very difficult. If, however, delicate apparatus is employed, very feeble charges can be indicated. In fact, if a piece of zinc and a piece of copper are simply placed in contact the feeble charge of electricity then developed can easily be rendered evident. If the same pieces of metal are placed in saline or acidulated water, a similar result follows, although in this case the water itself becomes an important factor in determining the resultant electrification. The end of the zinc outside the liquid will be found to possess properties similar to those of sealing-wax after it has been rubbed with fur. It is, therefore, said to be negatively electrified. The copper, on the other hand, will have an electrical state similar to that of the fur itself, or of glass which has been rubbed with silk, and it is therefore said to be positively electrified.

It follows that whether the electricity is the result of so-called friction or whether it is a consequence of the simple contact of two dissimilar bodies, it is with precisely the same kind of force that we have to deal, and the old distinction between "frictional" and "galvanic" electricity, which used to be urged with considerable persistence, is virtually a myth. The quantity of electricity may vary, and we may view it in its two phases, positive and negative, but neither of these considerations can affect the character of the force.

It may be accepted as a general fact that when the same kind of force is bestowed upon two points or bodies, but to a different extent in the one case as compared with the other, there is a universal tendency to equalize the distribution of the force—that is to say, to produce equilibrium, and this equilibrium will be established when the conditions become such as to render it possible. Reverting again to the zinc and copper plates partly immersed in water, the exposed ends will be electrified to different degrees. There will be a tendency to produce equilibrium, or as it is more generally called, neutralization. This will be accomplished if the necessary facilities are afforded, and until this is done the intervening space will be subjected to what may be called electrical stress. It is found by experiment that a piece of metal affords the readiest means of relieving the strain due to this stress, thus facilitating neutralization, for on joining the two plates together, say by a piece of copper wire, a momentary rush of electricity from the one end to the other will take place. This phenomenon is that which is generally known as discharge, and it affects the whole combination, including the liquid and the metal surfaces in contact with it.

This brief spasmodic flow or rush of electricity, whose function it is to restore the electrical equilibrium, causes, however, a series of chemical changes to take place in the liquid itself, among other things a portion of the zinc being dissolved and converted into what is called a salt of that metal. These chemical reactions cause in their turn a fresh electrical difference between the plates, which is followed immediately by another equilibriating flow, and that by another difference, and so on.

These changes follow one another in exceedingly rapid succession, so rapid, in fact, that it is a matter of absolute impossibility to distinguish them separately, and we have consequently what appears to us as what is known as a continuous "current" of electricity.

SANDUSKY, MILAN AND HURON ELECTRIC RAILWAY.

The proposed electric line which is to be constructed and operated by the Sandusky, Milan and Huron Electric Railway Company, of Sandusky, Ohio, will run from Sandusky to Milan, and probably four miles beyond to Norwalk, with a spur to Huron, starting from the Milan line, either at Bogert, five miles south of Sandusky, or at the Middle Huron Road, just beyond the Soldiers' Home.

The total length of the line will be 21 miles. Commencing at Sandusky it will pass through Bogert, Avery, Milan and Huron.

Work will be commenced on the road during the coming fall, and it is hoped to have it completed and opened for traffic by June, 1893. The company has not yet decided upon what electric system it will adopt, nor as to the number of cars it will need.

Considerable stock has already been subscribed for, and

consent of property owners are now being secured, also subscriptions, bonuses, etc.

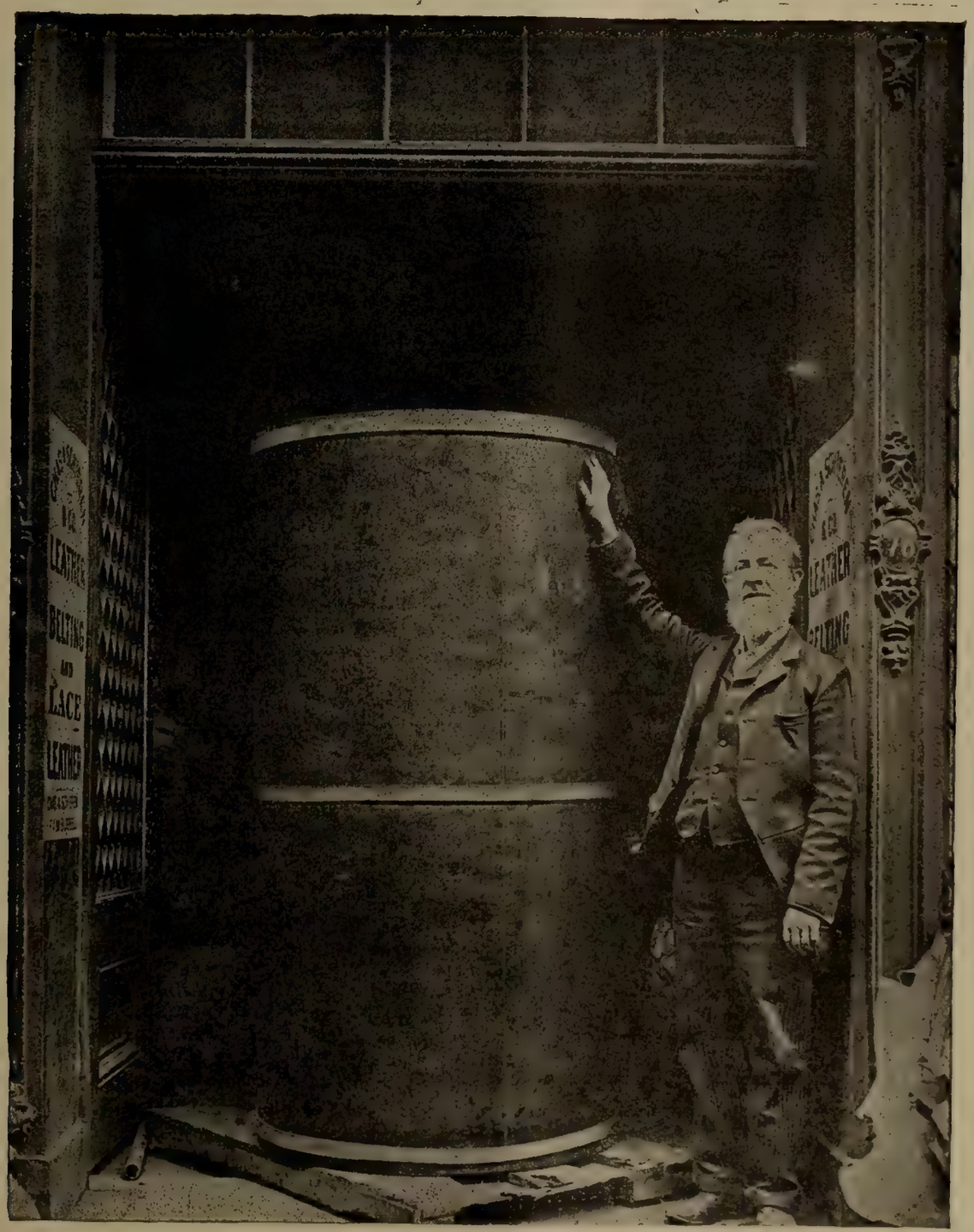
The capital stock of the company is $100,000, but it is proposed not to bond the road for over $75,000 at the outside.

Great interest is being manifested all along the proposed route, and the enterprise is considered to be very promising, connecting as it does country towns with centres of population in that section of Ohio.

The more perfect our mechanical appliances, the better are they fitted to direct the forces of nature to do useful work, and in this sense the electric transmission of energy must be regarded simply as an improvement on purely mechanical methods already existing.—*Kapp.*

A LARGE BELT.

In the development of electric machinery for light and power purposes great stimulus has been given to a large number of collateral industries. Among the latter may be mentioned the leather-belt business, which has attained a position in the mechanical world of very great importance.



72-INCH 3-PLY ELECTRIC LEATHER BELT FOR THE BROOKLYN CITY RAILROAD CO.

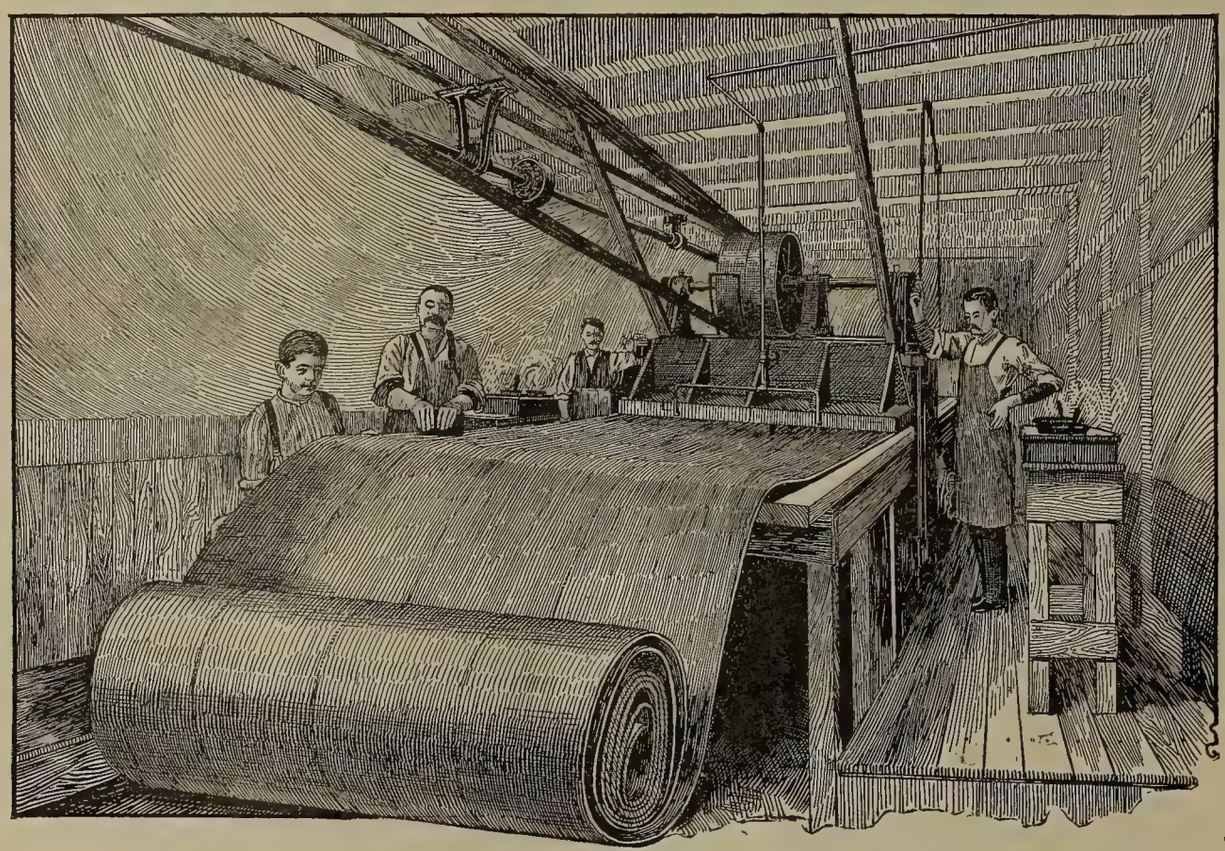
The necessarily uniform and perfect operation of electric generators has necessitated improvements in belting as well as in the steam-engine, etc., and among those who manufacture belting none has made greater efforts to satisfy the necessities of the electrical trade than Chas. A. Schieren & Co., 45–51 Ferry street, New York. Their belts are very extensively used, and judging from the

testimonials received by the firm, are giving abundant satisfaction.

The firm has just finished a monster electric belt for the Brooklyn City Railroad Co., Brooklyn, N. Y., an illustration of which is given herewith. This belt is 72 inches in width, or six feet. It is 116 feet in length and weighs 22,000 lbs. It is three-ply, and will transmit 1,600 horse-power from the engine to the electric generators.

"Electric" leather belting is a great favorite among electric-light and street-railway people. Every test that has been applied to it has been withstood, and in the matter of workmanship, elasticity and strength of leather, it is said to be unexcelled. Only the heart of the most solid part of the hide is used for these belts, and the leather is pure oak tanned.

The firm has recently erected in its factory an additional hydraulic belt-press which gives a pressure of over 200 tons. These presses are used in cementing together the various pieces of leather which go to make up the complete belt.



200-TON HYDRAULIC BELT-PRESS.

SHORT CIRCUITS IN ARMATURES.

During the process of winding drum armatures for dynamos it is essential to keep a watch upon the insulation of the wires. This becomes of still greater importance if the wire be fine and is wound in many turns. After each section is wound it should be tested for the following possible faults:

(1) Short circuit to core of armature.
(2) Short circuit, or leakage, to any other section.
(3) Short circuit within itself.

The testing apparatus generally employed consists of a bichromate battery to furnish the testing current, and a galvanometer for detecting purposes.

To ascertain short circuit to core, connect battery, galvanometer and core in series, and make contact (with a wire from the remaining pole to the battery) to the ends of the section it is desired to test. The smallest deflection of the galvanometer will indicate a leakage.

Short circuit, or leakage between section and section, is much more apt to occur. Before testing for this fault disconnect all sections from each other. Connect, as before, the various sections, each in turn, in series with the battery and galvanometer, and make contact with each remaining one of the sections. A deflection will indicate the sections that touch metallically in crossing. In order to obviate the inconvenience of unwinding several sections in case of a fault, this method of testing should be in constant requisition during the whole operation of winding the armature. In this way an incipient fault is located before other sections have covered it up. The third fault can only be detected by measuring the resistance of the section; any diminution of this would, of course, indicate a cross between some two of its turns.

CONVENTION OF EDISON ILLUMINATING COMPANIES.

The eighth annual meeting (13th Convention) of the Association of Edison Illuminating Companies met in Toronto, at the Rossin House, on Tuesday, August 9.

The first session was called to order at 2:30 P.M., by John I. Beggs, who has for the past six years been president of the association.

The following members were present: W. M. Brock, general manager Edison Electric Ill. Co., Paterson, N. J.; A. F. Walker, supt. Edison Light Co., Grand Rapids, Mich.; W. S. Barstow, general supt. Edison Electric Illuminating Co., Brooklyn, N. Y.; Wilson S. Howell, treasurer of the association and honorary member; Frederic Nicholls, president Toronto Incandescent Electric Light Co., Toronto, Can.; C. L. Edgar, general manager Edison Electric Ill. Co., Boston; J. H. Vail, assistant engineer-in-chief General Electric Co., New York; J. A. Colby, secretary and manager Edison Light Co., Des Moines, Ia.; F. E. Jackson, Edison Lamp Works, Harrison, N. J.; W. L. Garrison, treasurer Edi-

son Electric Illum. Co., Brockton, Mass.; Geo. R. Stetson, president New Bedford Gas and Edison Light Co., New Bedford, Mass.; Chas. R. Price, treasurer New Bedford Gas and Edison Light Co., New Bedford, Mass.; William D. Marks, president Edison Electric Light Co., Philadelphia, Pa.; J. H. McClement, president Edison Electric Light and Power Co., Amsterdam, N. Y., and Winston-Salem R'y and Electric Co., Winston-Salem, Va.; Arthur Williams, gen'l inspector Edison Electric Illum. Co., New York City; Arthur E. Kennelly, Edison Laboratory, Orange, N. J.; A. L. Smith, president Appleton Edison Electric Co., Appleton, Wis.; Chr. Wustenfeld, manager Elgin City R'y Co., Elgin, Ill.; Hoyt Post, director and attorney Edison Electric Illum. Co., Detroit, Mich.; E. R. Weeks, general manager Edison Electric Light and Power Co., Kansas City, Mo.; S. B. Eaton, general counsel Edison Electric Light Co., New York city; G. H. Van Etten, Edison Electric Light and Power Co., Little Rock, Ark.; J. E. Sayles, general agent Edison Electric Illum. Co., New York; Chas. H. Lindenberg, Columbus Edison Electric Light Co., Columbus, O.; A. W. Field, secretary and manager Columbus Electric Light Co., Columbus, O.; Samuel Insull, president Chicago Edison Co., Chicago, Ill.; W. J. Jenks, Edison Electric Light Co., New York city; G. H. Ferris, secretary, treasurer and manager St. Paul Edison Co., St. Paul, Minn.; Maurice Hoopes, supt. Edison Electric Illum. Co., West Chester, Pa.; W. E. Rundle, official stenographer; John I. Beggs, director Harrisburg Electric Co., Harrisburg, Pa.; J. H. Sheddy, general manager Renovo Edison Light, Heat and Power Co., Renovo, Pa.; A. D. Page, ass't manager Edison General Electric Co., Lamp Works, Harrison, N. J.; John R. Markle, director Edison Light Co., Grand Rapids, Mich.; John Langton, Canadian Works Edison General Electric Co.; Henry W. Darling, vice-president Newport Illuminating Co., Newport, R. I.; H. J. Smith, general operating supt. Edison Electric Illum. Co., New York; M. D. Barr, district-manager Edison General Electric Co., Toronto, Can.; Edwin W. Hammer, Edison Electric Light Co., New York City; C. R. Van Trump, engineer and manager Wilmington City Electric Co., Wilmington, Del.; W. S. Andrews, general supt. Canadian Works, Edison General Electric Co.

The standing committees of the association were called upon for reports, and from these reports several discussions of practical subjects resulted. These included the importance of high insulation in the interior wiring of buildings and the improvement of safety fuses. On several of these questions the association was favored with a practical talk by Capt. Wm. Brophy, who, by vote of the meeting, was especially invited to be present and participate in the discussion.

Mr. J. H. McClement raised some interesting questions relative to the possibilities of operating electric railway systems, and during the discussion Mr. William Lloyd Garrison, of Boston, was called upon and gave in an exceedingly interesting manner some results of his pioneer incandescent electric-light experience at Brockton, Mass.

Instructive remarks were made by Messrs. Barstow, of Brooklyn, and Mr. Stetson, of New Bedford.

By invitation of the association, Mr. M. J. Sullivan, for several years official stenographer of the association, read a paper entitled "The Central Station and Street Railways," which commanded the close attention of the delegates and occasioned further discussion on the question suggested.

An interesting and valuable paper, illustrated by statistical tables and diagrams, was read by Mr. J. H. Vail on "The Application of New Apparatus and High-Economy Engines in Central Stations to Secure Greater Commercial Efficiency and Economy of Coal."

SECOND SESSION, WEDNESDAY, AUGUST 10.

Returning from a delightful drive through the suburbs of the city, in open carriages provided by the Edison Company, of Toronto, the Association convened at 11 o'clock.

The courtesy of the Edison Company in arranging for this early morning ride and the moonlight sail of Tuesday evening was suitably acknowledged by vote of the Association.

The Canadian Department of the General Electric Company offered to the delegates the pleasure of an excursion to the Peterborough factories, but as the business engagements of the majority of the members of the Association prevented any general attendance upon such an excursion, the invitation was declined with regrets and thanks.

The principal feature of the day's programme was a discussion of important questions of business policy.

In the afternoon the discussions of the morning were continued, Mr. C. A. Coffin, president of the General Electric Company, and Mr. S. D. Eaton, general counsel of the Edison Electric Light Company, being present and participating.

The following officers were chosen for the year to come: President, John I. Beggs; vice-president, Frederic Nicholls; secretary, W. J. Jenks; treasurer, Wilson S. Howell. Executive committee: C. P. Gilbert, C. L. Edgar, E. R. Weeks, W. D. Marks, Samuel Insull.

The question of the place of holding the next annual meeting was left to be decided in future by the executive committee.

A statement regarding the work which has been done during the year by the Fuel-Gas Committee, was made by J. R. Markle. The committee was continued for another year, as were also the committees on Lightning Protection, Dangers from Systems of High Pressure, Grounding the Neutral Wire.

Adjourned.

The following-named gentlemen non-delegates were in attendance:

Capt. Wm. Brophy, electrical engineer and inspector for the Associated Factory Mutual Insurance Companies, Boston; R. B. Corey, general manager Electric Construction and Supply Company, New York; J. W. Gladstone, Edison Manufacturing Company, New York; J. K. Martin, of J. J. Murray & Company, Philadelphia; M. J. Sullivan, *Street Railway Gazette*, Chicago; Romane Mace, Interior Conduit and Insulation Company, New York; L. M. Pinolet, *Electrical Engineer*, Montreal; George T. Manson, Okonite Company, New York; J. S. Wise, General Electric Company, New York; B. E. Greene, *Electricity*, New York; Louis Stieringer, General Electric Company, New York; Thos. R. Taltavall, ELECTRICAL AGE and STREET RAILWAY NEWS, New York.

CONVENTION NOTES.

Mr. Romane Mace, of the Interior Conduit and Insulation Co., of New York, placed two Lundell fan motors in the meeting-room, which kept the delegates quite comfortable during the last session. The motors and the custom house red tape got tangled up somewhat, which caused some delay in getting the whirlwind producers into action, but the breeze, as brief as it was, was appreciated none the less by the perspiring delegates. It is hardly necessary to say that the Lundell motor won for itself a good many admirers, and Mr. Mace in consequence captivated a few orders.

On Tuesday evening a "moonlight" ride around the bay was given to the delegates by the Toronto Incandescent Electric Light Co. It was a very enjoyable affair, and Mr. Frederic Nicholls, the president and general manager of the company, exerted himself to the utmost to make his guests comfortable. The moon failed to keep its part of the agreement, but a good time was had nevertheless. On Wednesday morning the same com-

pany gave to the delegates a carriage ride through the city, under the leadership of Mr. Nicholls. Appropriate acknowledgments of the courtesies were tendered by the Association, as will be seen in the report of the proceedings of the meeting.

The presence of General Manager Coffin, of the General Electric Company, at the meeting on Wednesday gave a majority of the delegates an opportunity to become acquainted with that gentleman. He made a favorable impression upon those who made his acquaintance on this occasion.

The delegates from New York and the Eastern States went to Toronto in a special Wagner car attached to the 6 P.M. train, over the New York Central road, on Monday, August 8, arriving at Toronto on Tuesday noon. The following-named persons comprised the party: Arthur Williams, John I. Beggs, W. J. Jenks, E. W. Hammer, C. E. Rundle, J. W. Gladstone, J. E. Sayles, J. H. McClement, R. Mace, H. J. Smith and wife, R. B. Corey and T. R. Taltavall, all of New York; C. R. Van Trump, Wilmington, Del.; W. D. Marks, Philadelphia; W. M. Brock, Paterson, N. J.; F. E. Jackson, Harrison, N. J.; A. E. Kennelly, Orange, N. J.; W. S. Barstow, Brooklyn; Maurice Hoopes, Westchester, Pa.

TORONTO NOTES.

The representative of the ELECTRICAL AGE who was in attendance at the Edison Convention in Toronto called on all the electrical houses in that city and found them doing a good trade.

Mr. J. A. Kammerer, representative of the Royal Electric Co. of Montreal, is doing very well for his company. The province of Ontario is his bailiwick, and the Royal Electric has every reason to be satisfied with the results of his enterprise. Mr. Kammerer's office is on York street between Wellington and Front, and he has a very nice display of samples of the Royal Electric Company's goods, which include electroliers, electric fixtures, switches of all kinds, cut-outs, etc., etc.

The Toronto Construction and Electric Supply Co., 63–69 Front street, has an establishment which cannot be surpassed in size and completeness of stock anywhere in the States. The warerooms are very extensive, and immense stock of all kinds of electrical goods, both large and small, are constantly kept on hand. Among the large pieces noticed were a Vandepoele electric mining drill, a Gould triplex pump operated by a Crocker-Wheeler waterproof motor, for mining purposes, and a large line of Eddy motors. The general supplies include railway fixtures and line material of all kinds, lamp-shades, house supplies, wires of all sizes, from magnet wire to railway feeders, P. & B. goods, Grimshaw white core wires, etc., etc. The company is agent for the "Ward" arc lamps made by the Electric Construction and Supply Co., of New York, and carries a line of these celebrated goods. A "Ward" photo-engraving lamp was an article of prominent display in the warerooms. The showrooms are fitted up very artistically with incandescent lamps, which give a very pleasing effect to the interior when they are lighted. The offices of the Toronto Incandescent Electric Light Co., which company is practically identical with the Toronto Construction and Electric Supply Co., take up a portion of the space on the ground floor. They are very attractively fitted up.

The Edison General Electric Company, 77 Bay street, has an elegant display of goods, including electroliers of exquisite designs in copper, brass and wrought iron, motors and dynamos of different sizes, lamps, incandescent fixtures, switches, etc. Everything is arranged with a view to making the most advantageous display of the goods, and the effect is extremely fine. Mr. M. D. Barr, general manager of the Canadian District, has his office here.

Rapid progress is being made by the Toronto Railway Co. in the work of reconstructing the road-beds of the various lines for the electric cars. Girder rails of the English make are used, and the new ties are of cedar and of extraordinary dimensions, giving a wide bearing surface. Concrete is laid between and over the ties, and when it becomes hard the rails are as securely held as they would be if spiked in solid rock. The new road-bed on Queen street is rapidly approaching completion, and when finished will be unsurpassed by any other on the continent. Mr. H. A. Everett, the general manager of the company, is giving close personal attention to the active operations attending the transformation, and all the work is of the most excellent character. Mr. Everett spends his time about equally between Cleveland, Toronto and Montreal, looking after the interests of his company in each of these cities.

Mr. J. K. MARTIN, representing J. J. Murray & Co., of Philadelphia, the well-known manufacturers of electric-light glass shades of all kinds, was in Toronto during the convention. He reports gratifying activity in his line, and his company will have its hands full of work when the operation of its factory is resumed on August 15, after the usual summer shut-down. The opalescent and rich-cut shades for incandescent lighting are specialties with this company, and hold a very large trade.

OPENING OF THE TORONTO ELECTRIC ROAD.

The first electric car was run on the Toronto Street Railway on the afternoon of August 10. Its appearance excited much enthusiasm, and as soon as the fact became known that the first electric car had made its appearance on the road great crowds turned out to be witnesses of the notable event. The streets through which the car passed were lined with people who cheered and gave other evidences of their appreciation of the introduction of rapid transit.

The run was made from the power-house to Rosedale, a distance of five miles, and the trip was most successfully accomplished, not a hitch of the slightest character occurring. Considering the condition of the old road-bed, which is to be entirely rebuilt in the most improved and substantial fashion, the success of this trial trip was a remarkable one, and the officials have good reason to be proud of the result.

The franchise to change to the electric system was granted to the company on May 19 last. The line of road on which the trial-trip was made runs from the Union depot, through Church street to Rosedale, and the electric service was put into regular operation on Monday, August 15. Twenty cars were put into immediate service, and 40 more will be added at once, the first order calling for 60 cars. The cars are constructed entirely by the Toronto Railway Company itself, and are very fine specimens of street-car construction. They are roomy, and elegantly finished inside in oak and other light woods, and are lighted by a row of incandescent lamps along the oak ceiling. Oil lamps are used for the signal lights so as to provide light inside the car when the trolley is detached.

Eighteen feet inside and 26 feet over all is the standard length of car adopted by the company. The seats are elegantly upholstered in Wilton carpet, and are very easy.

The trucks were also made by the railway company. They are patterned after those made by the Fulton Foundry, of Cleveland, Ohio.

Each car is equipped with two 20 H. P. Edison single-reduction motors, and the company expects to run 200 motors in the city when the road is completed.

The overhead work was done by the Cleveland Construction Company, of Cleveland, Ohio, and has the appearance of having received careful attention.

Thirty miles of line will be operated electrically this summer, and by next summer the balance of the 80 miles of road will be given over to electricity and the horses will be laid off. The thirty miles of line which will be operated this summer will embrace the central and business portion of the city, the horse-car lines on the outlying sections being used as feeders for the electric system.

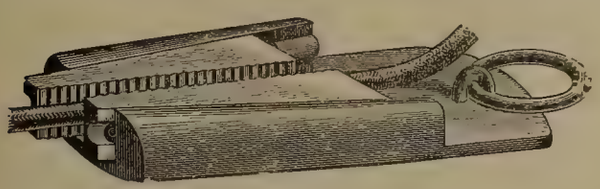
Among those on the car on the trial-trip were: Wm. Mackenzie, president of the Toronto Railway Company; H. A. Everett, general manager; Mrs. Mackenzie, Mrs. Everett, Hon. R. Fleming, mayor of Toronto; W. H. Brenner, electrician for the company's Montreal system, and Thos. R. Taltavall, ELECTRICAL AGE.

Messrs. Mackenzie and Everett received the hearty congratulations of the party, and both gentlemen expressed great satisfaction with the test.

COME-ALONG, OR WIRE GRIP.

The stringing of electric wires is greatly facilitated by the use of Cope's Automatic Come-Along, or Wire Grip, which is illustrated herewith. It avoids all twists and kinks in the wire, and in all cases where it is desired to take in slack in wires of all kinds it is unequalled. It is equally serviceable in stringing trolley wires, insulated wires of any size, guy or span wires, and can as well be used for splicing leather belting.

This Come-Along is made in 4 regular sizes, viz.: No. 1, which is designed for electric-light wires, has a space



COME-ALONG, OR WIRE GRIP.

between the jaws of $\frac{1}{16}$ to $\frac{1}{8}$ an inch, and will stand a strain of 500 lbs.; No. 2, for electric light and span wires, has a space between jaws of $\frac{1}{8}$ to $\frac{3}{4}$ of an inch, and will stand a strain of 1,000 lbs.; No. 3, for trolley wires, jaw space $\frac{3}{16}$ to $\frac{5}{8}$ of an inch, strain 2,500 lbs.; and No. 4, for electric railway feeders, with jaw space of $\frac{1}{2}$ to $\frac{7}{8}$ of an inch, and will stand a strain of 3,000 lbs. Special sizes are made to order.

On account of the wedge feature of the device, the stronger the pull is the tighter is the grip on the wire, and as soon as the strain is released the grip releases itself.

One important advantage in using this instrument is that it does not break the insulation, nor does it injure the naked wire. It is strongly made, and there is no danger of breaking.

Mr. T. J. Cope, 8 North Sixth street, Philadelphia, Pa., is the manufacturer and dealer in this handy and valuable device.

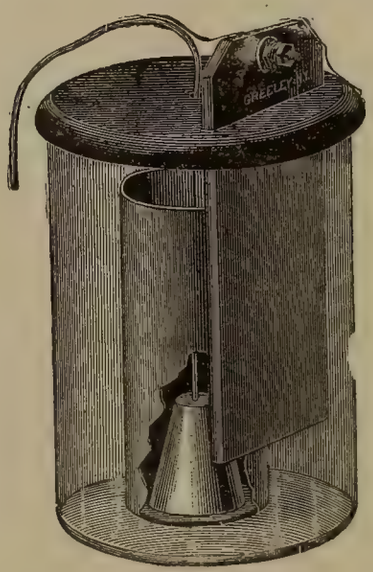
DISRUPTIVE DISCHARGES.

Chief among the mechanical effects of the disruptive electric-spark discharge is the shattering and piercing of glass and other insulators. The dielectric strength of glass, though much greater than that of the air, is not infinitely great. A slab of glass three inches thick has been pierced by the discharge of a power induction-coil. The so-called "toughened" glass has a greater dielectric strength than ordinary glass, and is more difficult to pierce. A sheet of glass may be readily pierced by a spark from a large Leyden jar or battery of jars by taking the following precautions: The glass to be pierced is laid upon a block of glass or resin, through which a wire is led by a suitable hole, one end of the wire being connected with the outer coating of the jar, and the other being cut off flush with the surface. Upon the upper surface of the sheet of glass that is to be pierced another wire is fixed upright, its end being exactly opposite the lower wire, the other extremity of this wire being armed with a metal knob to receive the spark from the knob of the jar or discharger. To insure good insulation a few drops of paraffine oil, or of olive oil, are placed upon the glass around the points where the wires touch it. A piece of dry wood similarly treated is split by a powerful spark.

If a spark is led through a tightly corked glass tube containing water the tube will be shattered into small pointed fragments by the sudden expansion of the liquid.

TELEPHONE BATTERY.

The accompanying illustration shows one of the best telephone batteries yet devised for general service. It is especially adapted for use in cities where telephones are almost constantly in use, and on long-distance lines over which extended conversations are held. Much attention



TELEPHONE BATTERY.

has been given to this form of battery by some of the largest telephone companies in this country, and after many trials and exhaustive tests has won their expressed approval.

The main features which place this type of Fuller battery in the front rank are its high efficiency, duration and uniformity of strength.

Messrs. The E. S. Greeley & Co., 5 and 7 Dey street, New York, are first hands.

AN ELECTRICAL MAN NOMINATED FOR CONGRESS.

Mr. George B. Shaw, who is connected with the National Electric Manufacturing Company, of Eau Claire, Wis., has been nominated by acclamation as the Republican candidate for the seventh congressional district of Wisconsin.

Mr. Shaw was born at Alma, N. Y., 38 years ago, his parents moving when he was of early age to Eau Claire. His father is the noted pioneer lumberman of that place. Mr. Shaw has been twice mayor of Eau Claire, and is very prominent in the electrical business.

THE PRESENT STATUS OF THE STORAGE-BATTERY SYSTEM OF STREET-RAILWAY PROPULSION.*

BY PEDRO G. SALOM.



A DISTINGUISHED scientist once told me that many years ago he was invited to give his first public lecture. He chose a subject that he thought he was very familiar with, as it was one in which he had been making long and careful investigations, but much to his amazement, after talking for ten or fifteen minutes, he found that he had exhausted the subject, and had told his audience all that he knew about it. Then he said he began to repeat himself, and he had continued to repeat himself ever since. Personally I am in very much the same position. I feel that I have already told all that I know about storage batteries, except what has been already better told by others. Still an old truth presented in a new light sometimes carries conviction for the first time.

This, then, is my reason for being here this evening. In discussing "The Present Status of the Storage-Battery System of Electric Street-Railway Propulsion," there are three questions to be considered:

(1) Why is it that so promising a field in electrical engineering has as yet produced no adequate commercial results?

(2) What definite knowledge has been gained by the trials and failures of the past? and

(3) What are the prospects for the future for the introduction of storage-battery traction?

Now, in respect of the first question, I would say that undoubtedly the dreadful patent litigation in which the whole subject of storage batteries has been involved is largely responsible for the failures in the past, although there are other causes which I will touch on presently.

I will not burden you with a history of the patent litigation, which has now extended over a period of five years and which has been prosecuted with a degree of vigor and intensity (and I might even say malignity) worthier of a better cause, further than to say, that the fundamental principle upon which all forms of storage batteries are constructed has been thrice awarded to Chas. F. Brush in the lower courts, and the case is now before the court of last resort, whose decision may be expected at any time, and which, of course, will be final. The fundamental principle just referred to is the broad claim for the application of the active material to a conducting support.

This uncertainty, therefore, of the ownership of the basic patents has rendered capital timid. Conservative street-car companies could not afford to equip their lines with a system that might be adjudged an infringement of others' patents, and upon which an injunction might issue at any time; and on the other hand the battery companies have not been in a strong enough financial position to properly equip and operate a line of sufficient magnitude to demonstrate the practicability and commercial success of their respective systems, or at all events if they have been, they have utterly failed to do so.

I might add, also, that as a further result of this doubt or uncertainty as to the ownership of the patents, a large number of storage-battery companies have sprung up in all parts of the country without any possible reason for their existence, beyond the fact that their promoters thought that it was only necessary to change the shape or form of a plate to escape the patents, and for the further purpose of selling stock to the innocent public.

Many of the attempts show an utter ignorance and disregard of all the principles that are well known on the subject.

Thousands, yes, hundreds of thousands of dollars have been squandered in this way, much to the sorrow and disappointment of the many innocent stockholders, and to the dismay and confounding of the general public, who, seeing so many failures, have come at last to doubt the practicability, or even possibility, of a commercial battery. We, however, have nothing to do with this. The success or failure of an engineering problem, fortunately, does not depend upon what the general public may think about it, unless it be a problem requiring an enormous capital, which can only be obtained through the government or by the co-operation of a large number of individuals. What then does it depend on? It depends on our ability to demonstrate that we can accomplish a desired result in a better and cheaper way than has heretofore been employed.

This brings us, then, to our second query:

What definite knowledge has been gained by the trials and failures of the past?

This, of course, is a vast subject of inquiry, as it embraces our entire experience during the past six years, and my time will only permit me to dwell on the essential features.

Assuming, now, for the sake of argument, that electric storage traction is practicable, what are the problems that confront the engineer?

The first and most important is the life of the battery.

(2) The capacity.

(3) The rate of discharge.

(4) The weight and size of the elements.

(5) The loss of power in the various transmissions between the prime mover and the axle; or, in other words, the relative efficiency compared with other methods.

(6) The distance or total length of line.

(7) The grades and curves.

(8) The speed.

We will not consider all these points separately, but the whole question in a general way.

In traction work there is only one reliable method of determining the life of the battery, and that is on the basis of car mileage. It is all nonsense to talk about batteries lasting eight months or eighteen months, unless there is a record at the same time of the amount of work accomplished, measured in electrical horse-power hours. The highest record yet obtained, that I have any reliable knowledge of, is that of a single set of 108 accumulators making over 6,000 miles. This record was made on the Citizens' Passenger Railway, in Indianapolis, and was made under the most trying and unfavorable circumstances.

Assuming that the battery could make 100 miles per day, this would mean that the battery would have to be renewed every sixty days. If fifty miles per day, then the life would cover a period of four months; and at twenty-five miles per day, eight months, etc. So you can readily understand that the bare statement that a battery would last six or eight months does not convey a correct idea of the real life of the battery.

Let us see what it would cost to run 6,000 miles with a single set of accumulators, or since two sets are always employed, the one being charged while the other is in service, we will make the calculation on a basis of 12,000 miles.

216 positive groups, at $2.50	= $540 00
Credit 2,592 pounds lead scrap at 3 cents	= 77 76
Balance	$462 24

462.24÷12,000=3.85 cents per car mile.

* Read at the stated meeting of the Franklin Institute, Philadelphia, June 15, 1892.

What amount of work is represented by this 6,000 miles, so far as the accumulators are concerned?

It was found by keeping the most careful records on the Fourth avenue line in New York, that the amount of energy consumed per car mile was about one and one-half E. H. P. hours. That is to say, that after making a round trip of eleven and one-half miles, it required about seventeen E. H. P. hours to replace the energy drawn from the batteries. Six thousand miles would therefore require 9,000 E. H. P. hours, and since a battery of 108 cells has a capacity of fifty-four E. H. P. hours for each total discharge, if we divide 9,000 by 54 we get 166 discharges that are required of the battery, before the positive plates break down. Any one who has had any extensive experience with storage batteries knows that this is a very conservative estimate of the amount of work that a good battery will perform.

It may be asked, have there been no improvements in late years with a view of diminishing the number and weight of batteries required to propel a car? I regret to have to answer no, and this brings me to the consideration of the limitations of storage batteries.

I have said that it requires about one and one-half E. H. P. hours per car mile, and that 108 accumulators are used and necessary for a twelve-mile run, and they have a capacity of fifty-four E. H. P. hours, or three round trips.

Why is it not possible to use a battery with one-third the weight? Simply because the weight of battery required is not according to the total amount of work to be done, but according to the rate at which it is to be done.

Let us go back to our twelve-mile run again. This requires one and one-half E. H. P. hours per car mile, or 1,119 watt hours, and since the E. M. F. is about 225 volts, this would be equivalent to nearly five ampère hours per mile, or sixty ampère hours for the round trip; and since the trip consumes two hours' time, this is an average rate of discharge of thirty ampères all the time.

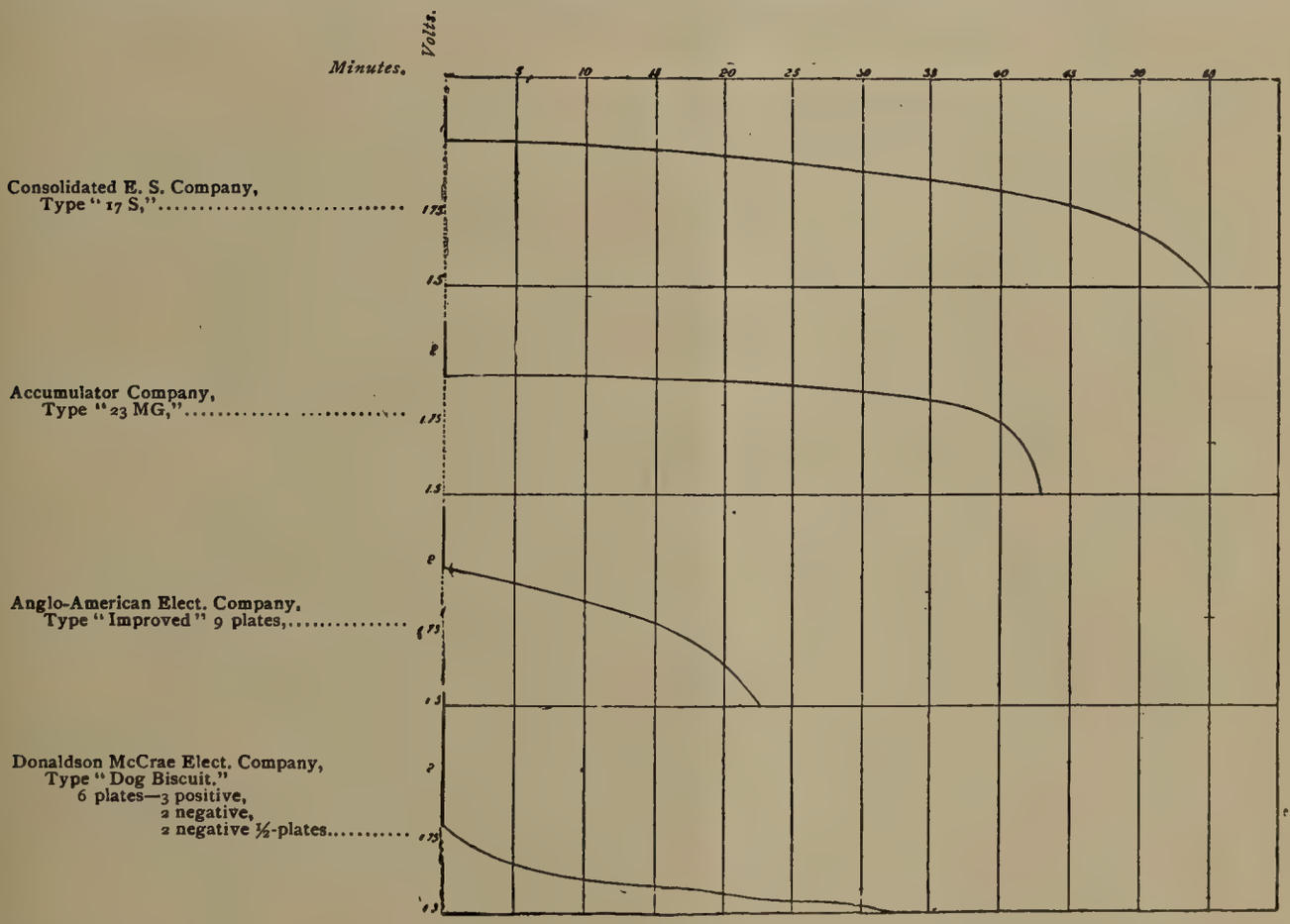
Of course it is very much greater than this at times, when the car starts or is going up steep grades, etc., when the battery is frequently called upon for a rate of discharge of over 100 ampères.

Now, if we were to use a smaller battery of less total capacity, there would not be sufficient surface area of active material exposed to develop such a current, the E. M. F. would drop and the car stop running. This is the trouble with all thick-plate batteries. The amount of surface area exposed is comparatively small for the weight of battery.

A reference to the following diagram, showing the curves of discharge (at 100 ampères) of four types of accumulator, will illustrate very forcibly why thick-plate batteries are not available for traction purposes.

The first two curves are from thin-plate batteries, and the second two from thick-plate batteries, all tested under the same conditions.

This comparison is not intended as a disparagement of the thick-plate batteries, the Donaldson-Macrae type in particular having a number of very valuable features embodied in its construction, but it is only designed and intended for comparatively low rates of discharge.



It will be observed that in the thick-plate batteries that the E. M. F. falls in one case to 1.5 volts in twenty-three minutes, while in the second case, although it falls more rapidly at first than the former, it maintained the current ten minutes longer before a fall to 1.5 volts was reached.

When the E. M. F. falls below two volts per cell the efficiency of the motor begins to fall *pari passu*.

Finally, we come to the consideration of the prospects for the future of storage traction.

It seems to me, in view of the facts which I have just stated, and which are indisputable, that the introduction of storage traction for surface roads in our large cities is inevitable.

The trolley may be introduced at the present time,

pending the solution of the difficulties under which storage batteries have come into disrepute, but that it can obtain in the long run against the many and obvious advantages of the storage system is incredible. Let the public once understand that there are no insurmountable difficulties connected with the storage system, beyond the fact that it costs a few cents more per car mile than the trolley, and the demand for its introduction will be irresistible.

The public are not interested in the cheapest and most objectionable method of transit, especially where they derive no benefit from the economies effected; but they are interested in and entitled to a safe, reliable and absolutely unobjectionable method of transit, which is cheaper than horses at the present time, and which may in a few years, from the further knowledge and experience gained by actual use, almost, if not quite, compete in cost with the trolley.

The reports of the West End Road in Boston for the months of May and June, 1891, show that the total cost of the overhead system was about twenty-one cents per car mile, while that of the horse system was about twenty-five cents per car mile.

These reports, showing the net results of the actual working conditions on a very extensive scale, are far more accurate than any paper calculations based on theoretical and ideal conditions, as all the uncertainties and unknown quantities always arising in actual operations are included in these results.

Now, inasmuch as nearly all the electrical and mechanical conditions are constant in both the trolley and storage systems, with the exception of the overhead line and batteries (with some minor advantages favoring the storage system), if we can show that the additional cost of the batteries, over and above the entire cost of the trolley system, does not exceed four or five cents per car mile, then it is manifest that the storage system will supersede the horse system, as the collateral advantages are so great as to render the consideration of any other system out of the question.

This, I think, we have already demonstrated by the record of the Indianapolis battery given above, and which is confirmed by the report of the Birmingham Central Tramway Company, Limited, wherein it is shown conclusively that with only a small installation of five or six cars, it is cheaper to run with storage battery than with horses. I append below the results obtained at Birmingham with horse and storage-battery traction.

COMPARISON OF COST OF OPERATING PER CAR MILE WITH HORSES AND STORAGE BATTERIES AT BIRMINGHAM, ENGLAND.*

The number of miles made by the storage-battery cars, from July 24, 1890, to June 30, 1891, was 138,396, and they carried 1,144,718 passengers. If five cars were in service, this would make nearly 28,000 miles per car.

The gross revenue was	£8,732
The gross expenditures	5,711
Balance	£3,021

STORAGE-BATTERY TRACTION.

Electric Haulage.

	Pence.
Wages	2.6
Fuel	1.66
Stores	.73
Water and lighting	.07
Sundries	.09
	5.15

Machinery.

Material	.29 .29

Car Repairs.

	Pence.
Wages	.6
Material	1.33
	1.93
Total traction expenses	7.37

HORSE TRACTION.

	Pence.
Wages	2.44
Forage and bedding	3.72
Veterinary and shoeing	.40
Water and gas	.06
Harness repairs	.16
Stable utensils	.04
Sundries	.08
Renewals	.43
	7.33

Repairs.

Wages	.28
Material	.26
	.54
Total	7.87

* *Electric Review* (English), August 14, 1892.

From which it appears that the total cost for storage-battery traction was 7.37 pence or 14.74 cents per car mile, and for horse traction was 7.87 pence or 15.74 cents per car mile, and I would call special attention to the fact that, under the heading car repairs, the item of material is only 1.33 pence, or 2.66 cents per car mile, and assuming that this was all for renewals of battery (although, of course, some of the expense must have been for repairs to motors, etc.), we find that the cost of battery renewals (really the only unknown quantity in this problem) was only 2.66 cents per car mile. In view of such facts, is it possible to contend any longer that storage-battery traction is not commercial?

I have purposely refrained from discussing the subject except from the one point of view—the storage battery. Every one knows that electric traction is a brilliant and phenomenal success, and in advocating the storage system we are merely proposing to furnish current to the motors indirectly by means of a battery instead of directly through a central station.

Of course, the same problems obtain in regard to gearing and motors, etc., in both systems, and do not enter into the question as propounded.

In my judgment the storage battery has a future. You cannot pound the life out of a fact. All the slander and ridicule that has been heaped upon storage batteries does not alter their capacity to do a certain amount of work at a given cost, one ampère second.

Give the storage battery a chance. Let the same engineering skill and ability be applied to the storage system as has already been done with the trolley, and the results will be surprising.

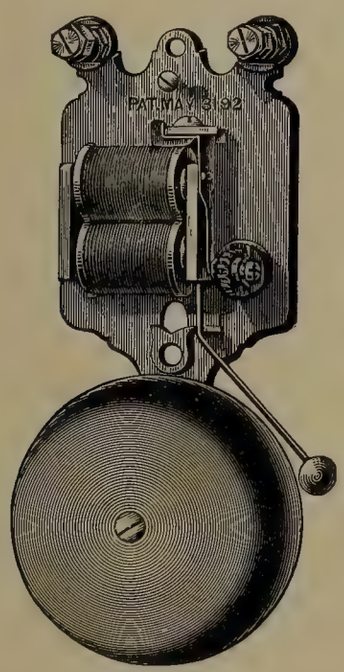
WROUGHT AND CAST IRON FOR DYNAMOS.

Two very important considerations influencing the construction of field-magnets are economy and mechanical strength, and in practice it is often considered advisable where the weight is unimportant to use cast-iron for part or all of the field-magnet core. It is preferable to forge or cast the core in one piece, as joints break the molecular continuity and increase the magnetic resistance considerably; this disadvantage is minimized by making the surfaces in contact fit truly. The principal practical objection to the use of cast-iron is that, since its sectional

area must be at least twice that of wrought-iron, a much greater amount of copper is required to form the field-magnet coils. Copper is expensive, while cast-iron cores are far less costly than equivalent ones of wrought-iron, and it is interesting to observe how different makers aim at true economy in this matter. Even leaving out the question of cost and weight, it does not by any means follow (as is sometimes supposed) that a dynamo properly designed to perform certain work, and having cast-iron in its construction, is inferior to one built wholly of wrought-iron to perform the same work.

NEW ELECTRIC BELL.

Messrs. Huebel & Manger, manufacturers of electric and brass goods, 286–290 Graham street, Brooklyn, have recently placed on the market a new electric bell which contains many new and improved features. The principal one, however, is found in the contact-post, which is so made that it cannot turn. In the old style the bell was very often rendered useless by the shrinking of the insulating bushings between the post and the base, which



THE ELECTRIC BELL.

causes the post to become loosened and through continual vibrations to turn one side and no longer present the platinized part of the screw to the contact-spring.

In this bell the contact-post is made of a strip of metal bent in U form, and its square base sinks into a recess formed in a raised boss on the base-plate. In order to admit of a layer of insulation, the groove in this boss is slightly larger than the bottom of the post. The post is held by a fastening-screw from underneath as usual and is thus prevented from twisting in any way. The two binding-posts are so arranged as to be fixed rigidly in place.

The bell is of neat design and in its construction only first-class material and workmanship are employed.

IN NEW JERSEY.

The New Jersey State Subway Commission on August 9 gave permission to the Passaic and Newark Electric Co. to erect a line between these two cities. Permission was also granted to the People's Electric and Power Co. to erect poles and underground wires in Jersey City. Like rights were asked for by the Citizens' Company, of Newark, and the New York and New Jersey Telephone Co. asked permission to construct underground conduits in Newark and Jersey City, and the Central New Jersey Telephone Co. requested that it be allowed to place its wires underground in Jersey City.

AN ELECTRIC STORM RECURRENCE.

BY WILLIAM FINN.

The same sun-spot which was unquestionably concerned in the production of the magnetic storm of July 16 last is probably responsible for a similar disturbance in telegraph lines which occurred Friday last, Aug. 12, and which fairly rivalled its famous predecessor in the extent of territory affected as well as in the magnitude of the disturbing forces.

In many respects, moreover, the characteristics exhibited by the earth-currents on the recent occasion were the precise counterparts of those observed in the case of the previous phenomenon. It is an interesting fact, also, that the interval between the two storms was exactly 27 days, or about the period taken by the sun to complete its axial revolution. This same periodicity has been observed in connection with previous storms, which fact affords further striking illustration of the relationship existing between sun-spots and recurring earth-current phenomena.

The storm of Friday last gave evidence of its approach as early as 8 A.M. on land lines, and prior to that on submarine circuits, but did not develop to serious proportions until about 12:30 P.M. At 1 P.M. most of the wires were practically useless and continued so until about 2:15 P.M. After that time there were intervals of quiesence from the disturbing forces, during which it was possible to dispose of some of the rapidly accumulating business.

During the height of the storm the forces would sometimes violently fluctuate from one polarity to the opposite, but more frequently the variations occurred with great deliberation and without changing their direction, while the galvanometer needle would often remain stationary at some particular point for several seconds at a time.

The writer succeeded in making some continuous observations during the height of the disturbance, and found the maximum values, in a Western wire 481 miles long, measuring 2,280 ohms. This was between 1:45 P.M and 1:48 P.M., when the current attained a strength of 285.4 milliampères, representing a difference of potential between the distant grounds of 650.71 volts, or about four times the strength of the voltage regularly employed on that circuit. This is the highest pressure ever recorded of natural currents.

Some milliammeter measurements taken in Buffalo between 1:40 P.M. and 2:07 P.M. on a New York wire show a range in the current strength of from 50 to 240 milliampères, the latter value being recorded at 2:01 P.M., the difference of potential between the two grounds at that time approximating 500 volts.

Advices from Chicago state that on wires between that point and Cleveland, Kansas City, St. Paul and Memphis, and on several circuits extending in various directions but connected together so as to enable Chicigo to come in circuit as an intermediate office, the electromotive forces varied from 50 to upward of 340 volts.

The greatest differences of potential as a rule were noted on the longer circuits. For instance, at 2:10 P.M. a wire to Newark, N. J., about 10 miles in length, and in which the current strength was 95 milliampères, showed a potential difference between the opposite grounds of 19 volts only.

A New York-Philadelphia wire, 91 miles long, with a

current of 26 milliampères traversing it, at 1:55 P.M. exhibited a pressure of 39 volts.

An 8-gauge iron wire between Richmond, Va., and Norfolk, whose grounds were 104 miles apart, furnished a current of 30 milliampères under a pressure of 86 volts at 1:30 P.M.

A current of 40 milliampères was developed in a wire from New York to Olean over one of the postal-telegraph lines 400 miles in length at about 3:45 P.M., the E. M. F. equivalent of which was about 91.5 volts.

The electrical pressure observed at 1:05 P.M. in a 413 mile circuit between New York and Lynchburg, Va., was about 112 volts.

No *simultaneous* readings, however, were obtained from wires on different routes, so that a proper comparison of the energy developed in the various circuits at any given time cannot be instituted.

The disturbance practically ceased about 5 P.M., and in this respect the recent storm differed from the preceding one, which was of much longer duration.

An idea of the powerful influence exerted on magnetic needles by the *direct* inductive action of the currents flowing in the ground at such times may be judged from the following circumstance: A New York electrician who was endeavoring to take the "constant" of his galvanometer in Seymour, Conn., about 1:30 P.M, with the view of making some practical tests there, was unable for a time to do so, owing to the deviations of the needle, for which he could not then account. These variations extended over about 40 divisions of the scale on either side of the zero point, although the coils of the apparatus were entirely disconnected from the ground, and its needle subject to a directing influence from permanent magnets. It was only by entirely overcoming the effects of the earth-currents by means of the controlling magnets that he finally succeeded in accomplishing his purpose.

Many other curious and interesting results were noted, which may form the subject of a supplementary article.

LONG-DISTANCE ELECTRIC RAILROADS.

The question of long-distance electric railroads is receiving considerable attention from electricians at the present time, and it is extremely interesting to note the various plans proposed to make such enterprises successful.

W. A. Johnson read an interesting paper on this subject before the meeting of the Canadian Electrical Society, held in Hamilton, Ont., last June, from which we make the following abstract, and which, no doubt, will be of special interest to our readers:

"For long-distance railroading the current can be obtained from any generating station (within say 50 miles) from automatic arc dynamos, using for a circuit comparatively small-sized wires and pressure varying according to distance. With an automatic series-wound dynamo at the power-station and with corresponding automatic motor at the sub-station, we have a simple and economic method of long-distance transmission of power whether for railroad or stationary motors or for lighting purposes. The regenerator wound to deliver required pressure for trolley line can be located at convenient stations alone the line. The machines will consist in a dynamo having an incandescent armature on one end and an arc armature with its regulator on the other. The direction of rotation to be reversed from that of regular arc practice (this is so that the arc or motor armature may cut down in the proper way for motors, *i.e.*, in direction opposite to rotation without having to alter position of movement regulator). Field to be shunt of the low-tension armature. Arc armature to be in circuit with source of supply. The field (or at least that part on the arc end) comes from the low-tension armature and is dependent for its strength upon the speed of machine, and that this field depending on speed operates the brushes of the arc armature so as to make it run faster or slower according as field changes. It will be seen that this arrangement must keep field and potential for the low-tension armature constant, while the position of brushes on arc vary to meet the load. With water-power at one end with automatic dynamo, and with corresponding automatic motor at the other end, you have the problem solved of long-distance transmission of power. The field of your motors to be fed from small generators belted from motor so that its speed depends on speed of motor. You will see that in this you have constant speed from constant-current circuit. Should you wish to operate a small electric car over long distance (say up to 50 miles on each side of generating-plant), it can be done in same line as above. In this case the small-field generator is in the control of motorman, and he, by changing the position of brushes, changes speed, and by reversing brushes of small-field generator he can change direction of car. While position of brushes of field-generator remains unchanged, speed of car is constant, whether going up or down grade, if current of supply is kept constant. In short the new automatic dynamo and regenerator solves the question of series transmission of power with constant current. By a block or sectional trolley system as many trains may be operated as wished. In this case also a motor-dynamo is to be placed in each train precisely as last referred to. Some of my hearers may think such a method a little far-fetched, but it is certainly as practical and in as fully developed shape as any other methods proposed, and it would not be nearly as difficult to secure high insulation. I certainly desire as much as others to see the success of the alternating plan, and the investigations and suggestions of all are necessary to reach the end in view. The field for the electric road is immense, and if the apparatus of the present central stations can be utilized, so much the better for them."

MR. EDISON TO THE RESCUE.

On August 11 a new building in the course of erection at the Ogden iron mine, Ogdensburg, N. J., by the New Jersey and Pennsylvania Ore Concentration Co., collapsed, killing two men and injuring many others. Mr. Thomas A. Edison was at the works at the time, and aided in the rescue of the unfortunates. The New Jersey and Pennsylvania Ore Concentration Co. uses magnetic ore-separators invented by Mr. Edison.

CATALOGUES, ETC.

The Aluminum Brass and Bronze Co., of Bridgeport, Conn., has issued its descriptive price-list for 1892, of the various lines of aluminum, brass and copper goods manufactured by it. This list is very exhaustive in its details, and contains a great deal of valuable information. All interested in the class of goods handled by the company should secure a copy. The New York office of the company is in the Stewart Building, 53 Chambers street.

The Peckham Motor Truck and Wheel Co., of Kingston, N. Y., is distributing a list of testimonials received from a number of railway companies in recognition of the merit of the celebrated "Flexible" non-oscillating motor trucks manufactured by it. The front and back

of the list contain illustrations of the company's various types of trucks and wheels.

We have received from the Fort Wayne Electric Co., of Fort Wayne, Ind., a copy of a little pamphlet issued by it, containing a list of companies operating Wood arc and Slattery incandescent apparatus manufactured by this company. From the great number of names contained in the list it is easy to see that the company is meeting with great success in the demand for these systems.

A. M. Mason, 366 Myrtle avenue, Brooklyn, has issued a neat little illustrated catalogue and price-list of the various domestic and electrical appliances manufactured and handled by that house.

The Conover Manufacturing Company, 95 Liberty street, New York, has just issued a handsome illustrated and descriptive catalogue of the various styles of independent belt and steam-driven air and circulating pumps, and condensers manufactured by it.

The North American Phonograph Co., Edison Building, Broad street, New York, has issued in pamphlet form a selection of a few of the many letters received in testimony of the merits of the Edison phonograph as a great convenience and time-saving machine.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, August 13, 1892.

WM. MACFARLAND & Co., 81 Grand street, carry a first-class line of silk for electrical purposes. Purchasers would do well to send or call for a sample. Reasonable prices are the prevailing rule with this house.

C. A. SCHIEREN & Co., 45–51 Ferry street, leather-belt manufacturers, have in their store a huge belt-clamp. It is 72 inches wide, and was constructed to fasten the 72-inch belt to be used in the power-house of the Brooklyn City Railroad Co.

THE NATIONAL ELECTRIC MANUFACTURING AND CONSTRUCTION COMPANY, 136 Liberty street, New York, has been granted a franchise by the board of commissioners of the town of Keyport, N. J., to establish a light and power plant.

WHILE in Boston recently, I met Mr. Romane Mace, of the Interior Conduit and Insulation Co., of this city. He is having remarkable success in introducing the new Lundell motors in the East, and he is very active in his work. He is making many friends everywhere.

MR. H. G. MADDEN, 114 Liberty street, is sole agent for the "De Mott" portable fan-motor and battery. He claims that it will run 500 hours with one charge, representing a cost of one-half a cent per hour. This fan-motor and battery is sold at a reasonable figure, and any one desiring to purchase one should give Mr. Madden a call.

T. J. MURPHY, of the Electrical Exchange, Liberty street, has lately discovered a way of making slate absolutely waterproof. A board of this description, 5 x 5, will be soon mounted by a leading firm and placed in the First Baptist Church of New York city. Slate prepared in this way costs very little more, and can be applied to marbleized or plain slate.

WHILE talking with Lieut. F. Jarvis Patten, consulting electrical engineer, 45 Broadway, about alternating dynamos which friends of his were bringing out, he said that he would shortly put on the market a new 5 H. P. self-exciting alternating-current motor without commutator or brushes, guaranteed to start at full load. He is only waiting for patents to issue.

THE BALL & WOOD COMPANY, of 15 Cortlandt street, New York, last week closed a contract for three of its improved Ball engines for Frederick Loeser & Co., of Brooklyn, and for three others to be placed in the United Charities Building, corner 22d street and Fourth avenue, New York. Contracts are also under way with different parties for more than ten of the company's 300 H. P. cross-compound engines, all of which are fitted with the new Ball low-pressure valve, which has proved so successful in the compound engine of this company's make.

THE ELEVATOR SAFETY COMPANY, this city, has a device which ought to be used in every building in the country in which one elevator or more is operated. Elevator accidents, such as falling down shafts through open doors, etc., are impossible with this device. It is not possible to start the elevator on its journey until each and every door in the shaft is closed tight. The simple opening of any one door locks the elevator mechanism so that it cannot start. The apparatus is electro-mechanical, and is very ingenious in its conception and application. There is certainly a large field for it.

B. W. PAYNE & SONS, 42 Dey street, are having great success with their new Payne Corliss engines. Among some of those they are now installing are the following: One 300 H. P. triple-expansion new improved Payne Corliss engine; also four 300 H. P. vertical boilers for the Elmira Street Railway Company, Elmira, N. Y. (these boilers have three fire holes); a 200 H. P. Payne Corliss engine for the Columbus Street Railway Company, Columbus, Ga.; one 125 H. P. Compound Condensing engine, boilers, etc., for Bath (N. Y.) Electric Light Company, to operate Thomson-Houston arc and Westinghouse incandescent systems; one 125 H. P. Payne Corliss engine, boilers, etc., for Cornwall, N. Y.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	88 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	117 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*106
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	6,500,000	100 00	99 00
Edison General	15,000,000	100 00	
Edison General Receipts		100 00	
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	115 25
General Electric Co., 5s	4,000,000		*103
General Electric pref.		100 00	120 00

Great West. Elec. Sup. Co. pref. 8s....	350,000	10 00	10 00
Guarantee Identification Co., N. Y....	50,000	50 00	40 00
Hickory Electric Co., N. C.....	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y....	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Laclede Gas Co.....	7,500,000	100 00	24 25
Laclede Gas pref.....	2,500,000	100 00	65 25
Laclede Gas 5s.....	10,000,000		*84
Law Telephone.....	400,000	100 00	96 00
Leetonia Elec. L't & Power Co., 6s...	30,000		*99
Livingston E. Lt. Co., Mont., 6s.....	30,000		*92
Marshalltown Elec. Co. 6s, Iowa.....	65,000		*98
Marysville L. & W. Co. 6s, Ohio.....	60,000		*99
McLeod Railway Equip. Co.....	3,000,000	25 00	35 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver.....	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s.....	26,000		*170
Morristown L. H. & P. 5s, N. J.....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co.....	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s.....	1,500,000		*98
N. Y. and N. J. Telephone Stock.....	2,535,000	100 00	98 00
North American Railway Co.....	39,767,200	100 00	13 75
Postal Telegraph.....	10,000,000	100 00	69 00
Pettingell Andrews Co., Boston.....	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum....	1,000,000	100 00	105 00
Rockaway Elec. Light.....	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N.Y.....	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.....	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.....	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.....	50,000		*97
Suffolk Electric Co., Boston.....	300,000	10 00	10 50
Swan Incandescent.....	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.....	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.....	100,000	100 00	105 00
The Ongley Electric Co., N. Y.....	250,000	100 00	85 00
The Siemens & Halske Co., Ill.....	500,000	100 00	par
The Washington Wat. Pow., Wash.....	1,500 000	100 00	90
The Wells & French Co., Ill.....	600,000	100 00	par
Thomson-Houston Electric Co.....	6,000,000	25 00	
Thomson-Houston pref.....	4,000,000	25 00	
T.-H. Electric Co. 5s, N. Y.....	500,000	30 00	*101
United States Elec. Co.....	1,500,000	100 00	25 00
United States Illuminating, N. Y.....	1,250,000	100 00	26 00
Western Union.....	86,188,852	100 00	99 25
Westinghouse Elec. & Manf. Co.....	7,000,000	50 00	30 00
Westinghouse Elec. Co. pref. 7s.....	4,000,000	50 00	47 75
Westinghouse Ass. Rects.....		50 00	19 00
West Point W. Lt. & P. Co., Va.....	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Still as a leading feature in the Stock Exchange, and very near the most important, are the electric securities, and there they will be found for some years to come. It is now the common thing to find in all the financial reports that "the market was strong with a decided upward tendency" and the "largest dealing" in industrial stocks, with the electric as the advanced guard, followed by national cordage, sugar, whiskey, cotton-oil, Claflin, Thurber-Whyland, and the other industrials; most of them, however, have reached a point at which the dividend is regular and the field about filled; with the electric the seed is planted, the crop is growing and the harvest is sure, with a market for it greater than the supply, including, as it does, so many industries that no single student cares to compute them. It requires a half dozen Huns, Fins or Poles, to be discharged by some insulating company to show up the trades and unions whose incomes are directly derived from electric construction, equipment and maintenance. The new corporations, with their franchises and few thousand dollars in hand, are here in numbers, seeking to place their bonds as against construction, paying with pleasure the money raised, be it $10,000, $50,000 or $100,000. One of the latest is from the capital of one of the most prominent Middle States, with a perpetual franchise for an electric road to all parts of the city and $40,000 cash in hand, desirous of bonding for sufficient to complete the road; who wants it? No less than four complete light and power plants earning over six per cent. net on their par value are for sale as going concerns, to be taken over free and clear by the purchaser at any early date. Parts of other complete paying plants are also to be had, also bonds, from the Westinghouse seven per cents., up or down, at remunerative figures, and all of them as safe as governments, offering opportunities for exhaustive examination before investment. Small lots of shares in many of the various electric corporations are for sale, as is usual with all business schemes, the last offered in that line being 100 shares of American Engineering for $35, the par being $100. There are a great many of these chances which are well worth the attention of investors.

The Suffolk Electric Co. are doing an enlarged business with the Russell arc lamp. The peculiarity of this lamp is that the positive carbon is in the shape of a wheel which revolves with regularity, burns equally and for from fifteen to twenty hours without any attention. It more than takes takes the place of the Brush double carbon, as it can be made to last longer and requires less machinery in the lamp to automatically continue it in operation. There is a grand investment possible in this electrical invention, and the lamp is being used so extensively that there is no time to waste getting the interest you desire unless you prefer to pay a large premium for it this winter. Electric traction in all its various departments as an investment is advancing rapidly. The introduction of large motors, endorsed and approved by the most intelligent electrical engineering scientists and experts, is fast opening up another channel for safe and very remunerative returns; and still another accomplished fact is a new locomotive head-light apparatus, giving 5,000 candle-power, the machine not weighing over one hundred and fifty pounds; or if the whole train is to be lighted with 100 incandescent lamps, the weight will not be over 300 pounds and the space occupied on the locomotive not exceed 12" x 12" x 26", the head-light alone, of course, considerably less. There is an opportunity to secure an interest in this corporation if taken soon at attractive figures. This is one of the goody-goody things which will make its way rapidly and at good profits.

DETROIT NOTES.

Mr. Frank B. Rae the well-known electrical engineer, has secured the contract for wiring and installing an electric-light plant in the new Union depot, Chicago.

The Electrical Equipment Company has closed the following contracts within the last two weeks: With A. Sax & Co., of Washington, D. C., for decorating the building for the coming G. A. R. Encampment, the least number of lights to be used to be 800, the maximum to be 1,500; with David Whitney, Jr., for wiring his new granite residence, 1,000 lights. This is beyond question the largest private residence in the State of Michigan, and one of the largest in the United States. Mr. Whitney deviates from the time-honored custom of "putting in gas in case of the electricity giving out," and will depend solely upon electricity. The aggregate of the electrical work on the house will cost, it is thought, in the neighborhood of $5,000. The company has also closed contracts for wiring 34 residences within the last six days.

WARD PHOTO-ENGRAVING LAMPS.

The following testimonial is one of the many received by the Electric Construction and Supply Co., 18 Cortlandt street, New York, in reference to the Ward Photo-Engraving Lamp:

NEW YORK, June 21, 1892.

THE ELECTRIC CONSTRUCTION AND SUPPLY CO.,
18 CORTLANDT ST., NEW YORK CITY.

GENTLEMEN: The electric lamps we bought of you give us entire satisfaction, and we think are the best lamp made for photo-engraving purposes—steady, bright and cover a larger area than any we have ever seen.

Very truly yours,
NEW YORK ENGRAVING AND PRINTING CO.,
C. M. COOPER, *Supt. and Sec'y.*

The Electrical Age's Illustrated Patent Record.

Issued August 9, 1892.

480,266. Secondary-Battery Plate. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

480,284. Incandescent Electric Lamp. Paul Scharf, Vienna, Austria-Hungary, assignor of one-fourth to Rudolf Latzko, same place. Filed Aug. 7, 1891. Renewed July 1, 1892.

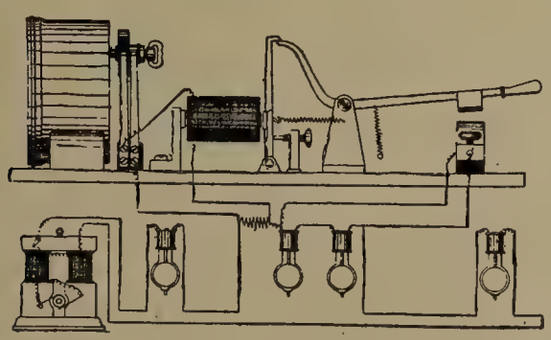
480,285. Arc Lamp. Charles Schmidt, Chicago, Ill., assignor of two-thirds to Henry Schuettler and Pancratius Friedich, same place. Filed Dec. 7, 1883. Renewed April 30, 1892.

480,319. Electric Bell. George W. Conover, Chicago, Ill. Filed Oct. 31, 1891.

480,340. Burglar-Alarm. Fred H. Neal and John R. Donnelly, Fairfield, Me. Filed March 7, 1892.

480,350. Justifying Attachment for Matrix-Making Machines. Willoughby W. Street and Charles L. Travis, Minneapolis, Minn., assignors to the Minneapolis Electro-Matrix Company, same place. Filed April 12, 1890.

480,369. Time Cut-Out for Electric-Service Systems. Samuel R. Linville, Philadelphia, Pa. Filed March 29, 1892.



480,369.—TIME CUT-OUT FOR ELECTRIC-SERVICE SYSTEMS.

480,372. System of Electric Lighting. George F. Myers, Pittsburg, Pa. Filed Dec. 15, 1891.

480,375. Electric-Lighting System. Charles Selden, Baltimore, Md. Filed April 9, 1892.

480,384. Galvanic Battery. Herbert H. Dow, Midland, Mich., assignor of two-thirds to Albert H. Smith and John C. Hale, Cleveland, Ohio. Filed April 4, 1892.

480,392. Method of Electric Soldering. Elihu Thomson, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 22, 1887.

480,393. Method of Electrical Regulation. Henry E. Vineing, Roseville, N. J., assignor to the Electric Secret Service Company, New York, N. Y. Filed Feb. 23, 1892.

480,409. Closed Conduit for Electric Railways. Alexander L. Lineff, London, England. Filed June 30, 1891.

480,411. Block-Signal Apparatus. Thomas H. Patenall, Rahway, N. J. Filed Feb. 10, 1892.

480,470. Supporting Device for Electric-Arc Lamps. John Maier, St. Louis, Mo. Filed Dec. 11, 1891.

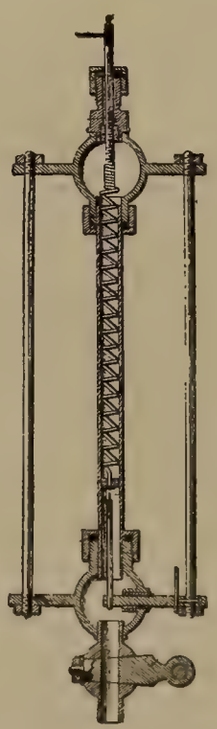
480,475. Telegraph-Key. Alfred E. McClaren, Joplin, Mo. Filed April 9, 1892.

480,491. Electrolytic Cell. Elisha B. Cutten, New York, N. Y., assignor, by mesne assignments, to the Union Chemical Company, of New Jersey. Filed Aug. 19, 1891.

480,492. Method of Electrolytically Producing Potassium Chlorate. Elisha B. Cutten, New York, N. Y. Filed April 11, 1892.

480,493. Method of Electrolytically Producing Potassium Chlorate. Elisha B. Cutten, New York, N. Y. Filed April 11, 1892.

480,507. Circuit Closing and Breaking Device for Railway-Tracks. Thomas H. Patenall, Rahway, N. J. Filed Oct. 20, 1891.



480,673.—ELECTRIC LOW-WATER ALARM.

480,525. Electric-Arc Lamp. Elmer A. Sperry, Chicago, Ill., assignor to the Sperry Electric Company, same place. Filed June 7, 1890.

480,539. Support for Electric-Arc lamps. Augustus Wright, Providence, R. I., assignor to the Hope Electric Appliance Company, same place. Filed April 27, 1891.

480,543. Electric Railway. Francis B. Badt, Chicago, Ill., assignor of two-fifths to Lester S. Hills and A. M. Searles, same place. Filed Dec. 19, 1891.

480,546. Electric Door-Opener. Louis Bates, Jersey City, N. J. Filed Aug. 13, 1891.

480,567. Duplex Telegraph. Thomas A. Edison, Newark, N. J., assignor, by mesne assignments, to the

PATENTS.—Continued.

Western Union Telegraph Company. Patented in England; in France; in Italy; in Austria-Hungary; and in Russia.

480,573. Conduit for Electric Wires. Samuel H. Flagg. Providence, R. I. Filed Jan. 26, 1889.

480,575. Electric Accumulator. Giovanni Gandini, Lodi, Italy. Filed April 15, 1891. Patented in Italy.

480,576. Method of and Apparatus for Testing Circuits for Electric Time Systems. William F. Gardner, Washington, D. C. Filed Jan. 7, 1891. Renewed July 8, 1892. Patented in France.

480,644. Telegraph-Transmitter. Charles Willoughby, San Francisco, Cal. Filed June 30, 1891.

480,651. Electric Fuse-Box. George W. Baumhoff, St. Louis, Mo., assignor of one-half to George D. Capen, same place. Filed Dec. 16, 1891.

480,656. Telephone. James A. Christy, San Francisco, Cal., assignor, by direct and mesne assignments, to Thomas W. Cosgrove, Bernard Shrafl, Frona Eunice Wait, and E. J. Baldwin, same place. Filed Dec. 1, 1890. Renewed Oct. 5, 1891.

480,673. Electric Low-Water Alarm. Erneste Rothlisberger, Lima, Ohio. Filed April 18, 1892.

480,681. Electrical Spool. Schuyler S. Wheeler, New York, N. Y., assignor to the Crocker-Wheeler Electric Company, same place. Filed Dec. 30, 1891.

480,683. Electric Push. John F. Wollensak, Chicago, Ill. Filed May 10, 1892.

480,689. Automatic Circuit-Closer for Telegraph-Keys. Charles W. Bradford, Clinton, Me., assignor of one-half to Forest J. Martin, same place. Filed May 31, 1892.

480,694. Electric Switch. Jacob S. Gibbs, Hartford, Conn., assignor to the Perkins Electric Switch and Manufacturing Company, same place. Filed Feb. 27, 1892.

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ELECTRICAL AGE

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HONOR THE LIVING AS WELL AS THE DEAD.

Is there any good reason why any one who is distinguished among his fellow-men or the race at large for some especial service rendered to mankind should not be honored during his lifetime by a memorial of some character? This is an interesting question and one that probably can never be definitely settled one way or the other, because those who believe in the propriety of such movements can maintain their position with as strong arguments as those who view the matter in the opposite light.

A Southern contemporary does not think good taste was shown by the British Board of Trade in recommending that the word "kelvin" be adopted to signify the kilowatt-hour, in honor of the services rendered by Lord Kelvin (Sir William Thompson) to the electrical science, because he is still alive.

No rule can be laid down to govern these matters, and there is no reason why the present generation should be tied down by custom. There is a precedent for this action of the British Board of Trade in the case of the statue of Prof. Morse, which was erected during that inventor's lifetime.

WASTE OF ZINC IN BATTERIES.

The article on another page by Mr. G. d'Infreville on the subject of zinc for gravity batteries will be of great interest to those concerned.

At the present time as high as forty-five per cent. of the zinc in the cell commonly known as the "Crowfoot" must be thrown away unused because it cannot be consumed in the battery, and at the same time maintain the battery at an efficient standard. To a large consumer of zinc in batteries, a telegraph company for instance, this waste material in the aggregate represents the equivalent of a very large sum of money, and any improvement that will prevent this waste and save the money it represents should be welcomed, provided that the cost of the introduction of the improvement will not offset the saving effected by its use.

The improved zinc referred to does effect a large saving, and every user of the same has besides the satisfaction of knowing that he is getting from the zinc its full value in current.

Mr. d'Infreville's invention covers many interesting points, the main one of which is, of course, its economy. By the use of this zinc the gravity battery is rendered more efficient than the old style, which result widens the field of application for this battery. As its internal resistance is much less than that of the ordinary gravity cell the battery is available for operating motors and doing other work, for the performance of which the old-style cell is not adapted.

Mr. d'Infreville is an authority on batteries, and whatever he produces in this direction may be safely accepted as something of value.

SAVE YOUR LIGHT.

An ingenious device is described elsewhere in this issue. It consists of a time-switch which will cut off the supply of current from a lamp at the end of a definite period of time.

The application of this apparatus is found in battery installations for small electric lights for the temporary illumination of cellars, halls, closets, etc.

It is customary in some cases to turn a switch placed at some convenient point when we desire light for the time being, and it very frequently happens that we forget to turn the current off when we have no further immediate use for the light. The result of this is the zinc and other materials in the battery are consumed wastefully.

The apparatus referred to switches off the current automatically at the end of 2½ minutes or multiples thereof, according to the number of turns given to the switch-handle.

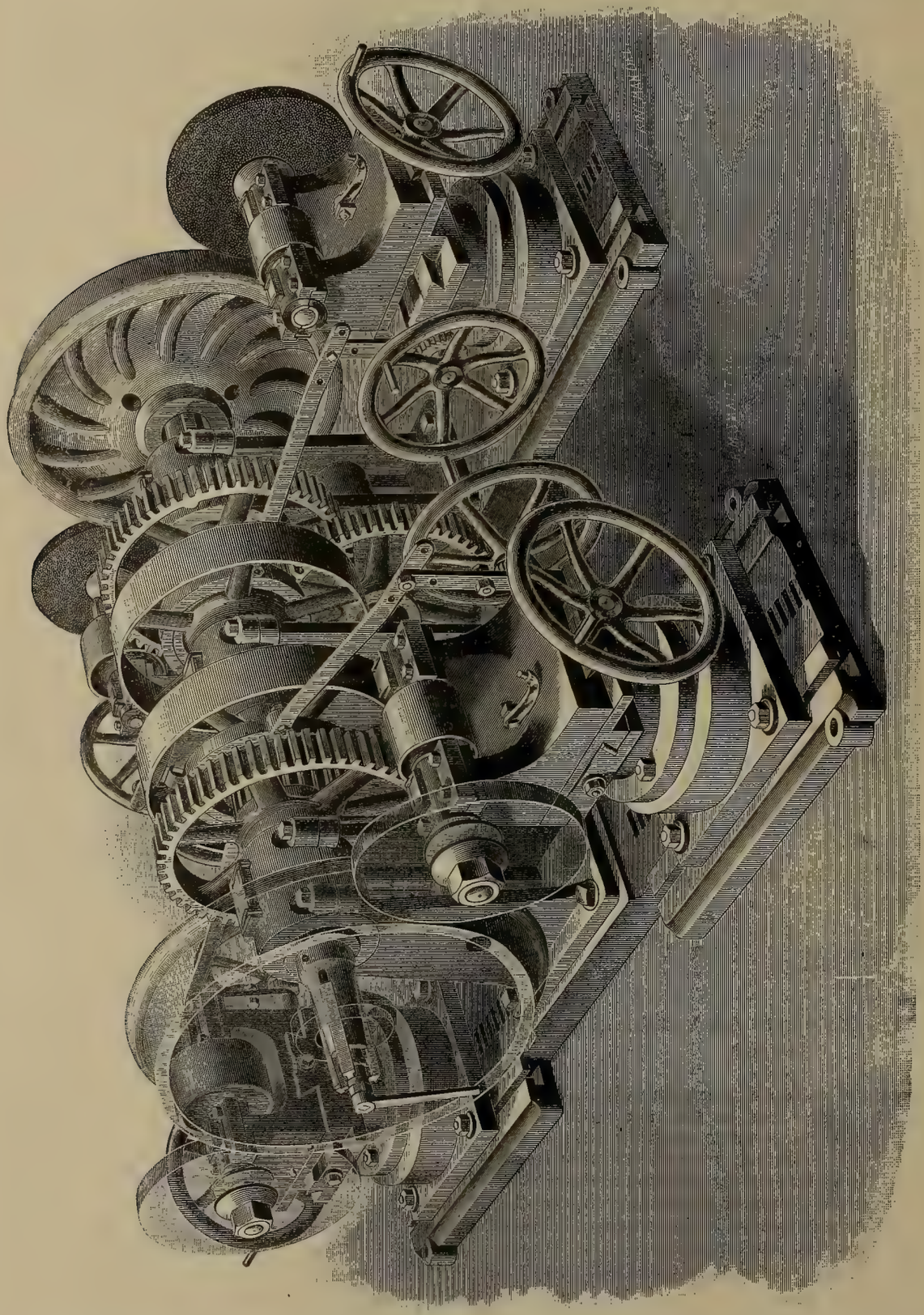
This apparatus undoubtedly can be applied to similar uses in other directions.

THE MANUFACTURE OF ELECTRIC CAR-WHEELS.

BY J. H. GLOVER.

At the present time electricity is, and will likely be for a long time to come, the dominating force in the industrial world, especially in street-railroad operations. In the latter connection about every consideration is electric in its nature, and the other parts of a street-railway equipment, not involved directly with the electrical part, are apt to be forgotten for the time being. True it is that the development along electric lines is so rapid that there is time for little else, and for this reason other considerations are lost sight of—not by the street-railway manager, however, but by those who read about the marvellous progress made in electric railroading.

The street-railway manager does not become so blinded by his enthusiasm for electric power that he loses sight of everything else that contributes towards the construction of his line and rolling stock. He does and must know all about the cars, the materials used in their construction, the rails, ties, roadbed, etc., or else he cannot carry on operations with the greatest economy and advantage.



MACHINE FOR GRINDING CAR-WHEELS.

Car-wheels constitute a subject that is little discussed in the trade papers these days, and thinking that a little account of them might be of interest to your readers, I have collated a few facts.

Most of the wheels used on street cars are made of chilled cast iron. There are wheels made, however, of steel and with steel tires, and the demand for these seems to be on the increase, based on the supposition that they are superior in actual service. It is claimed by their advocates that they possess greater tractive force, and are safer for electric cars, which attain comparatively high speeds.

The advocates of the chilled wheel, of course, do not admit the truth of these claims, and put forth just as strong arguments in favor of their own goods.

There is no doubt, however, that both classes of wheels are excellent if the best are obtained. The best car-wheels, like the best of everything else, have a certain value, and if cheaper goods are bought of some one who claims to have just as good wheels as the best for less money, the purchaser need not be surprised if his cheap wheels fit themselves for the scrap-heap much sooner than they should. It is always the cheapest in the end to get the best, and in the case of car-wheels the chilled wheel and the steel or steel-tired wheels stand at the head. The best of wheels need proper care, and to get the best results from them they must not be abused because they are "the best made."

"Chilled" wheels get their name from the fact that the tread and flange are chilled in the process of moulding the wheel, so that these parts become very hard and durable, as compared with the inner parts.

The wheel mould is surrounded by a metal mould or "chill," having the form of the wheel tread and flange in reverse, and when the molten metal comes in contact with this "chill" it becomes suddenly cooled. The iron thus cooled differs very much in its texture from that not so treated, the difference being very noticeable to the eye when the iron is fractured. The chilled iron is whiter and more crystalline in texture and gradually blends into the inner portions until its characteristic appearance entirely disappears.

One of the devices used in producing this "chill" is known in the trade as the "contracting chill." The inner surface of the chill is divided into segments, the space between them being so small that the molten iron does not penetrate to any appreciable extent. The heat of the molten iron causes the segments of the drill to expand inwardly, keeping the inner surface in contact with the metal. Some wheel manufacturers, however, prefer the solid chill, claiming that with proper manipulation equally good results can be obtained.

After the iron is set, whatever form of chill may be used, and while the wheel is still hot, it is removed from the mould and placed in the annealing-pit, where it remains for four or five days. By this process the wheel cools off gradually, and cracking, due to unequal contraction, is avoided.

The wheels are then cleaned off by means of a sand-blast, and then put into a machine which grinds the tread to an even and round surface. As the surface of chilled wheels is very hard, ordinary tools are not suitable for smoothing it off, therefore an emery-wheel is used.

The accompanying illustration shows a machine of this character, with a wheel undergoing the grinding process.

This machine accurately bores the holes in which the axles are to be placed, and at the same time the swiftly-revolving emery-wheel is brought into contact with the tread, which is ground perfectly true. Wheels thus treated are therefore perfectly true when they leave the foundry.

It is of the greatest importance that car-wheels should be perfectly true and round. Any inequality in their rotundity will tend to cause a flat spot on the tread. A defect of this nature causes more or less pounding and consequent wear and tear on the entire car-body and its mechanism. Wheels with flat surfaces on the tread are practically unfit for service.

The usual diameters of wheels used for electric-motor cars are 30, 33 and 36 inches, with weights varying from 300 to 425 lbs. Lighter wheels, of course, are used for horse and trail-car service, and on cable cars the diameters run from 22 to 30 inches, with weights from 140 to 240 lbs.

The patterns of wheels are, in the main, a matter of personal taste. The average life of wheels under motor cars is about 30,000 miles.



FIG. 1.

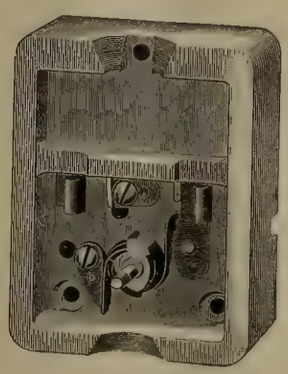


FIG. 2.



FIG. 3.

COMBINED SWITCH AND FUSE-BOX, FOR RAILWAY LIGHTING CIRCUITS.

The accompanying illustrations show a very neat combination switch and fuse-box for use on the lamp circuits of electric street-railway cars.

Figure 1 shows the box complete with the switch-handle in place; Fig. 2, the body of the box with the rotating ratchet switch in the lower compartment, and Fig. 3 the reverse side of the cover with the terminals and thumb-screws for the metal fuse.

This box possesses many advantages over anything heretofore in use for railway-lighting service. It is very compact, neat, and, as it is made entirely of porcelain, perfectly incombustible.

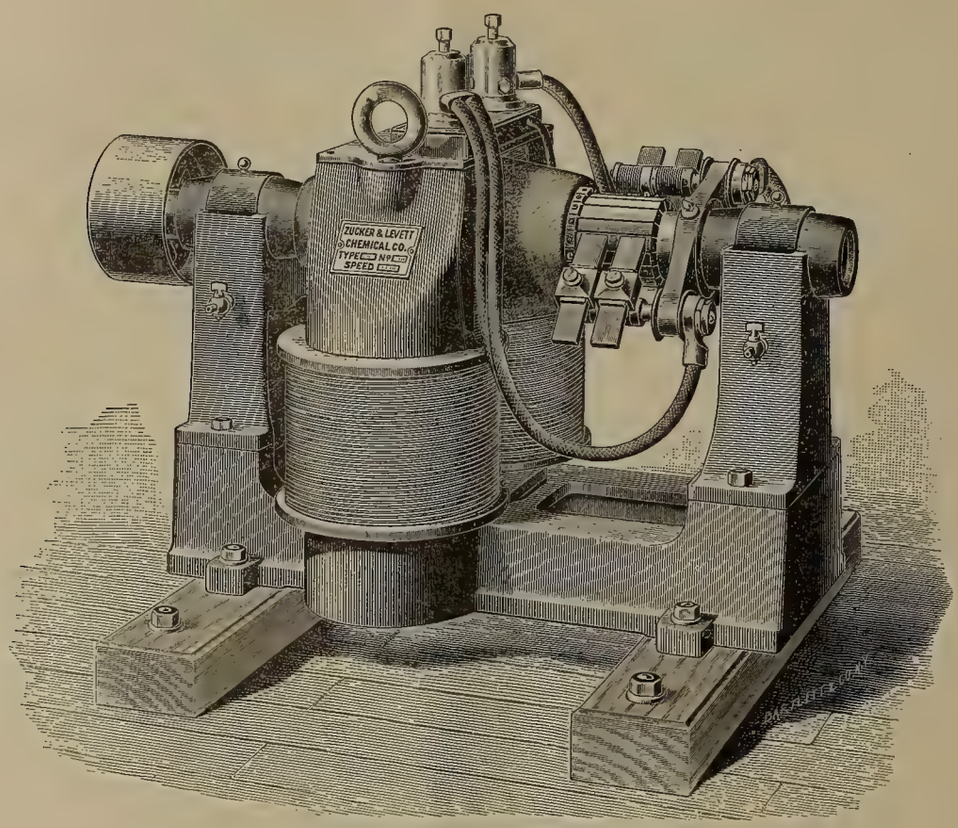
The switch is of the latest improved type of rotating ratchet switch manufactured by the General Electric Co., and possesses the essential points of good contact and sudden break.

The fuse is placed on the inside of the cover, so that in replacing a blown-out fuse the fuse, terminals are taken completely out of the circuit and it is utterly impossible to receive a shock in any way. No tools are required to replace a fuse.

The brass clips on the cover fit over the two contact posts in the box, and serve the double purpose of holding the cover in place and forming a part of the circuit.

As will be seen in Fig. 2, the box is divided into two parts, the lower holding the switch and the terminals for the wire, and the upper part consisting of a shallow recess into which the thumb-screws on the inside of the cover project. In the back of the box, behind this upper recess, is a magnetic blow-out, which breaks the arc formed when the fuse is blown. The devices heretofore used consisted of a separate switch and cut-out, while this device accomplishes the same results, and saves labor in installing, as it makes but one break in the circuit.

In general appearance the box is quite ornamental, and with its great superiority over other and older devices for the same purpose, it should commend itself strongly to all street-railway men.



"NEW IMPROVED AMERICAN GIANT" PLATING DYNAMO.

NEW PLATING DYNAMO.

The accompanying illustration shows the "New Improved American Giant" dynamo for electroplating and electrotyping, which is placed upon the market by the Zucker & Levett Chemical Company, of New York city, and designed by its electrician, Mr. M. Mayer.

The machine is of the inverted horseshoe type, having a laminated field-core in the smaller sizes, and in the larger a special cast-iron core which is equal to wrought iron. There is also a groove on the end of the bearing shell which prevents slinging of the oil. The field-coils are separately wound on brass spools, and are interchangeable. The armature, which is of the modified "Siemens" type, is large in diameter, having very few turns, and a large number of sections. The windings consist of a large number of wires connected in parallel, thus preventing Foucault currents in the coils themselves, and facilitating the winding. The magnetism of the field is very powerful in proportion to the armature, thus preventing all sparking and insuring good regulation.

The machine is practically self-regulating; that is, the voltage is about the same whether one or the maximum number of articles are in the bath, and the power consumed is exactly in proportion to the load—a very important factor when the coal bill is taken into consideration. The efficiency of the machines is also very high, varying from 75 to 90 per cent. according to the size. The machines are shunt-wound, and reversing is impossible. The mechanical details are very carefully worked out, and the workmanship is of the very best. The shafts are short and very large in diameter.

The bearings are long in proportion to the diameters, and are made of phosphor bronze. The commutators, which are made out of drop-forged copper, are perfectly insulated with mica, and baked to prevent short circuiting of the strips.

The brush-holders are of an improved pattern and are adjustable in every respect. The brushes can be lifted off the commutator by means of a spring catch provided for this purpose. All other parts are made to standard gauges and are interchangeable.

A large number of these machines have been in use for some time under the most severe tests, and they have proved to be most durable and highly efficient. There is absolutely no sparking, excessive heating or wear at the commutator or brushes—features which, although well known to users of incandescent machines, are new and will surely be welcomed by users of plating dynamos.

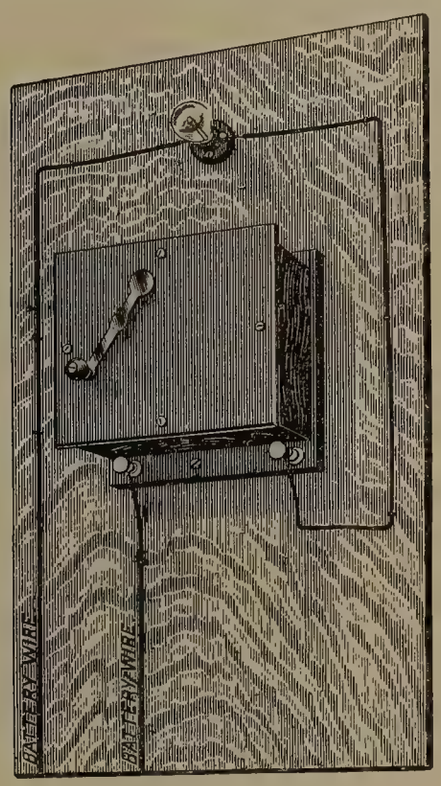
In keeping records and making reports of tests for future reference, or for the information of others, care should be taken to make the information recorded as full as possible, so that all the dates that can possibly be required at any future time may be always accessible.—*Webb.*

THE EDISON TIME-SWITCH.

One of the latest electrical novelties is a circuit-breaking time-switch, actuated by a clock movement. This is being placed on the market by the Edison Manufacturing Company, and is intended for use in connection with the lighting of cellars and dark basements by miniature incandescent lamps operated by Edison-Lalande batteries. The switch can be placed at the head of the stairs so that the lamp can be switched on before going down.

Perhaps the greatest trouble encountered in miniature lighting by battery is the neglect of the users to turn off the light and consequently the unnecessary consumption of the battery

This new switch entirely overcomes this trouble, as the circuit is opened automatically at the end of either 2½, 5, 7½ or 10 minutes, the time depending upon the number of turns given to the switch-handle, each turn adding 2½ minutes to the length of contact. The mechanism has a Geneva stop movement, and to one of the cogwheels is attached the contact-wheel, having an insulated section



EDISON TIME SWITCH.

with a V-shaped groove cut in it. On turning the switch-handle and winding up the clock, a contact-spring is brought to bear against the metal part of the contact-wheel and the circuit is established. When the insulated section of the contact-wheel has travelled around to the contact-spring, the spring locks into the V-shaped groove, the circuit is broken and the clock stopped. The switch is connected in series with the lamp as shown in the accompanying illustration.

The employment of this system of lighting cellars, etc., is strongly to be advocated on account of the perfect immunity from fire, as well as the great convenience of being always ready for use. The batteries will maintain a 4 candle-power lamp for 100 lamp hours without needing any attention, which means that they will last for about a year if the lamp is used on an average of 20 minutes daily. The outfit consists of time-switch, one 4 C. P. lamp and socket with the necessary wiring, and 6 Edison-Lalande cells Type K porcelain jars. It can be seen in operation at the offices of the company, 110 East 23d street, New York city.

"WASTELESS" ZINC FOR ELECTRIC GRAVITY BATTERIES.

BY G. D'INFREVILLE.

Heretofore there has been a great waste of zinc in all batteries, owing to the fact that the zinc electrode must be removed before it is entirely consumed, the current having become too weak on account of the increased internal resistance due to the decreased size of the zinc electrode. No practical or economical remedy has yet been found to entirely avoid this waste which, in the case

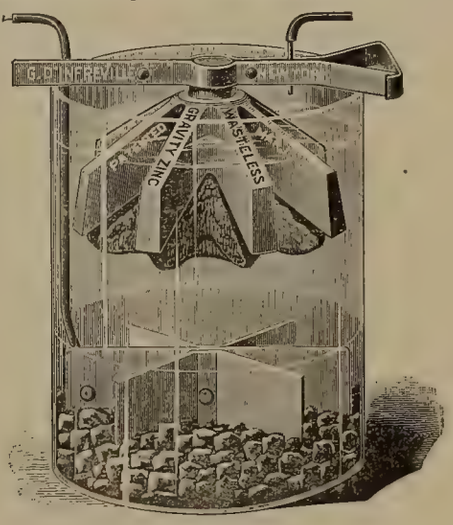


FIG. 1.

of the best patterns of zinc for gravity battery, often reaches forty-five per cent. of the total weight of zinc purchased (1½ pound being wasted out of 3¼ pounds of zinc); for, as a matter of fact:

1. In many places the stumps which constitute said waste cannot be used to any advantage, nor sold for want of a purchaser at that place, and it would not pay to gather them and to ship them to a place where they could be disposed of.

2. In frequent cases, that of telegraph companies, for instance, but about twenty per cent. of the stumps can be gathered with trouble and expense from scattered and distant places, as proved by actual experience.

3. Said stumps, even when all collected, can at best be sold as impure metal at but about half the price of spelter.

So that, to resume: in the first instance, the waste may reach fully forty-five per cent., while in the second case, but one-half of the value of said twenty per cent. of gathered stumps being recovered, the ultimate loss will amount to about forty per cent., and in the third or most

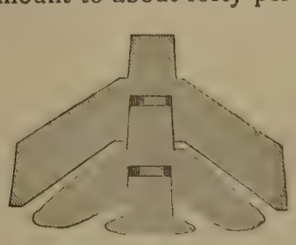


FIG. 2.

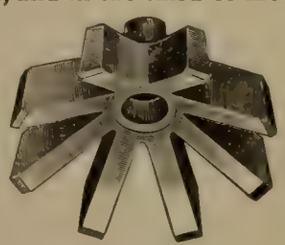


FIG. 3.

favorable case, where one-half of the value of the stumps is recovered, the loss will still amount to about twenty-two per cent.

The object of the invention of the "Wasteless" zinc is mainly to entirely avoid such waste of zinc.

The invention consists in using for the zinc electrode a number of pieces adapted to be connected to one another in column by joints or connections which are

liquid tight or adapted to preserve the connecting parts from the action of the battery liquid, so that a partially consumed piece may be connected or attached to the bottom of a fresh or new piece, which latter, after being partially consumed and after the still greater state of consumption of the first one, may in its turn be connected under and to a new piece, and so on.

In time the lower piece of zinc will have been *entirely consumed*, then in turn the one directly above it and to which it was attached, and so on, so that practically every piece of zinc introduced in the battery will in its turn be entirely consumed, which fact has been repeatedly confirmed by experience. This is why it is called the "Wasteless" zinc.

This arrangement and process is shown in perspective in Fig. 1, which represents one complete gravity element fitted up with the "Wasteless" zinc electrode, and which

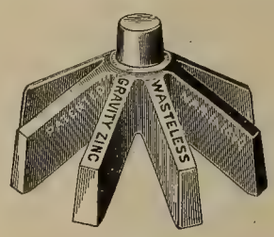


FIG. 4.

consists, first of a new zinc piece suspended from a hanger connector resting on the rim of the jar so that the zinc piece bathes about half way in the sulphate of zinc solution, of a second piece of zinc partially consumed and suspended from the first one, and of a third piece or stump of zinc almost entirely consumed, and suspended from the second piece The two last zinc pieces are entirely below the upper level of the battery solution.

Fig. 2 shows the three pieces constituting the zinc electrode, showing their relative positions and their comparative sizes, due to the state of corrosion of the two lower pieces, which depends on the length of time they have been in use.

The manner in which a "Wasteless" zinc piece, whether new or partially worn out, is fastened to another one placed above makes it perfectly secure, both as regards contact and guarding against any possibility of dropping down on the copper electrode below; for the



FIG. 5.



FIG. 6.

fastening is obtained through the wedging by a small twisting motion combined with pressure, or rather by a light blow, the slightly conical socket provided at the bottom of the upper zinc (Fig. 3) over the correspondingly tapered complementary stud or shank provided at the top of the zinc (Fig. 4) which is to be placed under.

The guarding against corrosion from the solution is also perfectly secure, as the socket below each zinc is in fact an inverted cup and cannot allow, any more than a diving-bell would, the access of liquid against its inside walls.

The latter operation connects the two zinc pieces together so strongly that they cannot be torn asunder when pulled straight apart, while a twist, combined if necessary with light tapping sideways on the radial branches can easily loosen them when desired.

The conical stud or shank above and the conical socket below each "Wasteless" zinc are made to uniform gauge, and such as to leave about $\frac{1}{4}$ inch distance between two zincs when the branches of the upper one are exactly over the branches of the one below which position permits the introducing of the blue vitriol, and the use of the hydrometer.

It is a simpler and cheaper method than connecting them by a screw thread, which is, however, also shown in the patent. The present friction conical attachment has proved to be quite effective and reliable in practice.

A new feature with the "Wasteless" zinc is that the radial branches are slanting downwardly from their supporting trunk so that they will wear out gradually from their extremities which are lower in the solution or nearer to the copper electrode, towards their point of support, which latter is higher in the solution or farther from the copper and thereby less acted upon chemically; the branches will thus become entirely consumed before their support be itself too much corroded.

The slanting direction of the branches furnishes at the lower part of the zinc a space which a partly worn out piece or stump will fill advantageously, so that the zinc electrode will be more even at its lower part.

From the start one single zinc, or if a greater amount of current, or technically a greater ampèrage is needed, two zincs, one on top of the other can be suspended in the same jar, the upper zinc from a hanger connector (Fig. 5) which rests on the rim of the jar, and the lower zinc under the upper one as explained before.

For the first time in the history of electric batteries of whatever kind the "Wasteless" zinc furnishes by its own form means for perfectly connecting and fastening two or more new or partially worn out pieces of zinc, without the help of mercury or the adjunction of anything else, below the outside level of the battery solution, and beyond the possibility of being corroded by it.

It is equally suited to operate circuits of high resistance, such as one single long or a few long telegraph lines, in which case one single zinc per cell will suffice at first, or to work from the same battery, with two pieces in each battery jar, *three times* as many similar lines as it was possible to do before with the same size of gravity battery under the same circumstances; but when they were provided with other patterns, as the internal resistance per cell when two "wasteless" zincs are used together in each jar, is thereby reduced to about one-third (0.7 ohm.) of what it is now with other well-known patterns, under the same and best circumstances.

Among the immediate beneficial results derived from the lower internal resistance due to the simultaneous using of two zincs, one under the other, and one stump under the lower zinc in the same jar is the saving of 50 per cent. in the expense of now superfluous jars and coppers, of 50 per cent. in amount of room required, and of 40 per cent. in total battery weight, and also the resulting savings of money and time in packing, handling, shipping, storing and attendance, with the reduction of risks, delays, etc.

With two zincs one under the other, and a stump below them in the same jar, the internal resistance falls to 0.7 ohm per cell (the electromotive force being 1.07 volt as usual), giving a current of about $1\frac{1}{2}$ ampères; they are, therefore, well suited for operating circuits of moderately low resistance, such as local telegraph circuits, for electroplating and the working of small motors, in which case one single cell equipped with two zincs will do about as much work as three cells of most of other gravity batteries, alike in every respect except

as regards their well-known zinc electrodes, which necessarily are single and generally placed further away from the copper electrode.

The "Wasteless" zinc is made at present for the standard and most generally used glass jar which measures six inches in diameter and eight inches in height.

It weighs nearly three pounds, as this weight for several motives has been deemed to be the most advantageous one for the above said size of jars.

The "Wasteless" gravity zinc has been in actual continued use for the last year in many places. It is finding a steadily increasing demand and general favor as it is getting known and understood, and it has yet given no cause for complaint.

It is not only gradually superseding other patterns where they are used at present, but on account of some of its new, special and advantageous features, it has opened new fields of application for the gravity battery when the latter is equipped with it.

Its use is indispensable in telegraphy and telephony, it is especially valuable for railroad signalling and for fire, police and other alarms, and in general whenever there is need of economy or reliability in the service, or both.

It has enabled the sulphate of copper (blue vitriol or blue stone) gravity battery to be now economically applied to the operating of printing telegraphs, the running of small electric motors, electro-plating, medical apparatus, the charging small accumulators, etc.

The hanger connector for the "Wasteless" zinc (Fig. 5) is made simply of two pieces of brass fastened together, has no screw whatever, weighs but about two ounces and takes little room.

It provides a broad elastic and tight connection all around the stud of the zinc which it supports. On one side it is triangular, so that the whole rests by three points on the rim of the jar, giving sufficient steadiness to the zinc suspended therefrom, while its edgewise position gives it all the rigidity necessary to safely support at the same time two or more zincs connected in a pile.

Its triangular end serves also to fasten and securely *lock* either a wire or a metal strip, not necessarily by their ends as when a screw with hole is used, but at any place, from the smaller magnet wire to the largest telegraph office wire, always with a nearly uniform pressure, ample contact and an elastic-locked grip not liable to get loose, as is the case with a screw connection (Fig. 6).

ELECTRICITY IN THE HOME.

At the headquarters of the Edison Electric Illuminating Company, on Pearl street corner of Elm, this city, is an interesting exhibition of the application of electricity to domestic purposes.

One of the features of the exhibition is the display of electric-heating apparatus. There are electric flat-irons, electric tea-kettles, etc., all of which are put into operation by simply pressing a button or turning a switch. There are also on exhibition some German cooking utensils, one especially being a novelty. It consists of a metallic handle about a foot long, at one end of which is a thick metal disc a few inches in diameter. This disc contains the resistance, and the device is for the purpose of cooking soups. All that is needed is to plunge the large end of the heater into the soup and turn on the current; in a short time the soup is cooked. This is one of the most economical applications of heat known. No heat whatever is lost, and it is all concentrated just where it is needed.

Electric heating is considered the most economical of all known methods. The heat can be applied just where it is wanted, and as the current is turned off when no more heat is required, there is no waste of heat as there is in the case of a stove.

Another piece of apparatus that attracts attention is a small heater or radiator for heating a room. It is not more than a foot square, but it is said will heat a small room comfortably. It looks like a plate of metal and stands upright on a standard.

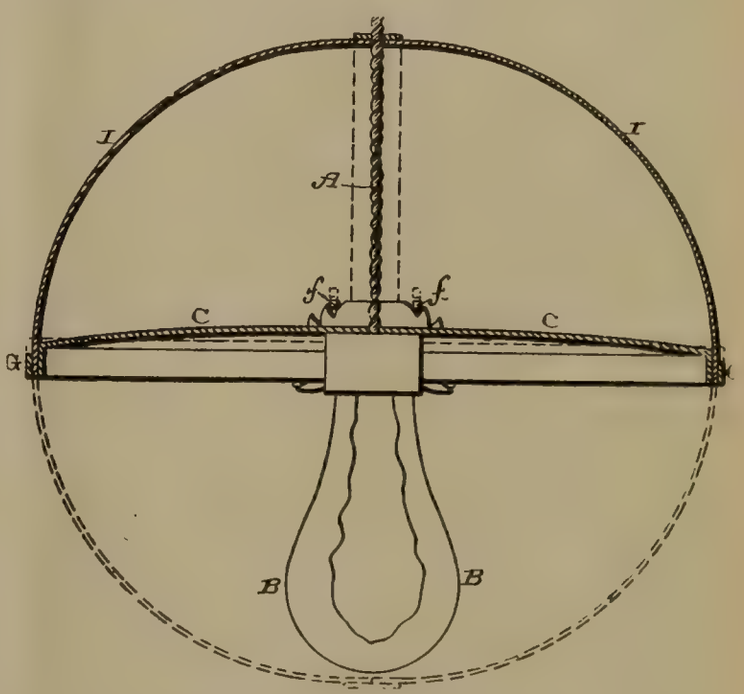
An electric motor operates an ice-cream freezer, a coffee-grinder, a meat-chopper and a dumb waiter. Any one of these pieces of apparatus can be stopped or started independently of all the others.

Many private houses are now lighted by electricity; and by the introduction of an electric motor and the installation of the proper mechanical apparatus, much of the labor in the kitchen, laundry, etc., can be accomplished by electric power. The same current that is used for lighting can be used for these purposes, and for heating as well. All the cooking could be done by electricity by the use of electric cooking utensils.

The Edison Illuminating Company is now confining its operations solely to that of generating and supplying electricity for light, power and heat.

INCANDESCENT LAMP SHADE.

The accompanying illustration shows a new adjustable shade for incandescent lights, invented by Mr. Joseph H. Huber, of Greensburg, Pa., which can be used with



ADJUSTABLE SHADE FOR INCANDESCENT LAMPS.

or without the ordinary glass shade, and can be so adjusted as to modify the light to a greater or less degree as may be desired without interfering with the light itself.

This shade consists of two quarter-spherical sections, which are independently hinged to the shade-rim, and which, when turned up to meet above, form conjointly a hemispherical top to the regular shade. This is the normal position. When it is desired to circumscribe the reflector or radiator of the lamp, the shade sections are turned downward to any desired degree, closing together beneath if required, and shutting out the light from below.

Numerous advantages are claimed for the shade, and it should meet with an extensive sale.

THE FRENCH ATLANTIC CABLE CO.

The history of the French Atlantic Cable Company affords an interesting illustration of the ups and downs of commercial life. This company had scarcely commenced its existence and was but little known to the general public before the celebrated cable pool was formed in 1882, and in order to protect itself was forced to join the procession. So bitter was the feeling manifested by the public against the pool that the Direct United States Cable Co. and the French Atlantic Cable Co. ostensibly withdrew from it, and jointly opened an independent office at 40 Broadway, New York city.

Things went along smoothly until 1887, when the French Company this time actually withdrew from the pool and opened an office at 8 Broad street. This movement may be said to have been practically jumping from the frying-pan into the fire. The percentage of the profits of the pool receipts which it received was greater than it had earned before joining, and being but little known to the public and in face of the well-established patronage of the other companies, its chances for success were very dubious. It had not been long alone before falling into the hands of the Commercial Cable Company, which simply used it as a cat'spaw in its own interest; whenever the Commercial Company's lines were blocked up its business would be transmitted over the lines of the French Company, taking precedence over that company's traffic. The poor French Company simply was "not in it" with its powerful neighbor. It was in need of assistance too badly. The pool companies had brought suit against it for damages, and expensive litigation had well-nigh depleted its treasury. This suit has been decided in favor of the pool companies in several courts, and is now before the Court of Appeals for final adjudication.

Since 1886 Mr. J. W. Mackay, president of the Commercial Cable Company, has acquired 20,000 shares of the French Company's stock and turned them over to his company.

During the past four years the French Company has been endeavoring to secure the necessary capital to lay a cable between the Antilles and North America, preferably between New York and Puerto Plata (San Domingo). This, by the way, is the scheme which was so strenuously opposed a short time ago by Mr. Blaine, while Secretary of State, as far as permission being granted the company to land its cable on the shores of the United States was concerned.

The Commercial Cable Company approved of the French Company's project, and Mr. Mackay lent his assistance in endeavoring to secure the necessary permission to land the cable in New York.

Negotiations were still being carried on by the directors of the French Company to secure the desired authority, when in 1891 representatives of the Commercial Cable Company were sent by Mr. Mackay to inform the French Company that it was desirable to discontinue all further proceedings with the Antilles cable project, as the Canadian Pacific Railway Company and the Commercial Cable Company had purchased the Halifax-Bermuda cable, and would lay the proposed cable themselves. This was the last straw to break the camel's back. The directors positively declined to give up the project, and it is reported that efforts are being made by the Mackay contingent to force them out and elect those in their place who would be subservient to the dictates of the Commercial Cable Company. The directors have appealed to the shareholders to uphold them in their action.

The following brief statement of the company's annual report for 1891 will be of interest, showing as it does the financial condition of the company's affairs. After deducting expenses, there is a balance of fr. 46,053.32 (about $9,000), and as the capital stock is fr. 42,000,000, it is easy to reckon how much shareholders will get in the shape of dividends.

The net receipts during 1891 amounted to fr. 1,256,930.79, and the total expenses to fr. 1,210, 877.47, leaving a balance of fr. 46,053.32; the net receipts and the expenses showing increases as compared with 1890 of fr. 88,488.23 and fr. 131,147.74 respectively. The expenses had been sensibly diminishing during the present year, while the receipts up to May 15 showed an increase of fr. 116,000 compared with 1891.

THE HIGHEST ELECTRIC RAILWAY IN THE WORLD.

Doubtless few of the visitors to New York during the past year have failed to avail themselves of the opportunity to view the city from the famous Madison Square Garden tower.

It is an imposing structure built of iron and terra-cotta, yet so artistically constructed that artist and artisan alike stand awe-struck as they behold its beauty from the street or square below.

But to the electrical mind the tower in the day is as dormant as an owl, and is simply recuperating from the brilliancy of the display of the night before. When the greater light of the day has been spent the tower seems to throw off its drowsy cloak, and in a moment all is awake in radiant brilliancy. Clusters of incandescent lights shed their mellow rays in great profusion from the street to the very head of Diana, whose gilded figure surmounts the whole, and whose attention is turned in the direction of the slightest zephyr.

Visitors are accommodated to the second loggia by a spacious Otis elevator, from here an easy ascent is made to the fifth loggia, where if one is fortunate enough to secure admission to the circular veranda he will see the highest electric railway in the world.

The purpose of this railway was conceived by Mr. Stanford White, of the well-known firm of McKim, Mead & White, who are architects of the garden, to carry the famous electric projector built by the General Electric Company around the tower.

The projector consists of a mortar-shaped band mounted on a standard built of sheet iron and insulated from the base by a large wooden gasket.

To supply current to the lamp heavy mains are run from the dynamo room to the tower; one wire of the same polarity as the neutral of the street service is connected directly to the rails, the other, after being intercepted at the second loggia by a rheostat, is connected to a strip of copper which is fastened to the inner circumference of a large insulated support placed between the rails. The construction of this support is such that quite a suitable promenade is made around the tower.

Current is taken from this conductor by means of a heavy brush fastened to an insulating arm and is kept in firm contact on every portion of the circuit.

The arrangement of the carbons and mechanism for regulating them is of the finest and most sensitive nature conceivable. On the top of the lamp just above the carbon is placed a box containing the motor and relay, the latter capable of reversing the motor to a sensitiveness of a fraction of a volt.

The mechanical operation of the carbons is as follows: A right and left threaded shaft to which the carbons are connected by adjustable nuts—the difference in the pitch of the two screws is calculated to be proportional to the difference of consumption of the carbons, and a tangent screw which operates the shaft by means of the small motor.

The electrical operation is effected by the use of a relay, which is a shunt from the two carbons, so that when the arc becomes greater its resistance as compared

with the relay is greater, the latter is allowed to act and switches the motor so as to feed the carbons together and consequently reduce the resistance of the arc till they rest at a point of equilibrium, which is regulated according to the size and density of the carbons and the amount of current given the lamp. The motor is differentially wound so as to avoid sparking of the relay armature in changing the contacts.

In the rear of the projector is placed a reflector of the Mangin type; it is said to be the most perfect and strongest in the country, having been especially imported for this installation. In its centre is fastened a crystal prism which transfers the image of the carbon-points on a little ground-glass plate at the side of the projector, similar to the inverted image of a camera focusing-glass. This arrangement is indispensable to the operator, who can at all times view his arc without the blinding rays of the direct light. Another good feature consists in the glass being a gauge as regards the focus of the reflector, and by its aid and the adjusting screw at the base of the lamp a perfect center is at all times maintained. In the Edison projector a convenient alternative is taken from the general construction of focusing lamps of this kind—instead of adjusting the carbons to the reflector it is *vice versa*, and a beam of varying intensities and magnitudes may be attained by the use of the hand-wheel at the back of the lamp.

In setting the carbons great care is taken to keep them in perfect alignment in one direction and to place the positive carbon a little in advance of the negative in the other, so that the crater on the former may in itself act as a reflector to throw the otherwise diverging rays directly into the larger reflector. To aid this and to concentrate the heat at the arc a hemispherical crucible is fastened to the carbon frame and is lined with a refractory material.

To supply current to the motor for propelling the car, and also the smaller motor which feeds the carbon, both of which are wound for a higher potential than the lamp requires, a special trolley wire is suspended from the iron railing on the side by porcelain insulators. Bearing on the lower surface of the wire is a brush which is connected down the trolley to the two motors respectively.

In order to make the plant a success a first-class electric motor was an indispensable requisite, and consequently one of the perfected Crocker-Wheeler motors was used to propel the car, which is also furnished with a Crocker-Wheeler reversible regulator, so as to place the whole in perfect control of the operator.

An insulated tangent screw is connected to the motor shaft, thus reducing the speed to a maximum of fifteen revolutions per minute of the car wheels, it being thought that a greater speed than that would be dangerous in case of any carelessness of the operator, who might for a moment doubt the centrifugal force in nature which could dislodge him from that dizzy height. But even at that speed and the projection of the light left on a plane, the wide circle of the far-reaching beam would sweep the surrounding country like a flying spectre.

The projector carriage was especially designed for the purpose by Mr. J. Van Vleck, of the Edison Electric Illuminating Company of New York, and his able assistant, Mr. Wm. Erickson, whose underground conduit, published in the ELECTRICAL AGE of July 4, 1891, has had a noteworthy reputation, principles of which were used in the installation of the insulated support for the central conductor, and which has given a surprisingly high insulation test under very unfavorable conditions of weather.

At a pressure of 45 volts the lamp will operate with the best results with 50 ampères of current, which is about 2¼ kilowatts, to produce a light which will enable one to plainly distinguish objects at a distance of over three miles.

ELEMENTS OF ARMATURE CONSTRUCTION.

The generation of an electric current in a dynamo is effected by the rotation of one or more coils of wire in a magnetic field, the coils being situated on the armature and the magnetic field being produced by the field-magnets.

Dynamos are designed to produce a given current at a given electromotive force at a given rate of armature speed, and the predetermination of the proper lengths of wire, size of wire, masses of iron, etc., to effect given results is one of the most interesting features of dynamo construction.

The calculation of the elements of armatures, if anything, requires greater mathematical skill than is needed on any other part of the machine, for the reason that with a given magnetic field the resulting current generated in the armature depends upon the number of turns and size of wire used in the coils and the revolutions of the same.

In this connection the following general rules concerning the calculation of armatures, given by Mr. Carl Hering, will be of interest:

In general, the following order may be recommended for cylinder and Gramme armatures. Assume first a certain induction in volts per foot, which is thought to be attainable in that type of machine. Dividing this into the total number of volts to be generated will give the length of the active wire in one-half. Assume 70 to 80 % of the surface of the armature to be active—that is, embraced by the pole-pieces. Dividing the active length of wire by this percentage gives the total length of wire on the cylindrical surface of the armature. From the current which is to flow through the armature determine approximately the size of the wire, remembering that the two halves of the winding are in multiple arc, and that, therefore, only half the current flows through each wire. From the length of wire on the cylindrical portion of the armature, and from the diameter of the covered wire, it is easy to ascertain the diameter and length of an armature which will contain this amount of wire on its outside cylindrical surface. The number of layers being always a whole number, which, from the nature of the armature, is limited to very few values, and the circumference of the armature being some multiple of the diameter of the insulated wire, it will generally be found that two, or at most three trial calculations will enable one to determine the diameter and length of the armature and therefore those of the core.

For cylindrical armatures, a simple deduction will show that the following relation is approximately correct: The length of the wire in inches on the cylindrical surface, multiplied by its diameter in inches (including insulation) and divided by the assumed number of layers, is equal to the cylindrical surface of the armature in square inches; that is, its length in inches multiplied by its circumference in inches. This will enable one to calculate the cylindrical surface, from which the diameter and length can readily be determined, as the circumference must evidently be such a multiple of the diameter of the insulated wire as, when taken together with the number of layers, gives an even number of lengths, equally divided among the commutator bars or coils.

Another method, which will frequently be found to be shorter, is to assume any fixed number of commutator bars, turns per coil and layers; this will determine the circumference or diameter of the armature. From the number of wires obtained thus, and from the total length required, the length of the armature may then be readily ascertained. If it is found to be absurdly large or small,

it is easy to find what changes in the assumed number will correct it.

It is assumed herein that there are no iron or wooden lugs or partitions between the coils on the armature; if, however, such lugs are to be used, the circumference of the armature, obtained as described, must be increased by the sum of the spaces occupied by these lugs; that is, by the width in inches of one lug, multiplied by their number.

After having made these preliminary calculations it is necessary to ascertain whether the resulting proportions of the armature will comply with other conditions which did not enter into the calculations. For instance, from the nature of the armature determine the speed at which it will be safe to run it, and from this, together with the diameter, find the inductor velocity. From the induction in volts per foot assumed at the outset and from this inductor velocity, determine what the intensity of the field must be. This may be ascertained as follows: Suppose the induction assumed was 1.3 volts per foot, and the inductor velocity 45 feet per second, then any one of the wires will move one foot in $\frac{1}{45}$ of a second.

To generate 1.3 volts, a foot of wire must cut the field at the rate of 130,000,000 lines of force per second, or in $\frac{1}{45}$ of a second it must cut $\frac{1}{45}$ of this, or about 2,800,000 lines of force. As one foot of wire, in moving a distance of one foot, cuts through one square foot of field, the number of lines of force just determined must pass through one square foot, independently of the actual shape or size of the field; dividing this number by 144 gives the number of lines of force per square inch—that is, the intensity of field required to generate an induction of 1.3 volts per foot at a velocity of 45 feet per second. In this case the intensity of field will be about 20,000 useful lines of force per square inch, which intensity can readily be generated by properly proportioned and economical magnets.

From the diameter and circumference of the armature ascertain, approximately, what percentage of the length of one complete winding or coil will be active; that is, will lie on the cylindrical surface of the armature, taking care to allow for the extra length required at the heads of cylinder armature, which for short armatures with many windings will be no inconsiderable amount. Dividing the length of wire on the cylindrical surface determined at the outset, by this percentage, gives the total length. From this, together with the size of the wire, find the resistance of the armature, allowing also for the heating. The square of the current multiplied by the resistance gives the loss of energy in the armature, which should be from 2 to 10 % of the total energy generated by the machine, depending on its size and on the desired efficiency. If it is found to be much greater, the armature will probably heat badly, being poorly designed for efficiency; if it is less, it shows that a smaller armature could be used if desired, decreasing some other parts proportionally. A more rational method for determining the diameter of the wire would be to find what its resistance should be from the allowable loss in the armature, and from the current; from this resistance, together with the total length of wire, find its cross-section. But this will frequently be found less convenient, as the length cannot always be ascertained without first assuming some diameter.

Having thus determined roughly the proportions of some one form of armature, which will generate the desired potential, and will not heat too much with the required current, ascertain, by varying such dimensions as the nature of the machine will permit, whether the construction of the armature may he cheapened, or whether the efficiency may be increased, or both. As a rule it is not necessary to make these preliminary calculations with any very great degree of accuracy, as there are a number of factors—such as the self-induction, the heating, the sparking, etc.—which do not enter into the calculation, but which will affect the results. In order to allow for these, as well as for other small errors in calculation, it is advisable to assume a slightly higher potential at the outset. Any small errors made may be corrected in the winding of the field-magnets, provided such corrections are not too great to be within the limits of the field.

ELECTRIC POWER.

Only a portion of the power given electrically to a motor is converted usefully into mechanical power, a part being spent in heating the armature, field-magnet coils, etc. When the armature is at rest the whole of the electrical power absorbed by the motor is so converted into heat, and the efficiency of the machine—that is, the ratio of the useful power obtained on the shaft to the total power supplied—is at its lowest value. When the armature is moved the useful performance of work begins, and as the current also falls in strength, the power wasted in heating decreases. The higher the speed of rotation the higher becomes the counter-E. M. F., and the less becomes the power wasted as heat in the conductors; in fact, the ratio of the power usefully absorbed by the motor to the whole power supplied is very nearly proportional to the ratio of the counter-E. M. F. to the E. M. F. applied at the terminals of the machine. The efficiency of the machine is therefore highest when the load is a minimum—that is, when it is doing least work per revolution, while the torque, or the force with which the armature tends to rotate, is greatest when the load is sufficiently great to prevent the armature turning and when, therefore, it is doing no external work at all. Now, when a motor is running at a high speed it performs very little work indeed during one revolution, although, the number of revolutions being great, a considerable amount of work may be performed during a given interval of time—say one minute. On the other hand, when the speed is very low, the amount of work per revolution is comparatively great, but the small number of revolutions per minute prevents the quantity of work reaching during that interval a very high value. By considering these two extreme cases, it might be supposed that there is a certain intermediate speed of rotation at which the work performed by any given motor is a maximum. This is the case, and the speed of a motor at which it can perform the maximum amount of work per minute is that speed at which the counter-electromotive force becomes equal to the electromotive force applied at the terminals. This result is quite independent of the efficiency of the conversion, which increases with the speed of rotation.

ALTERNATING DYNAMOS.

The most important class of alternating-current dynamos appears to be the disc armature machine. Many excellent machines have, however, been constructed for alternating currents having drum armatures.

There is one leading feature in most of the machines with disc armatures—a multipolar field. This is essential in view of the necessary rapidity of the alternations. Since the currents are required to recur some hundreds of times in a second this can only be accomplished by increasing the number of poles between which the coils pass during one revolution There are in many of these disc machines from twenty to fifty magnetic fields. When a single coil or section passes once around the circle it cuts the lines of force a proportionate number of times, and thus, by a comparatively slow period of revolution, a disc armature may give rise to a high rate of alternations.

The sectional windings of a disc armature generally assume the form of wire whirls, or snail-like spirals, or

of narrow disc-like coils. The course of the conductor in these disc coils almost invariably occurs in alternate directions in a series of coils. This is essential in view of the fact that the magnetic field is also of an alternating nature. But in armatures of very low resistance the coil section is dispensed with altogether, the conductors merely forming radial bars or loops. The multipolar field is common to all of these.

LEGAL.

INJUNCTION DENIED.

Judge Bischoff, in the Court of Common Pleas, denied the application of the Thomson-Houston Electric Company, formerly the East River Electric Light Company, 425 E. 24th street, this city, to enjoin the Durant Land Improvement Company from ejecting it from the old Durant sugar-house on East 24th street, pending an appeal. The company informed the court that if ejected from the premises a large section of the city which is lighted by the company might be plunged in darkness.

The property was leased by the plaintiffs from the Durants for a period of thirty-three years from May 1, 1888, at an annual rental of $14,500. Subsequently the the property was sold to the Durant Land Improvement Company subject to the lease.

The company expended $190,000 in installing an electric plant, and has contracts for 3,500 incandescent and 800 arc lights, part of which are used in lighting several streets. It has paid no rent since taking possession, claiming that the premises were not put in proper repair, and that the building has been condemned by the authorities.

A judgment for $75,000, arrears of rent, was recently secured by the Durant company, and as the plaintiffs refused to pay dispossess proceedings were commenced by the defendants, which were stayed by an injunction issued pending the trial.

THE CHICAGO-ST. LOUIS ELECTRIC ROAD.

According to a despatch from St. Louis, the preliminary work on the Chicago-St. Louis electric railway is being pushed with vigor. It is stated that the greater portion of the right of way has been secured, and that a large tract of land has been purchased in Edinburgh, Christian Co., Ill., on which a power-house will be erected. The despatch states that plenty of capital is available, and that there will be no difficulty in having the road completed and in operation by the time set for the opening of the World's Fair next year.

THE NIAGARA TUNNEL.

It is expected that the Niagara Falls tunnel will be completed by October 1, and the excavation for the wheel-pit shortly afterwards. Everything will be in readiness for the distribution of power not later than March next, and possibly in January from two stations, viz. : the central station from which 10,000 H. P. will be developed by three 5,000 H. P. wheels to be used most likely in generating electric power for commercial purposes. Ten 5,000 H. P. wheels can be placed at this point by enlarging the wheel-pit. From the second point 3,000 H. P. will be supplied to the Niagara Falls Paper Company, at the rate of $8 per year, per 24 hour H. P.

The company has announced the following rates for power delivered: $10 per H. P. for 5,000 H. P. or over; $10.50 for 4,500 H. P.; $11 for 4,000 H. P., etc. The power can be used for 24 hours if desired.

The same company is building the tunnel on the Canadian side, and work will be pushed with all possible speed.

ANALYSIS OF OBJECTIONS TO THE TROLLEY.

Bradstreet's, in its issue of August 20, has this to say in regard to the trolley system :

"In this, an age of extraordinary development and improvement of electrical appliances, it is somewhat strange that so cumbersome, unsightly, crude and altogether unsatisfactory a mode of propelling street-railway cars in cities as what is called the 'trolley system' should have gotten into use to the extent it has. There are half a dozen objections to the trolley system of propulsion for street-railway cars to one that may be urged with reference to any of its competitors, with two exceptions—horse propulsion and that by means of storage batteries. Horses as a means of propelling street cars are probably less desirable than trolley wires with the electrical current, but almost any other system is better than the trolley. The best form of the storage-battery system of propulsion, when that shall be attained, will probably supplant all others; meanwhile it is remarkable to notice the extent to which promoters of the trolley system are succeeding in establishing their dangerous and generally unsatisfactory method of securing rapid transit."

This is a rather sweeping denunciation of the trolley, but we suspect that these statements are based mainly on daily newspaper publications. The latter class of papers, as a rule, sacrifice truth for sensation and exaggeration, and the trolley particularly gets more than its share of thrusts and spite, originating in the brain of the average newspaper reporter.

The facts are the so-called objections to the trolley cut a very small figure as compared with the advantages enjoyed where electric cars are operated. We know of not a single community where the trolley system exists that has not been benefited largely by the fact that it is a trolley line. Sparsely settled districts and suburban areas have been rapidly built up as a consequence, and in every way property has been benefited. The people who patronize these roads have become accustomed to the new features and conditions incident to electric rapid transit, and they enjoy and appreciate the increased speed of travel.

As far as the dangers are concerned, 500 volts [the pressure of current used on railway wires] is not sufficient to kill a human being, and there is not a recorded case where death has resulted from such a shock. We do not intend to state inferentially that it is pleasant to take such a shock; it is anything but pleasant. What we mean is that a 500-volt current will not kill a human being, and there is no case on record where it has killed. Linemen on poles have received shocks which have caused them to fall to the ground, the fall causing injuries which resulted in death. Such an accident is generally charged to electricity by the newspapers. This sort of treatment is not fair.

Poles are not altogether desirable objects on a street, but they can be made ornamental and pleasing to the eye, and until something better is devised to take their place, the little matter of appearances can be sacrificed for the greater advantages derived by the use of the trolley system.

The storage-battery system of propulsion may be a commercial success before long, but it would not be in accordance with American spirit to ignore one improvement because of the hope of obtaining a still greater one in the indefinite future.

The trolley is a great improvement over any of the ex-

isting methods of street-car propulsion, and this fact alone is sufficient reason for its present extensive use. When anything better is brought out, the street-railway companies will not be slow in adopting it, even to the total exclusion of the "deadly trolley."

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electric Measuring Instruments.

Before the advent of electric lighting the instrument generally used for the measurement of electric currents was the galvanometer, but since then measuring instruments have multiplied in number and name. The chief difference in them however is in the name, as most of them are essentially galvanometers.

All instruments designed for the measurement of electric currents are based on one of the four following principles :

1. Electric attraction and repulsion.
2. Relations between electricity and magnetism.
3. Development of heat by the current.
4. Amount of metal deposited or gas generated by electrolysis.

Since the introduction of the electric light measuring instruments for specific uses have been devised, among which the best known are the voltmeter and the ammeter or ampèremeter.

The instruments now classified as galvanometers are used chiefly for the measurement of battery currents, and are based on the principle discovered by Oersted, viz., that the magnetic needle tends to assume a position at right angles with a wire through which an electric current is flowing.

Voltameters is the name given to instruments constructed on the principle of electrolysis, and are used for the measurement of the electromotive force of batteries. [This instrument must not be confounded with the voltmeter, which is an entirely different one and used for a different purpose.]

Voltmeters are designed for the purpose of measuring differences of potential, and give readings directly in volts.

Ammeters or ampèremeters give the strength of dynamo currents in ampères. Voltmeters and ammeters are now constructed for use in telegraph work in place of the ordinary galvanometer, and are of great advantage for the reason that the readings of these instruments give the values of the electromotive force and current directly, avoiding the necessity of mathematical calculations.

The difference between voltmeters and ammeters is mainly in the resistance of the coils of the instruments ; the voltmeter has coils of large resistance, and the ammeter coils are of low resistance.

COMING DEVELOPMENT OF ELECTRIC RAILWAYS.

The question of electric railways for long distances and heavy-freight service is one of paramount importance at this time. It is being seriously discussed in many directions, and everything seems to point in the direction of ultimate success.

Mr. Frank J. Sprague, president of the American Institute of Electrical Engineers, in his annual address before that body at the Chicago meeting last June, gave many interesting facts concerning the possibilities of such electric roads.

We give below an abstract of this address which will be of particular interest to our readers :

"In discussing the use of electricity instead of steam, a well-known steam engineer recently stated that, in his judgment, it must be conceded that electromotive force for the propulsion of cars will not be economical except for suburban traffic, and upon certain sections of important trunk lines, like the New York Central between New York and Albany, the Pennsylvania system between New York and Philadelphia, the other lines of like character where it is necessary to disband a large number of comparatively light trains every day and at short intervals. The principal field for a power of this kind would be in suburban service long enough to make the ordinary street electric cars unpopular because of the time required, and in such cases as these mentioned above ; also for moving freight trains in cities—that is, for the performance of transfer service. This is precisely in line with the arguments which I have advanced from time to time, and which I illustrated in a paper before the National Electric Light Association at its convention in Kansas City, where I outlined the possible service between New York and Philadelphia, and to which I will again refer.

"I must repeat that it narrows itself down to the one question as to the number of trains operated between two terminal points. Make that number of trains sufficiently large and the electric motor is the best means of propulsion, whether for high or low speed, whether for large or for small cars. Decrease this number and we must rely on steam propulsion ; or to put it in another way, the answer to the query, Will electricity take the place of steam for railroad purposes ? is : Only in part, and then only when the number of units operated between the terminal points are so large that the fuel economy would pay a reasonable interest and depreciation of the necessary cost of the central station and the system of conductors.

"Of course I do not in this general reply consider those special cases where advantages are to be gained for which there is a return for capital in another direction. Such a case is that of the Baltimore tunnel, where the investment and cost of operation will be greater than that for steam propulsion; in fact, there will practically be no economy in power, because the steam locomotives are not done away with, but simply unused for a period of a little over a mile. There is in this specific case, however, the incidental advantage of doing away with the necessity of a ventilating plant and yet getting rid of the annoyance incidental to tunnel service.

"Every system has its limitation. The electric is not exempt from this law, and hence it will set forth what are well-known limiting laws concerning the transmission of energy. They have been stated time and time again, but somehow or another people often lose sight of them in discussing the question of investments in large electric railways, so that I think it would be well, perhaps, to restate and emphasize them.

"The weight of copper necessary to transmit a given amount of power with a fixed loss will vary inversely as the square of the electromotive force used.

"The distance to which it can be transmitted with a given weight of conductor will vary directly as the pressure.

"The distance to which it can be transmitted over a conductor with a given cross-section will vary directly as the pressure.

"The weight of copper necessary where the supply station is in the centre of the system is only one-quarter that required if the station is at one end.

"The weight of copper will vary inversely as the square of the number of supplying stations properly placed.

"The electromotive force required will vary inversely as the number of stations.

"Lack of knowledge of these simple and unalterable laws has led to much misconception of electrical possibilities, and these have not been confined to the electrical engineers.

"In many of the suggestions which have been made, even by practical steam engineers, there has been an unnecessary confusion of the practicable and impracticable, and the specific object which should have been borne in mind has been lost sight of.

"Committees have drawn impossible specifications for trunk-line service, and demanded of electric motors a capacity and performance superior to that of the best compound steam locomotives. I unhesitatingly pronounce any attempt to build some such machines for the present certainly unnecessary and impracticable. The service thus suggested, if at all needed, will for many years be better performed by the steam locomotive than the electric.

"Leaving out of present consideration trunk-line work, there are three problems requiring solution in the application of electricity to propulsion on a large scale under conditions existing—for example, in Chicago or in any other place where there is a movement of a large number of trains on more or less complicated tracks, as will be found at almost all terminal stations. They are:

"*First.* The development of an electric locomotive of ample power which shall be as readily controlled as the steam locomotive and shall be reliable in operation and shall show a high economy. Of course such a machine must have all the adjuncts which are necessary for train movement.

"*Second.* A system of conductors and method of supporting the same, which can be relied upon for ample supply of current and absolute certainty of continuous contact at all speeds on curves, switches, cross-overs and the multitudinous combinations which exist on yard tracks.

"*Third.* A system of automatic block signalling which, while effective for steam traffic, will not be thrown out of operation by the use of tracks as conductors of electricity for a general supply. This is a more serious question than is at first considered, for this use will materially interfere with, if not absolutely destroy, the utility of what is known as the rail-circuit system.

"This third problem is one which must necessarily follow the development of the other two, as the automatic signalling systems now existing have followed the development of steam practice.

"It will probably be found necessary to erect a variety of kinds of conductors. From the most careful consideration which I have been able to give to the subject, I believe there is one way, and only one way, in which the current can be supplied in any complicated system, and that is from the overhead conductor, practically rigid in character, following very nearly the centre line of all tracks and switches with no movable overhead parts, and with return through the rail. The locomotive would then practically be moving between two electric planes, the lower being the guiding one. I know there has been a great deal said about other possible systems of supply. We have heard much of the charged rail using low-potential currents supplied at frequent invervals by motor generators driven from a central station.

"Since we have discovered no conductors devoid of resistance, and the art of welding is not particularly applicable for railway service where moving contacts are a necessity, little credence need be given to any scheme of this character.

"Intimately connected with the question of conductors, and one of the most serious ones which has to be met by the electrician, is that of potential. The personal danger-limit of continuous or ordinary period alternate currents is pretty well determined, and it seems generally admitted by constructors that the danger-limit for the continuous-current machine, with its commutator, is about the same as the personal danger-limit.

"Hence we meet with two dilemmas. If using continuous-current motors we are limited to a difference of potential per machine of 1,000 to 1,200 volts, and we can, so far as safety of the machines is concerned, only probably go above this limit by putting the motors in series precisely as has been proposed for long-distance stationary transmissions.

"If this is not done then we have the introduction between the transmitting dynamo and the receiving motor of a motor-generator system, another pet theory which is often suggested but which I unhesitatingly pronounce as so uneconomical as to be impracticable.

"If using an alternate-current system, then converters must be used, either distributed along the line and supplying the working circuit or placed upon the locomotive to safeguard the motors.

"While the use of a converter under these conditions is not as objectionable as the use of a motor generator, it cannot commend itself as a very practicable scheme, and certainly in view of the fact that no single-phase alternate motor promises up to the present serious success.

"For the present, and, I think, for a long time to come, we must confine ourselves to the consideration of railroad problems where continuous currents are used, and where the traffic is sufficiently large to justify the investment in central stations and conductors which would be required for the operation of such assistant.

"There are two methods of propelling trains electrically, one by following steam practice—that is, by building a motor and hooking it to the head of a train, the weight of the motor being such as is required for the necessary power and traction when grades and slippery tracks are encountered. From all that has been developed up to the present, to get the control that is necessary and to build the machines safely, the electric locomotive will weigh nearly as much per horse-power as the steam locomotive. This weight can be better distributed; but I do not think if steam practice is followed on trunk-line service that there could be any very material reduction of weight of train.

"The other plan is to have each car propelled by one or more motors. This would be the ideal system so far as propulsion goes, provided the electric motor was unlike all other mechanical apparatus, in that it never failed, and if a number of machines could be as well taken care of, cost no more and show as little depreciation as fewer machines of larger capacity operated as a unit.

"Should we arrive, as we hope, to possession of a single-circuit, alternate-current motor, then in view of the simplicity of its control, we may fairly hope for the distributed motor system. But here also the capacity and, likewise, the weight of the motor being determined by the total duty done, the weight of train limit would not de decreased, but rather increased.

"Among the roads that are ripe for the electrical engineer, and on which in the near future I hope he will demonstrate he has a most legitimate claim, are the New York elevated and the Chicago elevated, the handling of the trains on the New York Central and Harlem roads below the Harlem river, the long-talked-of rapid-transit road of New York, the Metropolitan underground road of London, the proposed tunnel roads in London, Paris and Berlin, and, coming more immediately home, suburban service such as that of the Illinois Central Railroad, a most ideal track for the electrical engineer; and last, and as it will prove, one of the most important, the operation of the terminal and warehouse systems for the interchange of freight on the lines entering a city situated as is Chicago.

"There will probably be in operation in the United States within twelve months not less than five electric locomotives varying from 700 to 1,200 H. P. and from forty-five to eighty tons in weight. The character of the work done will vary. In that work in which I am most concerned from a personal standpoint, a 700 H. P. electric locomotive will be built for experimental work, and to attempt to solve as far as may be the various problems

involved in railroad practice in Chicago. If my judgment is followed there will be an experimental section of track in the form of a loop about thirteen miles long with eighteen miles of rail, and with every variety of single and double track construction, and simple and compound crossings and switches.

"On this I hope to see erected such varieties of overhead construction as may be found best to meet the various kinds of service, and where the railroad problems on track jointly operated by steam and electricity can be developed in the most satisfactory manner. On this track there will be not only this locomotive, but also one of equal rated capacity supplied by one of the larger manufacturing companies. The duty demanded of these machines will be severe. They will be required to haul a train of not less than 450 tons, at thirty miles an hour, up a grade of twenty-six feet to a mile. They will probably be required to develop their full rate of capacity at all speeds between thirty and sixty miles per hour, and if there is sufficient track room they will be driven at a speed of at least seventy-five and perhaps one hundred miles per hour for short distances. The potentials used will be nearly double that at present obtaining in street-railway practice."

IMPROVEMENT IN BUSINESS.

It is gratifying to learn that the general electrical trade is improving after the summer's dulness, and the prospects for an active business in the immediate future are satisfactory. Where dulness has reigned for the past few months we now find signs of returning activity, and manufacturers and dealers generally speak with satisfaction of the outlook. Returning prosperity seems to be at hand, and once it is felt we hope it will remain.

THE "KELVIN."

A Southern contemporary thus criticises the proposition of the British Board of Trade to give to the kilowatt-hour the name "kelvin":

"The British Board of Trade authorities have decided to call the kilowatt-hour the 'kelvin' in official documents for the future. No one has greater respect for the brilliant Sir William Thompson (created Lord Kelvin) than we have; but a morbid desire for doing the right thing at the right moment impels us to say that it is bad taste to name the kilowatt-hour after a living electrician, who is acting as consulting engineer to various corporations. The Board of Trade unit does not belong to the C. G. S. system, and, therefore, did not need a non-descriptive name. Electricians are ever ready to make themselves laughed at by members of other learned professions by naming things after members of their own profession."

CONSOLIDATION IN BUFFALO.

The Thomson-Houston Electric Light and Power Co. and the Brush Electric Light Company, both of Buffalo, have been consolidated under the name of the Buffalo General Electric Company. The consolidation agreement was filed with the secretary of state at Albany on the 19th instant, and the capital of the new concern is $1,900,000.

The directors of the consolidated company are Daniel O'Day, George Urban, Jr., William W. Sloan, Thomas Hodgson, John L. Williams, James A. Roberts, Henry W. Burt, Franklin D. Locke, Charles R. Huntley, James Adams, John M. Brinker, Peter P. Miller, of Buffalo, and John. I. Beggs, of Chicago.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, August 20, 1892.

MR. H. D. STANLEY is temporarily associated with the Okonite Co., city, on some special work.

WILLIAM HINE, formerly of the United States Electric Lighting Company, has gone into the theatrical business and joined the Marie Tempest Combination.

THE WHITNEY GLASS WORKS, of Philadelphia, claim to produce first-class battery jars of glass at low cost. Mr. G. R. Robertson, 55 Murray street, this city, represents the company here, and he will be pleased to quote prices on standard and special goods of this class.

RANDOLPH & SULLINGER, electrical engineers, lately connected with the Edison Illuminating Company, have opened an office at 114 Nassau street, and are prepared to contract for electric light and motor wiring. They are also agents for dynamos, motors, engines and lamps. The firm has been appointed selling agents for the Perret motors.

H. LAMARCHE'S SONS, 83 John street, this city, carry a large stock of zinc in rods and plates for all kinds of electrical batteries, to enable them to fill all orders with despatch. The quality of the zinc this firm handles is well known for its purity, and the advantage of using pure metal is that the full value of the zinc is returned in electric current.

THE PHŒNIX GLASS CO., 42 Murray street, city, Mr. A. H. Patterson, manager, is now pushing the fall trade, and its half dozen travelling representatives are out gathering in orders all over the country. The demand is large and continuous for the company's beautiful etched and cut-glass shades and bulbs. The new fads in shades are extremely popular and the demand for them is great.

MR. J. VAN VLECK, of the Edison Electric Illuminating Company of this city, is the author of a valuable little work on house-wiring, which will shortly be issued by the company. The book sets forth the requirements and recommendations of the Edison Electric Illuminating Company of New York in respect to house-wiring, and is probably the most complete work of the kind ever published. Every condition and contingency is provided for, and the book will be valuable for reference.

GENERAL J. W. GODFREY, of the "World's" New York Insulated Wire Company, 13–17 Cortlandt street, city, maker of the goods universally known as "Grimshaw Wire," is with us again after an extended trip throughout the South and West. General Godfrey's office is becoming a great news centre, from which all of the latest and most important events of the day are heralded. This is particularly true since the addition to General Godfrey's staff of Mr. Harrington, the celebrated wire-order "scooper." General Godfrey reports that the outlook for fall business is very favorable, and at all the agencies of the company in the South and West good business is reported. These agencies keep constantly on hand a large stock of the company's standard goods so as to enable immediate shipment on orders.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	86 25
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113

Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s.	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	118 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*106
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	98 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	118 00
General Electric Co., 5s	4,000,000		*105
General Electric pref.		100 00	120 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 25
Laclede Gas pref.	2,500,000	100 00	66 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	56 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 75
Postal Telegraph	10,000,000	100 00	69 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	99 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	32 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Through the latter part of the summer, when all New York financial business is quiet, the electrics have continued to hold the most prominent position, ever increasing, while railway securities have had a hard struggle to keep their heads above water. And not only do the electric securities increase in price, but lead the list in the number of shares handled nearly every day. With the beginning of the fall business I propose to drop the quotations (unless requested to continue them in the list) of the corporations which by consolidation formed the General Electric. They will carry many of their bonds no doubt for a time; also the shares, which for one cause or another have not been exchanged, but none of these falling into the possession by exchange, purchase or limitation will ever be reissued by the General Electric. The field of speculation in these securities has been transferred from New England to New York, and when the price for the common stock reaches one hundred and fifty, the Eastern investors will unload altogether and seek another channel for their money. The steady business of the Edison Illuminating Company, of Boston, as well as in Brooklyn and New York, is raising the current market value of all three of those stocks as well as the bonds. The principle of all are similar; substantially three-wire underground incandescent lighting with small electric power by the same circuit at an equal price per hour. I think there is a chance for twenty-five or thirty points rise in either of the three, and am only grieved to find how few of them I have in my strong box. By their machinery and persistent general management, quite distinct from all the other electric light and power companies, they are virtually masters of the territory they occupy, and are constantly increasing it. They have no complicated contracts with the cities for public lighting, and therefore are free from the annual annoyance of dancing attendance on the aldermen for renewal of contracts, the loss of which means absolute annihilation of the company so treated. The incandescent current is being introduced rapidly at remunerative rates all over these cities; both share and bond holders are more than satisfied with the situation, and although a few of the daily papers fill column after column with alleged disaster the public will have it as much as an elevator, hot air and water, coal oil, gas, stairs, windows, airy roofs or fire-escapes, either of which in the last ten years have caused fully as much damage as the incandescent electric current, and neither of them viewed from a financial standpoint can compare with the three companies under discussion for legitimate profit, present permanent value and assured future. "A word to the wise is sufficient." If you prefer paying from one hundred to one hundred and fifty for the shares instead of eighty there is no law of record to influence you. Western Union for the first time in many years is at par again. The rise has been slow but sure. Only one action can reduce the value of this stock, and that is for the Government to purchase it at an arbitrated value. At present the horizon is clear in that direction. Western Union will do to lay aside for your grandchildren, meantime the Telephone holds its own. We follow very closely in the footsteps of the British Government, and before the late Parliament dissolved they appropriated a million sterling to purchase all trunk or main lines. The Bell patents expire at the end of all obstruction early next year, and there is no doubt of a strong effort to hold the fort on both sides. There will be business enough controlled by the Bell Company (or its successor) to hold the stock at par, but the 100 per cent. premium can't stand forever. The new Postmaster-General of Great Britain, Mr. Arnold Morley, who is endowed with a very considerable idea that his main duty is first of all to protect the property of his department, will rule the electric, and especially the telephone interests with a firm, unswerving hand. The offerings of safe, paying electric securities continue to come, and many fortunate investors are reaping as well as laying the foundation for present and future ease and luxury.

THE CABLE KING HONORED.

Sir John Pender, the cable king, chairman of the Direct United States, Eastern and Eastern Extension Cable Companies, has been made a Knight Grand Cross of the Order of St. Michael and St. George, the highest branch of the order. He was formerly a knight-commander of the order.

EFFICIENCY OF TWIN CONDUCTORS.

The following is a copy of a letter received by the Interior Conduit and Insulation Company, of New York city, which tells a story concerning its standard twin conductor that is highly gratifying to that company :

PHILADELPHIA, PA., Aug. 12, 1892.

Mr. E. W. Little, Gen. Mgr.,
42 Broad Street, New York.

DEAR SIR: Thinking it would be of interest to you to have a testimonial relating to the performance of your standard twin conductor at the New Neversink Mountain Hotel, Reading, Pa., during the recent and very severe electrical storm, I being an eye-witness and Walker & Kepler, the contractors, it was very gratifying to see the results. We have tubed the entire hotel with about 30,000 feet of the brass conduit tube and have placed the twin wire throughout the entire building.

The lightning was said to be the most severe ever seen in Reading, even by the oldest inhabitants of that place, and seen to play around and through the building in every direction, but did not affect our lines in any manner, not even so much as to blow the smallest fuses.

During the storm several of the lamps were broken by the overcharged lines, the glass being blackened as though they had been painted with black paint on the inside.

Some were bursted and cracked like little pistols when they went off. The building gets its current from the Reading Electric Light Co., whose plant is located 9,500 feet from the hotel. It is an overhead system, and therefore the overcharge in such a storm would be very heavy.

Hoping that this testimonial will be of some benefit to you, I remain Yours respectfully,

[Signed] I. C. WALKER.

PLEASED WITH THE "WARD" ARC LAMPS.

The following is self-explanatory:

THE DE LA VERGNE REFRIGERATING MACHINE CO.
NEW YORK, June 29, 1892.

Messrs. Electric Construction and Supply Co.,
18 Cortlandt Street, New York City.

GENTLEMEN: Yours of the 24th inst., regarding the arc lamps which we have purchased of you, is at hand, and in reply we beg to state, what we have verbally stated on many occasions, that the lamps are first class in every particular. The last lot of lamps obtained from your people we believe to be as near perfection as the arc lamp has attained up to the present time.

We are greatly pleased with them, and extend to you our congratulations on their excellent working.

Yours very truly,

E. V. CLEMENS, *Supt.*

FORREST SILVER BRONZE PACKING.

That Forrest Silver Bronze Packing is an excellent article may be judged from the following:

PROVIDENCE, R. I. July 2, 1892.

Forrest Silver Bronze Co.,
115 Liberty Street, N. Y. City.

GENTLEMEN: We have not had the packing on long enough to test its wearing qualities, but as a steam tight packing it is giving us better satisfaction than anything we have ever tried before. Yours truly,

PROVIDENCE MACHINE CO.

[Signed] WM. C. PIERCE, *Supt.*

The Electrical Age's Illustrated Patent Record.

Issued August 16, 1892.

480,720. Holder for Arc Lamps and Similar Globes. Frederick D'A. Goold, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed Dec. 5, 1891.

480,721. Electric Arc Lamp. Frederick D'A. Goold, assignor to the Edison General Electric Company, same place. Filed Dec. 5, 1891.

480,722. Snap-Switch. Frederick D'A. Goold, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed March 26, 1892.

480,727. Armature-Conductor and Means for Insulating the Same. Emil Kolben, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Feb. 8, 1892.

480,728. Ring-Armature. Emil Kolben, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Feb. 8, 1892.

480,729. Electrical Drop-Annunciator. Thomas W. Lane, Boston, Mass., assignor to the Electric Gas Lighting Company, Portland, Me. Filed Dec. 19, 1891.

480,739. Commutator for Electro-Magnetic Machines. Horace F. Parshall, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 11, 1891.

480,745. Electric-Light Fixture. James T. Robb, Mount Vernon, assignor to the Edison General Electric Company, New York, N. Y. Filed Aug. 31, 1891.

480,762. Ventilated Brush for Dynamos. Howard H. Cherry and Seward D. Younglove, Syracuse, N. Y. Filed Oct. 2, 1891.

480,780. Commutator for Ring-Armatures. Gustav Pfannkuche, Cleveland Ohio, assignor to the Brush Electric Company, same place. Filed July 8, 1890.

480,794. Arc Welding and Heating Apparatus. Philip I. Unwin and Henry Howard, Halesowen, near Birmingham, England, assignors to Lloyd & Lloyd, same place. Filed June 14, 1892.

480,802. Electric Fuse. Otto T. Blathy, Buda-Pesth, Austria-Hungary. Filed May 8, 1890.

480,804. Electric Dispatch System. Andrew Bryson, Jr., New York, N. Y. Filed Oct. 15, 1891.

480,845. Electric Elevator. Frank E. Herdman, Indianapolis, Ind. Filed Oct. 20, 1891.

480,846. Electric Elevator. Frank E. Herdman, Indianapolis, Ind. Filed Dec. 22, 1891.

480,850. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston Mass. Filed May 28, 1887.

PATENTS.—Continued.

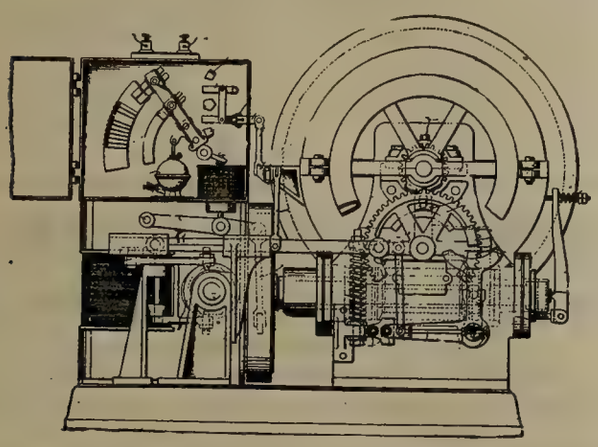
480,883. Storage-Battery. Edward P. Usher, Grafton, Mass., assignor to the Hopedale Electric Company, of West Virginia. Filed Aug. 22, 1891.

480,884. Battery-Cell. Edward P. Usher, Grafton, Mass., assignor to the Hopedale Electric Company, of West Virginia. Filed Feb. 19, 1892.

480,885. Storage-Battery. Edward P. Usher, Grafton, Mass., assignor to the Hopedale Electric Company, of West Virginia. Filed Feb. 19, 1892.

480,886. Battery-Plate. Edward P. Usher, Grafton, and William F. Draper, Hopedale, Mass., assignors to the Hopedale Electric Company, of West Virginia. Filed Feb. 19, 1892.

480,887. Battery-Plate. Edward P. Usher, Grafton,



480,845.—ELECTRIC ELEVATOR.

Mass., assignor to the Hopedale Electric Company, of West Virginia. Filed Feb. 19, 1892.

480,888. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed March 11, 1891.

480,889. Apparatus for Retarding or Dampening the Motion of Moving Bodies in Electrical Instruments. Edward Weston, Newark, N. J. Filed March 11, 1891.

480,890. Electric Time-Indicating Apparatus. Edward Weston, Newark, N. J. Filed June 4, 1891.

480,891. Temperature-Regulating Device for Electrical Circuits. Edward Weston, Newark, N. J. Filed June 4, 1891.

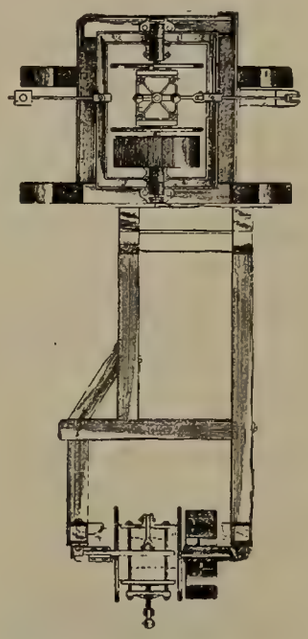
480,892. Rheostat. Edward Weston, Newark, N. J. Filed Dec. 5, 1891.

480,893. Rheostat. Edward Weston, Newark, N. J. Filed Dec, 10, 1891.

480,894. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Jan. 8, 1892.

480,895. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Jan. 14, 1892.

480,896. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Jan. 14, 1892.



480,981.—DYNAMOMETER.

480,897. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Jan. 14, 1892.

480,898. Electrical Measuring-Instrument. Edward Weston, Newark N. J. Filed Feb. 17, 1892.

480,899. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Feb. 19, 1892.

480,900. Adapter or Plug for Incandescent-Lamp Circuits. Edward Weston, Newark, N. J. Filed March 21, 1892.

THE

"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

480,918. Electric Locomotive. Rudolf Eickemeyer, Yonkers, N. Y., assignor to the Eickemeyer Field Company, of New York. Filed Dec. 21, 1889.

480,947. Electrical Pressure-Indicator. John W. Howell, Newark, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Jan. 2, 1892.

480,948. Snap-Switch. Joseph Hutchinson, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed Jan. 12, 1891.

480,954. Incandescent Electric Lamp. George F. Melick, Metuchen, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed March 4, 1892.

480,968. Electric-Arc Lamp. Rupert Schefbauer, Paterson, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Nov. 24, 1891.

480,981. Dynamometer. Ernest P. Warner, Chicago, Ill. Filed April 18, 1892.

480,988. Adapter for Incandescent-Lamp Sockets. Henry P. Ball, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed May 7, 1892.

481,019. Incandescent Electric Lamp and Lamp-Socket. Bruce Ford, Gloucester, N. J. Filed Nov. 27, 1891.

481,025. Joint for Electric Wires. Walter E. Harrington, Atlantic City, N. J., assignor of one-half to Leonard Atwood, Philadelphia, Pa. Filed Aug. 28, 1890.

481,030. Method of Electric Welding. Henry Howard, Halesowen, near Birmingham, England. Filed May 31, 1892.

481,042. Electric Train-Signal. George Merritt, San Francisco, Cal. Filed April 13, 1892.

481,047. Incandescent Electric Light. Eugene McOuat, Boston, Mass. Filed July 9, 1891.

481,048. Microphone. Eloy Noriega, Mexico, Mexico. Filed June 11, 1891.

481,049. Telephone. Eloy Noriega, Mexico, Mexico. Filed June 11, 1891.

481,050. Microphone. Eloy Noriega, Mexico, Mexico. Filed May 7, 1892.

481,062. Electric Control of Railway-Trains. Robert C. Sayer, Bristol, England. Filed March 10, 1892. Patented in Belgium.

481,075. Electric Battery. Peter Stiens, Charlottenburg, Germany. Filed April 20, 1892.

481,114. Combined Telegraph-Key and Circuit-Closer. William F. Lott, Philadelphia, Pa., assignor of one-half to Romuald T. McDonnel, same place. Filed April 26, 1892.

481,120. Electric Annunciator. Frank A. Pickernell, Newark, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed April 16, 1892.

481,132. Insulator. William J. Bowen, Norwalk, Ohio, assignor to William Hubbard, Elgin, Ill. Filed May 2, 1891.

481,138. Telephone. Frederick H. Brown, Chicago, Ill., assignor of one-half to Sidney F. Andrews. Filed March 23, 1891.

LEONARD'S 3-WIRE SYSTEM.

Indentical in Cost and Efficiency

WITH EDISON SYSTEM.

SIMPLER TO OPERATE.

Copper required guaranteed to be not over 30 % of that required for 2-wire system, under same conditions.

Royalty, 1 cent per lb. of Copper Installed.

PATENTED JUNE 7, 1892, No. 476,544.

CHARLESTOWN, W. VA., June 18, 1892.

MESSRS. H. WARD LEONARD & CO.,
136 LIBERTY STREET, NEW YORK.

GENTLEMEN: The central station plant, which you installed for us here, under your new patented 3-wire system, has given entire satisfaction ever since it started, which was about six months ago.

The operation of the plant is quite simple and economical, and as a result the plant is making very satisfactory earnings, although our town is rather small, having only about 3,000 inhabitants.

Yours very truly,
(Signed) CITY ELECTRIC LIGHT CO.,
WM. CAMPBELL, *Sec'y.*

For bids for complete plants, or conductors only, address

H. Ward Leonard & Co., 136 Liberty St., New York City.

VULCANIZED FIBRE COMPANY,

Established 1873.

Sole Manufacturers of HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

FACTORY WILMINGTON, DEL. **The Standard Electrical Insulating Material of the World.** OFFICE: 14 DEY ST., N. Y.

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ELECTRIC MOTORS.
Brushes for Sprague Motors.
Write for



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NEW YORK.
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Hoods for Arc Lamps.
Prices.

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FOR ALL PURPOSES.
SCRAP and NATIVE PLATINUM PURCHASED.
BAKER & CO.,
168-174 New Jersey Railroad Ave., Newark, N. J.

BATTERY ZINCS

RODS AND PLATES FOR BATTERIES.

H. LAMARCHE'S SONS,
83 John St., N. Y.

ELECTRICAL AGE

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J. B. TALTAVALL, PRES. W. T. HUNT, VICE PRESIDENT.
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DIRECT-CURRENT TRANSFORMER.

A machine that will find many applications is the motor-dynamo described on another page. Frequently it is desired to utilize a current of less voltage than some one of the three standard voltages, and to reduce the pressure and preserve the large ampèrage it is necessary to insert resistance. While this accomplishes the desired result as far as the current is concerned, it is not economical for the reason that users are required to pay for the current they waste in overcoming resistance. But by the use of an apparatus of the sort described the consumption of current would be properly reduced at great reduction in expense.

THE ELECTRIC CLUB.

It is gratifying to the members of the New York Electric Club to see how ably the board of managers has brought the club through its difficulties and put it once more on a firm foundation. There is need for a club of this character in New York, and every member should take a personal interest in its affairs and co-operate in the effort to maintain it successfully.

"JOHN BULL AND HIS ISLAND."

Our British cousins are proverbially slow to adopt new methods, but we are glad to see that at last they have become alive to the necessity of employing electric power for the propulsion of their street cars. Reports from London state that in the last parliament bills were introduced for the construction of several roads. The local government and taxation committee in reporting on the proposed lines, which are to be underground, particularly dwelt upon the special adaptability of electricity as motive-power for these lines. As yet no decided action has been taken in the matter, but nevertheless the strong recommendation made in favor of the electric system may be looked upon as a prognostication of its ultimate adoption.

ABSURD.

A New York daily paper last Monday morning published a lot of nonsense about the great danger into which Brooklyn is being plunged by the introduction of the trolley.

The paper informs its readers that there are two dangers in connection with the trolley. The first is "due to the wires and the second to the cars The first is not particulary great," it continues, "a little greater in fact, than that from the electric-light wires."

This fact will be news to electricians. It was generally supposed by them that the electric-light wires—the class referred to in the article in question—carried greater current than was necessary for the operation of cars, and that the trolley current was not particularly dangerous. But this shows how easy it is to err. Here comes a young man who knows nothing at all about electricity and its laws, who writes for a newspaper and gets paid therefor by the piece, and makes a statement in public that is directly contrary to well-established facts. Electricians do not know their own business as well as he does, and he tells them and everybody else that danger lurks in the trolley in places never before suspected.

We have seen many sensational stories about the so-called dangers of the trolley, but this one, we think, deserves the medal. Such stories are utterly absurd, and the writers thereof in their zeal overdraw the picture so much as to spoil the effect intended. It is regrettable that such a condition of things exists in journalism.

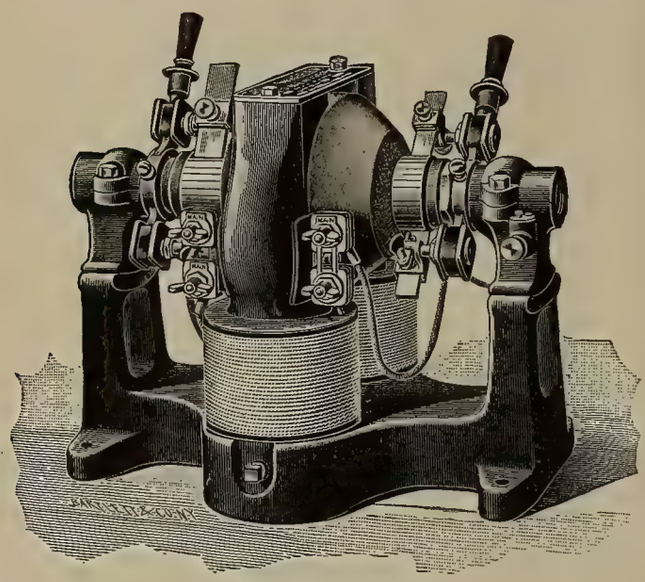
MOTOR-DYNAMOS.

There are three standard voltages in this country—115, 230 and 500 volts—and if a man does not happen to want any one of these three he cannot have any. The Crocker-Wheeler Electric Company, on account of the growing demand for special purposes differing from the three great standards has gone into the manufacture of machines to transform direct current from one potential to another, so that now the alternating current cannot claim that advantage as being peculiar to itself alone.

These transformers, or motor-dynamos, resemble motors or dynamos in all respects, except that the electrical parts are in duplicate. One side of the machine is devoted to receiving the current from the standard source; after transformation the other side distributes it at the potential desired.

It is often customary for shops which do silver and gold plating in moderate amounts, to take their current, which must necessarily be of large ampèrage, from 110, volt Edison mains, cutting down the voltage by means of large incandescent lamps. They are thus paying for their current at 110 volts when they are only using two or three volts. By the use of a direct-current transformer a consumption of 10 ampères in this manner would be reduced to about $\frac{3}{4}$ of an ampère, saving thereby from 90 to 95 % of the expense.

Another instance which does not recommend itself as much on the ground of economy for actual current consumed as on the ground of compactness and absence of attendance required, is the ringing of bells, etc., in large hotels, which now employ from fifty to one hundred Léclanche cells, at a cost per year of about one dollar each. The smallest size dynamo made, weighing about 30 lbs., will do the work of two hundred and fifty of these cells, and at the end of the year would cost for the equivalent output about one-quarter as much.



MOTOR-DYNAMO.

The larger sizes take current at from 600 to 6 volts at the motor end, and deliver it at the dynamo end at from 6 to 600 volts, and may be used as well as the smaller sizes for charging storage batteries, generating currents from telegraph circuits, transforming from direct to alternating current for telephone bells, etc.

The Crocker-Wheeler Electric Company, New York, is now making these machines in sizes from type $\frac{1}{6}$ to 3 H. P., the smallest size taking current at the motor end at from 230 to 6 volts and delivering current at the dynamo end at from 6 to 230 volts. The shaft of type $\frac{1}{6}$ can be so arranged that a dental drill may be attached to it, an emery or polishing wheel put on for polishing and sharpening tools, a fan for raising a breeze, or current taken from the dynamo end for heating cautery wires, and for various other medical uses. In generating currents type $\frac{1}{6}$ will do the work of 400 gravity cells and cost very much less. These machines (an excellent illustration of which is shown herewith) are made with great care and the scientific attention to details for which the Crocker-Wheeler Electric Company is noted, and the demand for them will grow as they become better known. The company already has large orders for them from some of the most prominent concerns in the country.

THE STORAGE BATTERY FOR STREET-CAR PROPULSION.

The storage-battery system of propulsion for street cars has lately received a boom which may result in bringing it within the limits of commercial success in the near future, and as so much has appeared in print lately about the probability of the extensive introduction of the system it will be of interest to those concerned to know what eminent authorities have to say on the subject.

Messrs. Crosby and Bell, in their recent book on the electric railway, say:

Taking up the application of the storage battery to the specific problem of electric traction one is at once confronted by the very considerable weight of accumulators absolutely necessary in the present state of the art to secure continued service. The experience of a very large number of electric roads extending over several years has shown that the work required per car mile on ordinary 16 or 18 foot cars is a little below 1 horse-power; at the car perhaps three-fourths of a horse-power hour is generally sufficient; this for ordinary grades and the usual rates of speed of from eight to ten miles per hour. We can therefore form a very good idea of the amount of stored energy that must be carried for ordinary service on an accumulator road. Assuming the average car mileage per day at 100, which is very nearly the mean of the roads now running, one sees immediately that the weight of batteries carried for an all-day run would have to be in the vicinity of 7,500 pounds. Ordinarily it has been the practice to change the batteries two or three times a day, but this smaller battery power carried means, on attempting to force the output for certain emergencies, a considerably diminished storage capacity, so that it has been found practically necessary to provide from 3,500 to 4,500 pounds of battery for the regular service of a car.

This dead weight is carried about continuously. The single car that has been experimentally operated with alkaline zincate batteries has considerably reduced this figure, carrying only about 2,500 pounds of battery, as might be anticipated from the greater weight efficiency; but it has not at the time of writing been in service long enough to permit a fair judgment of the results. As a matter of fact, the effect of forced output on batteries in such service is at times so great that even the weights of battery mentioned are not designed to furnish the power ordinarily used on overhead electric roads; in other words, most of the storage-battery cars that have been operated in this country and elsewhere have secured reduced weight of battery by skimping on power.

A very brief computation founded on a catalogue of storage batteries will show that to produce the 10 or 15 horse-power necessary on even quite moderate grades either a weight of battery considerably in excess of that mentioned must be carried or the discharge rate must reach a point very considerably above that for which the rated capacity of the cells is given. There is really no occasion for carrying battery power enough for long runs, for batteries can be changed just as horses are; the difficulty is, however, that a battery, even if charged

every trip, must be capable of a certain maximum rate of output; and this at present entails the use of heavy batteries, however often they are changed. The weight of accumulators to be carried can only be materially decreased by securing a higher efficient discharge rate.

It is readily understood that, in electric traction, in starting a car, and on curves and grades, there is always violent demand for current, lasting anywhere from a few seconds to several minutes, and demanding from the battery, if one is used, an especially heavy output. Every such call for a large current tends to lessen the efficiency and life of the cell, so that while in the laboratory the storage battery can be worked to nearly 90 per cent. efficiency—a figure which can be approximated in electric-light service—for traction purposes this percentage must be much reduced. Naturally, those most immediately interested are very chary about giving details as to commercial efficiency; but from the best sources of information obtainable, the results of experiments on a considerable scale with storage-battery cars, one is justified in concluding that in every-day traction work the mean efficiency of the cell is probably between 60 and 70 per cent.—in some cases even lower. Seventy per cent. is certainly a favorable estimate for the battery; and this lowered efficiency means also a lowered weight efficiency, hence more frequent changes of battery or a greater amount carried.

If it were not for the great weight of battery the low efficiency could be tolerated, but the result is a considerable increase in the dead weight that must be carried about; and dead weight in an automobile street car of any pattern is an unmitigated objection. The two tons of battery placed in a car require a very much stronger structure than would otherwise be necessary; and although the motors employed in storage-battery work are usually lighter than those used in the systems of direct supply, for the reason that it is intended to supply less power, the total weight of the car equipment is brought up to a figure unpleasantly high. A standard 16-foot car, with its two 15 horse-power motors, weighs about five tons; while the storage-battery cars of the ordinary pattern, such as have been used on the Fourth avenue road in New York, weighed about seven tons, of which 3,600 to 3,800 pounds was battery.

The carrying capacities of the two, however, are practically equal; so that, per unit of useful work, the necessary supply of power required in the direct and the storage systems of supply is in the ratio of five to seven. With a similar motor equipment, that is, the same capacity for doing work, the ratio would be about four to seven. That the two tons of extra weight carried about by storage-battery cars means a considerable disadvantage in the matter of power, is a question that admits of but one answer. With the ordinary co-efficient of traction of about twenty pounds per ton and a car speed of eight miles per hour, the additional power continuously needed to drag around the storage battery amounts to nearly 1 horse-power; this figure is for a level track; if grades are to be attempted in addition, the additional power required would be a little less than 1 horse-power for each per cent. of grade.

As regards the actual commercial efficiency of traction by storage batteries, it is not unfair to say that the systems of direct supply have at least the advantage consequent on less power needed for unit useful work. In the station the storage-battery road has somewhat the advantage, because the dynamos are of the same efficiency in either case, while in charging batteries both dynamos and engines can be worked at an approximately regular load and near the point of maximum efficiency. Taking the friction of the engine at about 10 per cent. of its rated full load, which is an estimate in accordance with the facts, the efficiency from steam to electrical energy at the charging station may be reasonably taken as about 75 per cent.

This is something like 10 per cent. better than is likely to be obtained on any but the very best overhead systems. The efficiency of the motors will not vary widely in the two cases, although the regulation, by changing the grouping of the batteries—which is readily accomplished in the storage system—gives it a slight advantage. Another small gain may be secured by using the motors as dynamos to restore a certain amount of energy to the batteries during the operation of stopping the car. To offset this we have on the one hand loss in the line, on the other the inefficiency of the battery; the former is somewhere in the vicinity of 10 per cent.; the efficiency of the battery, as just mentioned, is hardly likely to rise above 70 per cent., and is more probably below this figure. So that, taken altogether, we find that the storage battery in station and motors gains perhaps 15 per cent. in efficiency, and loses between 20 and 25 per cent. in the comparison between losses in battery and losses in line. As a net result, the total commercial efficiency from indicated horse-power at the engine to brake horse-power at the wheel is probably nearly, or quite, 10 per cent. less than in the system of direct supply. A similar figure may be reached by considering in detail the efficiency of the series of transformations that occur in a storage-battery plant.

Taking the efficiency of the station at 75 per cent., and the commercial efficiency of the motors at the same high figure, and combining these with the efficiency of the batteries—estimated at 70 per cent.—the total commercial efficiency of the system appears to be about 40 per cent.; while the various tests made on the very best direct systems indicate a total commercial efficiency of a trifle under 50 per cent.

Aside from this, we still have the greater power required on account of carrying around batteries, which is of the magnitude previously stated; this latter disadvantage could be for the most part obviated if it were possible to obtain a light storage battery. In the storage car using the alkaline zincate batteries, the total weight of car and batteries is just about the same as that of the standard motor car of the ordinary sort, although the power supplied is not equivalent in the two cases.

To find the relative commercial availability of the storage system, various other factors in the expense must be considered.

Accumulator traction undoubtedly has the advantage of requiring a smaller expenditure, and hence smaller interest charges at the central station. From the regular way in which the dynamos and engines can be operated the capacity of the charging station may be reduced to one-half, or at all events to two-thirds that required for operating the same number of cars by direct supply. On the other hand, we have to consider the relative cost of the equipment and maintenance of the battery, and of the overhead system necessary for distribution. In the first cost the ratio between them will depend on the number of cars per mile operated by the overhead wires, for the battery charges in the accumulator service vary almost directly with the number of cars. With direct supply the cost of the distributing system increases a little more rapidly than the mileage when the number of cars is uniform. In a long run with few cars the advantage would unquestionably be on the side of the storage battery; on a line with a large number of cars, quite in the other direction.

As regards cost of maintenance, the subject is open to no debate whatever. If an overhead system is properly put up it depreciates but slightly; 5 per cent. per annum would be a large estimate, while 3 per cent. would cover it in many cases. The depreciation of the batteries is an indeterminate quantity, but is undoubtedly large. Figures on this point are hard to find, for there is a very wide discrepancy between the estimates of the makers on the depreciation of a given battery and the results found when it is put in service for traction purposes.

There have been so few storage-battery roads operated, and of these so few have given to the public any definite report, that the question is a puzzling one.

STEAM AND ELECTRIC POWER.*

BY J. J. WRIGHT.

Having a steam-plant that we can depend on producing power at the lowest possible figure, we must turn our attention to the question of its distribution in an economical manner. This is not at all an easy problem to solve, and much will here again depend on location. The higher the pressure at which power can be distributed the greater the economy in first cost of construction and in subsequent operation. But there are two serious drawbacks to high potential: first, increased liability to derangement in the electrical apparatus, and secondly, the difficulty of building and successfully operating motors of small power. Given a certain distance to your centre of distribution, you have to strike a balance between interest on the cost of large-sized copper conductors to reduce the resistance, and the extra consumption of fuel required to drive your current over small wires. I am speaking now of a system of constant potential suitable for distribution to consumers in large or small quantities, and not of the new-fangled long-distance alternating-current exploits that require a deaths' head and cross-bones painted on every pole as a gentle hint to the unwary to keep their own side of the highway. For distribution from a central station within a reasonable area, say half to three quarters of a mile in any direction, a pressure of 250 volts appears to be most suitable. Motors can be wound for current as small as a quarter of a horse-power. For greater distances a second system of five hundred volts could be utilized with advantage and at not too heavy an expenditure for copper. There are many experiments being made with a view of bringing out a power-distributing system by means of alternating currents, but at present there does not seem to be anything positive in sight that would be better than a constant-potential direct-current system at a pressure as low as could be consistently used, taking into account distance from source of power, cost of fuel, and interest on cost of copper-mains for its supply.

It might be possible in very large installations, or where the ground to be covered is considerable in extent, to establish a system of high-tension mains to distribute an alternating current to central points and there transform it to a lower potential and utilize it to drive a motor-dynamo. This would again produce a direct current at the pressure desired. Except for small powers it would seem as if the complication introduced in a method of this kind would make the power realized about as expensive as steam on the spot. The position of a pessimist in electrical matters is a somewhat risky one to take at the present day, but it does appear to me that some of the schemes proposed for long-distance power transmission are a trifle outside of the limit of commercial success. The line must be drawn somewhere at a spot where the expense of maintaining costly electric apparatus and the interest on the original expenditure will about counterbalance the cost of fuel and maintenance of a steam-engine. It will also be found very much cheaper to locate a factory requiring a large amount of power at the source of power itself than incur a continual expenditure to transmit that power to a distance. As an instance, the elaborate scheme of water-power which is now in course of evolution at Niagara Falls may be cited. The American scheme, however, has crystallized into action, and large works are already undertaken. The primary object is to locate consumers at the power; but incidentally it is proposed to transmit a large quantity to the city of Buffalo. Time will show to what extent this may be commercially feasible; but when the complicated nature of the operation and its cost is considered there is room for a pretty large-sized note of interrogation.

First we have the proportion of the cost of the water-power to begin with, royalties, cost of rock excavation, cost and maintenance of turbine wheels and attendance. The electrical outfit must be first, low-tension dynamos producing alternating current, then transformers to raise the pressure sufficiently high to overcome the twenty miles and more of conductors to the city; the cost and maintenance, and above all the protection of this twenty miles of line; then again transformers to reduce the pressure to a manageable point; low-tension alternating-current motor to convert the current again into power; and finally the cost of its distribution. This expenditure will have to compete with coal at a cost for steam purposes of from a dollar to a dollar and a half per ton. Wonderful things have been done by means of electricity, and this enterprise may be successfully accomplished—financially I mean. Its practicability from a scientific standpoint has been already demonstrated.

* Abstract of paper read before the First Convention of the Canadian Electrical Association.

HUMAN ELECTRICITY.

In its last issue the *Fortnightly Review* printed an interesting article on human electricity. For the benefit of those of our readers who are interested in such matters we reproduce the article :

The investigation of physicists make it highly probable that all movements of matter, even those of a molecular character, are linked with electrical phenomena. Friction, even the brushing of the wind over the surfaces of things, the falling of rain-drops from the sky, the action of light and heat, the production of flame, and all the molecular chemical changes that are silently going on in inanimate nature, are associated with changes in the electrical state. It follows that our modern methods of producing electricity by friction, by induction, by heat, by chemical action, are but specially contrived imitations of processes carried on throughout the ages. Such considerations would naturally lead one to expect that electrical phenomena would also be associated with those finer molecular changes on which life depends, and that it is only a matter of experimental detail to demonstrate the existence of an animal electricity. It seldom, however, happens in science that we see far before us, and even acute minds miss recognizing facts that to their successors are everywhere apparent ; the usual procedure rather is that we look backward and find an intellectual satisfaction in tracing the gradual unfolding of any department of knowledge, while we have some difficulty in even imagining a time when such knowledge did not exist.

All this is true of animal electricity. Thus electrical fishes have been known from early times. The benumbing effects experienced by a fisherman in the Adriatic, when he drew a torpedo from his net, were familiar to Aristotle. An Egyptian inscription, executed about 5,000 years ago, shows figures of the well-known malapterurus, the thunderer fish of the Arabs, a fish having such electrical properties as could not have escaped the attention of the ancient people. It was not till 1773, however, that Walsh first demonstrated that the shocks of the torpedo were truly electrical. Thirteen years after—namely, in 1786—Luigi Galvani, professor of anatomy and physiology in Bologna, noticed that the limbs of recently

killed frogs became convulsed when brought near a frictional electrical machine in action. This famous observation marks a new epoch in the history of science. He found that the convulsive twitches occurred only when a spark was emitted from the conductor, and only when some metallic substance was in contact with the nerve. Recognizing the sensitiveness of the frog's nerves to electric shocks, he used them in investigations into the phenomena of atmospheric electricity; and on the 20th of September, 1786, he suspended, by copper hoops, three frogs to the iron trellis-work on the roof of his house, and saw, as the limbs were blown about by the wind, that convulsions occurred when the toes touched the iron railing. This proved that an electrical machine was not required, but while Galvani recognized the fact, he missed the true explanation. We now know that the twitches in the frogs' legs were caused by electrical currents that came, not from the sky, nor from the animal tissues themselves, as Galvani imagined, but from the contact of the copper hooks with the iron railing. About this period the old and ever-recurring question of the nature of life was in an acute stage, and it is not wonderful that the physiologist of Bologna thought, from this and numerous other experiments,that he had detected the "nervous fluid," the something which, if not life itself, was at least inseparable from it. This is now an old story, and all the world knows that the famous controversy between Galvani and his followers and Volta, the professor of natural philosophy in the University of Pava, led to the invention of the voltaic pile in 1799, and still more to the discovery of the production of electric currents by the contact of dissimilar metals, more especially when one of them is acted on chemically by certain fluids. For a long time the brilliancy of the results flowing from the investigations into voltaic electricity threw the discoveries of Galvani into the shade; but by and by, as experimental methods became more delicate, it was found that there is in truth an animal electricity, the existence of which was doubted by Volta and his followers.

We know now that in spite of Galvani's primitive experiments the electric currents that caused muscles to contract were undoubtedly produced by the living tissues themselves. It was next to impossible, at that time of day, to prove the fact. The apparatus for the detection of extremely feeble currents had not been invented. The next step was made by Oersted, in 1820, when he discovered the influence of a current of electricity on a magnetic needle, and the construction of a galvanometer thus became possible. Five years later, in 1825, Nobili constructed such an instrument for physiological purposes, and by means of it he demonstrated that a current could be obtained from a frog's muscle. He prepared a frog, introduced its two legs into two glasses of salt water, placed in each vessel a strip of zinc, connected the two strips with the galvanometer, and obtained a deviation of the needle to the extent of 10 degrees to 30 degrees. He showed that Galvani was right in maintaining the existence of an animal electricity, while he was wrong in holding that the contact of two metals with the tissues gave a proof of this. On the other hand, Volta was right in his statement that the twitches of the frog's muscles in Galvani's experiments were independent of an animal electricity, but he was wrong in denying, as he did, that electrical currents existed in the tissues. Matteucci, about 1837, enriched the subject by many beautiful investigations, and by joining the thighs of frogs in a special way, he made a living voltaic pile, which produced effects similar in character to the piles built up by physicists with discs of metals and intervening discs of paper or cloth. Then came Du Bois-Reymond, the present venerable professor of physiology in Berlin, and the successor of Johannes Muller, who was the intellectual godfather of such men as von Helmholtz, Du Bois-Reymond, Virchow, Brucke and Reichert. In 1841 Du Bois-Reymond, who combines, as his ancestry would lead us to expect, Celtic fervor with Teutonic thoroughness, took up the subject of animal electricity with rare enthusiasm, and since then has labored on it with much success. One feels, after reading any one of his numerous monographs, that he has left little for the gleaners in this field of research. Electro-physiology has attracted many able workers during the fifty years that have elapsed since Du Bois-Reymond entered on it, and much has been accomplished, more especially in examining the properties of the electrical fishes. It may not be uninteresting now to inquire as to what can really be demonstrated.

In the first place, by using a sensitive galvanometer. or the ingenious capillary electrometer, a kind of electric manometer, invented by Lippmann in 1873, and by connecting tissues with the unpolarizable electrodes of Du Bois-Reymond (a contrivance by which contact can be made between the galvanometer or electrometer and the tissues without the risk of generating currents by chemical action), it can be shown that all living tissues show differences of potential at different points, or in other words, that electrical currents pass through the instruments when the tissues are placed on the electrodes. With such sensitive appliances, a bit of skin, a morsel of muscle or nerve, a fragment of such an organ as a gland, an eye, or a heart, show electrical currents. Although a normal muscle, absolutely uninjured, is isoelectric; that is, gives no current, because all points of its surface have the same potential, it is often impossible to place on the electrodes a muscle, or, indeed, any living tissue, so not to show currents by the movement of the needle of the galvanometer. Careful examination, however, proves that the strongest currents are manifested when certain surfaces are brought into contact with the electrodes. For example, in the case of muscle, the strongest current is obtained when one electrode touches the centre of a transverse section, while the other touches the uninjured surface of what may be called the equator of the muscle; that is, a line encircling it in the middle of its length, and it can be shown that the surface is always positive to the transverse section. The same is true of nerve. If a frog's eye is placed on the electrodes, the centre of the cornea is positive to the transverse section of the optic nerve and the internal surface of the retina is positive to its outer or choroidal surface. Again, if a small piece is snipped off the apex of the ventricle of a frog's heart, this surface is negative to any other surface, while the heart is at rest and does not make a beat. All of these currents are, of course, due to differences of potential; and as they exist while the tissue or organ is at rest, they may be called resting currents, and they are usually due to the injured surface undergoing molecular changes causing it to become a different potential from that of any part that has not been injured. If living matter has a flesh surface exposed by an incision, the surface begins to die, that is to say, it rapidly undergoes molecular changes, and the dying matter becomes of lower electrical potential than the matter that is not dying, so that if the dying surface is connected with one electrode while the non-dying surface is connected with the other, a current passes through the galvanometer from the non-dying to the dying. Another way of expressing the same fact is to say that any local injury to living matter always disturbs electrical equilibrium, because the injured part becomes very quickly of lower potential. Now, it is evident that chemical action, as occurs in dying tissues, will be greatest on the injured surface. We may suppose that this surface, acting like the zinc, the positive, plate in a Daniell's cell, generates currents which pass through the muscle to its surface, issue from the surface (thus the positive pole) to the galvanometer, and back from the galvanometer to the in-

jured surface, which thus represents the negative pole. Such currents, therefore, are evidently not of much physiological importance, except that they differentiate between different planes of vitality.

But the case is different when the tissue or organ discharges its normal function. This will be readily understood if we examine what occurs in a contracting muscle. The normal function of a muscle is to contract; that is to say, there is a movement of its protoplasm by which it shortens in length while it increases in thickness. Now, suppose a muscle laid on the electrodes so that a "resting" current is manifested by the deflection of the needle of the galvanometer; let the nerve supplying the muscle be irritated so as to cause contraction of the muscle; instantly the needle of the galvanometer moves in the opposite direction, and it may pass even beyond the zero point. This is due to the generation of a new current in the muscle, in a direction opposite to that of the resting current. The proof is this: Let us compensate the resting current before causing contraction of the muscle, by sending a portion of a current from a Daniell's element in the opposite direction, so that the galvanometer is brought to zero, then cause the muscle to contract, and the new current—the action current, as it may be called—sends the galvanometer-needle to the opposite side of zero. This phenomenon of a new current in the opposite direction is known technically as the negative variation, and it is of importance physiologically because it is the indication of changes occuring in the muscle that are associated with its contraction. It is a vital phenomenon because it can only occur when the muscle is alive. The action current may be accounted for by supposing that at the nerve terminations in the muscle there is some kind of local change, just as occurs on the cut surface of the muscle. This local action, probably chemical, generates a current which passes through the muscle in the reverse direction of that of the resting current; that is to say, it flows to the cut surface, passes out by it to the galvanometer, and returns from the galvanometer to the point of entry to the nerve. The cut surface, therefore, during the action current, becomes the positive pole, while the uninjured surface is the negative pole of the little muscle battery; exactly the reverse state of matters to what obtained while the muscle was at rest.

Early observations seemed to show that this negative variation was a kind of wave of negativity that swept through the muscle, and was over and gone before the muscle contracted; but recent experiments of Burdon Sanderson, in which he simultaneously photographed the movement of the muscle and the movement of the mercury in the capillary electrometer, demonstrate that the negativity extends into the time of the contraction, or, in other words, that the two phenomena go closely together. The electromotive force between the longitudinal and transverse sections of the resting gastrocnemies muscle of a frog is from .03 to .08 volt, and the negative variation may amount to as much as .04 volt.

Similar action currents occur in the nerves. A nerve has a resting current, but when the molecular disturbances which, for want of a better term, we call a nerve current, pass along it, there is a negative variation.

Electrical phenomena may also be discovered in the central nervous organs. If we bring the electrodes of the galvanometer into contact with the surface of the brain electrical changes occur when light falls on the eye. Recently Gotch and Horsley have explored the spinal cords with electrodes connected with the capillary electrometer, and they have found electrical variations in the motor strands of the cord when motor centres in the cerebral cortex were irritated. Thus, in a sense, they tapped the wires of the living telegraph system and got information as to the paths in the cord along which motor, and even sensory impulses travel. It seems to be only a matter of experiment to discover electrical changes in all the cerebral nervous organs. Could we picture to ourselves the changes in the brain when its higher centres are in a state of molecular disturbance, as when one is thinking rapidly in a lecture, now adapting his words to his ideas, now thinking ahead as to what he will say next, now noticing the effects of his words on the audience, now becoming conscious that he is obscure, and again that he is succeeding in making things plain, now watching the clock and noting the inevitable flight of time—could we, in such circumstances of mental turmoil, examine the phenomena of the brain, we would, in all probability, obtain evidence of rapid changes of potential, and of currents flashing in a thousand directions, pursuing paths the intricacies of which are many times greater than if all the telegraphic and telephonic wires of London were concentrated in one vast exchange.

Take another illustration. Place a frog's eye on the electrodes; we at once obtain a resting current, as above-indicated. Keep the little eye in the dark and the resting current becomes less and less as the tissues die; but allow light to fall upon it—even a flash of light lasting the thousandth of a second, or the light of a vesta at a distance of several yards—and there is usually first, a positive variation, then a falling off, if the light is allowed to act; and, lastly, if the light is suddenly cut off, there is almost invariably a second (positive) increase, followed by a (negative) diminution of the current (Holmgren, Dewar and the writer). It is highly probable that similar electrical phenomena are related to the action of stimuli on all the terminal organs of sense.

The skin of all animals shows a current passing from the surface inward. This has been supposed to be due to abrasion of the surface, and the skin current must be distinguished from that due to secreting glands in that organ. Thus the skins of fishes show a true skin current, although they contain no glands. The glands of the skin, however, produce currents, and it can be shown that when the secretory nerves of the glands are irritated there is a positive variation of increase coincident with the secretion of sweat. Such electromotive phenomena connected with secretion have been demonstrated in the pad of the cat's foot, which contains numerous glands, and also in the submaxillary salivary gland. Thus the phenomena of secretion are undoubtedly connected with electrical changes.

One of the most interesting demonstrations of electrical phenomena in living structures is that of the variations connected with the beat of the heart. If the heart of a frog be laid on the electrodes, so that one electrode touches the base while the other touches a cut or injured surface at the apex, the needle of the galvanometer immediately begins to swing backwards and forwards, and it is easy to show that the swings are coincident with the beats. This remarkable phenomena has received much attention. It is almost impossible to trace the direction of the currents while the heart is beating; but if the rhythmic beat is arrested by applying a ligature around the heart at the junction of the sinus venosus with the auricle, as was first shown by Stannius in 1852, it is then possible to bring about a single beat by stimulating the heart either at the base or at the apex. Suppose, now, that the heart was connected with the galvanometer, or, still better, with the capillary electrometer, and that we stimulate at the base; there is contraction, the base becomes negative to the apex, and the next instant the apex becomes negative to the base. This is what occurs with a normal beat. On the other hand, if the apex is stimulated, the apex becomes first negative to the base, and then the base negative to the apex. Evidently, then, in a normal beat, the contraction commences at the base and travels to the apex. But the electrical change does not occur in the same phase throughout the heart at one

moment; on the contrary, the wave of negativity travels to the apex. An instant afterward, however, the contraction change at the base has disappeared, while it still remains at the apex. At this moment the apex is negative to the base. There are thus two phases with each contraction, and the phenomenon is termed a diphasic variation. Hence the swinging of the needle of the galvanometer. It is driven alternately in opposite directions. Similar phenomena have been noticed in the isolated mammalian heart. By far the most beautiful demonstration of this kind, however, has been recently given by Dr. Augustus Waller, of St. Mary's Hospital, London. Using the capillary electrometer, he has succeeded in showing electrical variations in man, without the necessity of making even an abrasion of the epidermis. Deeply placed as the heart is in the chest, full as it is of blood, and surrounded by the chest walls composed of bone, muscle and skin, yet by placing one electrode, say in the mouth, and the other on the left foot, or even by placing them on opposite sides of the heart on the chest wall, the electrical variations with each beat can be demonstrated. Each beat of the human heart shows different electrical potentials if two points are connected with the capillary electrometer, one on each side of an axis passing, roughly speaking, from the left shoulder obliquely downward to the right side. Thus the body may be divided into two asymmetrical electrical districts, so far as the beat of the heart is concerned, one including the head and right upper extremity, and the other the three remaining extremities.

We have seen that electrical variations occur in connection with muscular contraction, and at once the question arises of whether any such changes can be demonstrated in the human being. Suppose we have a very sensitive galvanometer. Take two shallow vulcanite troughs, and fill them two-thirds full with a three-quarter per cent. solution of common salt. Dip a perfectly clean slip of platinum into each trough, and lead wires from the strips to the galvanometer. Connect the two troughs with a strip of clean white blotting-paper wet with the salt solution. As a rule, if precautions have been taken to have everything absolutely clean, no current will pass through the galvanometer. Then wash the hands thoroughly and place one in each vulcanite trough. At first there is usually a swing of the galvanometer, but it soon comes to rest. Then contract powerfully the muscles of the right arm. There will be a swing in one direction, say to the right. Next, throw the muscles of the left arm into contraction. The needle of the galvanometer will now swing in the opposite direction. By alternately contracting the muscles of the right and left arms the needle of the galvanometer can be caused to swing rhythmically. This experiment, first made by Du Boise-Reymond demonstrating what he calls the man-current, is of great interest. Careful examination shows that when the muscles of the right arm are contracted an electrical change passes through the body from the right to the left arm, out from the left arm to the galvanometer, and back from the galvanometer to the right arm. When the muscles of the left arm are contracted the reverse occurs; or, in other words, a current passes through the body from the contracting to the passive arm, and through the galvanometer from the passive to the contracting arm. Some have supposed that this is skin-current, or rather a current due to a change in the cutaneous secretions, and it has been stated that it will not occur if the secretory nerves have first been paralyzed by atrophine. As excitation of secretory nerves gives a positive variation, it is difficult to account in this way for the negativity that occurs in the actively contracting muscles, while the remarkable uniformity in the results that one, by careful experiment, obtains by alternately and rapidly contracting the muscles of the two arms, is in favor of the view that the man-current is due to electrical changes occurring in the muscles themselves.

SWEDISH IRON.

Swedish iron, which is so valuable for electro-magnets on account of its extremely low magnetic retentivity, is almost entirely free from phosphorus and sulphur. This iron is very soft and ductile, yet possessing great tensile strength, and the supply is practically inexhaustible. It is found in all parts of Sweden, though the Dannemora district in the central part of the country is the chief mining region. One mountain in Swedish Lapland, within the Arctic circle, has four enormous strata of ore which, it is said, would alone supply all the iron needed in the country for a century to come. It is stated that about one million tons of iron are mined in Sweden every year.

ST. ALBANS' NEW CENTRAL STATION.

The new central station of the St. Albans Light and Power Co., St. Albans, Vt., is in every respect a thoroughly efficient one.

The main building is a commodious structure, and will contain the engines, dynamos and boilers, also storage-room, repairing department and counting-room. Of the boilers there are at present two of 200 horse-power capacity, with space for the addition of two more if necessity demands them. There are two engines, one of 80 horse and the other capable of developing as high as 150 to 200 horse-power. This latter engine has a 15-foot fly-wheel with 26-inch face.

Two dynamos, one for lighting the railroad yard and stores and the other for street service, have been set up, as have also two Edison incandescent dynamos.

Connected with the shafting are three transmitters, by the use of which any one of the dynamos may be cut out or started without interrupting the work of the main line of shafting.

The repairing department is thoroughly equipped with all the appliances for the renovating and testing of lamps.

The superintendent's office is in one corner of the main room. It is a neat and cosey apartment finished in the natural wood.

Protective measures in case of fire have been taken, a line of hose attached to a stand-pipe being in position for instant use. The sanitation of the plant is as near perfection as possible. All of the piping is arranged so that the drippings from all parts of the building centre in one sewer at a point in one corner of the boiler-room.

It is probable that the company will, a little later on, be in position to furnish electric power for various kinds of mechanical work in the village.

WASTE WATER-POWER IN CALIFORNIA.

The Oroville (Cal.) *Register* calls attention to the great natural water-power produced by the fall of Feather river, at the Golden Feather dam, and states that it has hardly a rival in the State. The height of the dam is over 30 feet, and the flow of water in midsummer in the Feather river is 1,200 cubic feet per second.

Mills and factories can be located at this point with ample room for yards and grounds, while the power for running machinery can readily be transmitted by electricity from the Golden Feather dam. Here is a chance for some electrical concern to do some good work.

To obtain the horse-power of a waterfall multiply the number of cubic feet per minute by 62.5 by the head in feet, which gives the foot-pounds ; this divided by 33,000 gives the horse-power.

EDUCATIONAL.

ELECTRICAL ENGINEERING AT HARVARD.

The programme of the department of civil engineering of the Lawrence scientific school, Harvard University, for 1892–93 includes a statement of the course of electrical engineering.

The design of this course is the preparation of students pursuing it for the discharge of such duties as electrical engineers as the rapid advance of electrical science in its manifold and increasing technical applications may demand. A thorough grounding, therefore, in the most advanced theories of electricity and magnetism is accompanied and supplemented by continuous instruction in their industrial applications by means of workshop and laboratory practice. So much of mechanical engineering is incorporated in this course as is requisite to complete the student's control in designing and operating electro-magnetic machinery. The subject of electric lighting and of the generation of electric power, including the establishment and operation of plants, is thus covered in a thorough and practical manner. A well-equipped electrical workshop provides the resources necessary for the instruction which is given in the course belonging to this branch of the department of engineering.

NORTHWESTERN ELECTRIC LIGHT ASSOCIATION.

The electrician, managers and officers of electrical works of the Northern Peninsula of Michigan and Northern Wisconsin, on August 19, at a well attended and enthusiastic meeting, effected an association at Marinette, Wis., under the title of the Northwestern Electric Light Association.

The officers elected were: H. C. Higgins, of the Marinette Gas, Electric Light and Street Railway Company, president; T. A. Pamperin, manager of the Citizens' Light and Fuel Company, and president of the Electric Manufacturing Company, of Oconto, Wis., secretary; and Louis Lusk, president of the Edison Electric Light Company, of Antigo, Wis., treasurer.

The directors—G. S. Leykem, Jas. R. Dee, F. B. Warren, A. A. Foreman, John F. Fitzpatric—are gentlemen well known throughout the Northwest in the electrical business.

The object of the association will be the regulation, settlement and exchange of ideas concerning matters of mutual interest in the electrical business.

A number of honorary members were elected, including H. C. Hamilton, of Sault Ste. Marie, Canada, W. T. Sullivan, electrician of the Chicago Auditorium, and J. E. Bowers, president of the Crystal Falls board.

After the adjournment of the meeting the visitors, under the guidance and through the courtesy of President Higgins, inspected the well equipped and regulated electric lighting and street-railway plant under the management of that gentleman.

The next meeting will be held on Oct. 12, at Oconto, Wis., at which full representation is looked for.

WATER-POWER FRANCHISE.

Mr. Alfred Tregidgo, president of the County Miners' Association, Nevada County, Cal., has acquired a valuable water-right on the South Yuba, and it is likely that electric power will soon be introduced into the Nevada and Grass valley districts for mining purposes. The right of way has been secured for a canal and electric lines and the necessary generating stations, and several electrical companies have been bidding for the contract for the electrical equipment. The South Yuba river, at its lowest summer stage, furnishes 2,500 inches of water, which will insure whatever water is required, and this will be conveyed by canal for a distance of about four miles, and then dropped to a station on the bank of the river, giving a pressure of 400 feet to drive the dynamos. This point is only three miles north of Nevada city and seven miles from Grass valley, and therefore the loss of power by transmission would not be great. The advantage of the location of the entire plant would be that it is below the snow line, and could not be obstructed by the snow-fall at any time. Neither would there be any loss of water, as whatever was taken out of the river by the canal would be returned again. The location of the canal will be near the Purdon bridge on the South Yuba, and the canal will be constructed on the south side of the river. It will be made of sufficient capacity to carry 6,000 inches of water, with a view to meeting the largest demands for power in the future for whatever purpose. The scheme is in all respects practicable, and can be carried into successful operation at a reasonable cost. The location is not surpassed by any in the State, and possesses the great advantage of furnishing ample power in a short distance for mining and other purposes. This valuable power has heretofore been running to waste, and its utilization cannot but exert a very beneficial influence on mining and other industries in the central portion of Nevada county. Work on this improvement will be commenced this season.

LIGHTNING AND THUNDER.

Three kinds of lightning have been distinguished by Arago: 1. The zigzag flash or "forked lightning," of ordinary occurrence. The zigzag form is probably due either to the presence of solid particles in the air or to local electrification at certain points, making the crooked path the one of least resistance. 2. Sheet lightning, in which whole surfaces are lit up at once, is probably only the reflection on the clouds of a flash taking place at some other part of the sky. It is often seen on the horizon at night, reflected from a storm too far away to produce audible thunder, and is then known as "summer lightning." 3. Globular lightning, in the form of balls of fire, which move slowly along and then burst with a sudden explosion. This form is very rare, but must be admitted as a real phenomenon, though some of the accounts of it are greatly exaggerated. Similar phenomena on a small scale have been produced (though usually accidentally) with electrical apparatus. Cavallo gives an account of a fire-ball slowly creeping up the brass wire of a large highly charged Leyden jar, and then exploding as it descended; and Planté has recently observed similar but smaller globular discharges from his "rheostatic machine" charged by powerful secondary batteries.

The sound of the thunder may vary with the conditions of the lightning spark. The spark heats the air in its path, causing sudden expansion and compression all round, followed by as sudden a rush of air into the partial vacuum thus produced. If the spark be straight and short, the observer will hear but one short, sharp clap. If its path be a long one and not straight, he will hear the successive sounds one after the other, with a characteristic rattle, and the echoes from other clouds will come rolling in long afterwards. The lightning-flash itself never lasts more than $\frac{1}{10000}$ of a second.

The damage done by a lightning-flash when it strikes an imperfect conductor appears sometimes as a disruptive mechanical disintegration, as when the masonry of a chimney-stack or church-spire is overthrown, and sometimes as an effect of heat, as when wires and objects of metal in the path of the lightning-current are fused. The remedy against disaster by lightning is to provide an efficient conductor communicating with a conducting stratum in the earth.

SERIES AND SHUNT WINDINGS.

In a series dynamo the field-magnets become demagnetized immediately the external circuit is broken, because the whole of the current is then stopped. In the case of a shunt dynamo, however, if the external circuit is broken there is an alternative path left for the current generated by the armature, viz., round the field-magnet coil. As the whole of the current will then pass through the field-magnet coil instead of only a portion of it, the strength of the field due to the field-magnet is always at its maximum when the external circuit is disconnected; exactly opposite to the case of the series dynamo. In the latter machine the most powerful current is generated, and the field is stronger when its terminals are joined by a piece of thick wire; but this proceeding would have the reverse effect upon a shunt machine, because practically no current would flow round the coils on account of the very low resistance of the alternate path. And, although the shunt dynamo (especially if the resistance of its armature is low) is through a certain range less affected by changes in the external circuit than the series dynamo, neither of them is, for many purposes, sufficiently "self-regulating" or able to accommodate itself to these external variations. We may require a dynamo to do one of two things: either to regulate itself so as to send a constant current or a current of uniform strength through the external circuit, although the resistance may be considerably varied; or, we may require it to maintain a constant potential at the extremities of the external circuit—that is, at the brushes—under like variations of resistance. A machine cannot be constructed to fulfil both these requirements, but there are several methods of maintaining a constant potential. One consists in the combination, in one machine, of the series and the shunt methods of winding. The simplest way, perhaps, of viewing the arrangement, is to consider the machine as a shunt-wound one, having added to it, round the magnet-limbs, a few turns of wire in series with the external circuit. Then, when the external resistance is made very low, and, as a consequence, the current in the shunt coils reduced to almost nothing, the magnetic effect of the series coils becomes a maximum, so that the opposite variations in these two sets of coils tend to keep the field more or less constant. It is clear that the success attending this combination will depend largely upon the proper proportions being given to the shunt and series coils; and in order to ascertain what these proportions are or should be for any particular case, the variation of the E. M. F. developed by a dynamo under varying conditions should be studied.

EFFECT OF TEMPERATURE ON RESISTANCE.

A highly interesting phenomenon is the wonderful effect which a variation in temperature produces upon the resistance of the various substances through which a current may flow. The effect would be less surprising were it general or were it consistently uniform in all bodies, but the great feature to be observed is that while in the case of metals the resistance of a conductor invariably increases with an exaltation in temperature, the non-metals all show a decrease in resistance under similar circumstances. It is also a remarkable feature that in the case of metals the variation is much less in alloys than in pure metals. These results are fraught with the greatest importance, as they limit considerably the number of substances available for many classes of electrical apparatus. For example, wires which are to be employed as standards for comparing or measuring resistances should have as nearly as possible the same value at all temperatures. It may be observed that the insulating coatings of the wires in the telegraph cables laid in such waters as the Indian ocean show a marked decrease in their insulating properties after submergence, consequent upon the fact that the water is several degrees warmer than that in the tanks in which the standardizing tests were made.

CAPACITY OF AN ACCUMULATOR.

The capacity of a cell may be defined as the amount of energy it is capable of storing, and is calculated generally in ampère-hours; that is to say, it is the product of the number of ampères at which the cell is able to discharge into the number of hours through which it can maintain that discharge. Capacity is also estimated by the ratio between the weight of the material and the electrical output. Thus the ordinary form of cells yields about four ampère-hours per pound of plates complete, while it is said the best form of Planté cells only yields about one-half as much. The amount of surface exposed to the solution really determines the charge which a cell can receive, and is therefore a measure of its capacity.

MAGNETIC FIELD.

An air-space filled with lines of magnetic force is called a magnetic field. A magnetic field cannot exist without an inducing magnet or current of electricity. The space surrounding and in front of the poles forms the field. As is well known, lines of attraction radiate from every part of the pole. These are most numerous in front of the pole, although they spread out in all directions. That part of the field in which the lines are most numerous attracts a piece of iron most strongly, and is said to be the most intense part. The greater the number of lines of force in a given space the stronger or more intense the field. If the magnet be bent, so as to bring its poles close together, the lines of force can be shown to have become concentrated. They are no longer diffused and scattered. Their area is restricted, and the field is said to be intensified because the lines are crowded together. Hence the strongest field is that in which there is the greatest number of magnetic lines per square centimetre or square inch, as the case may be.

The magnet setting up the field may consist of a bar or a horseshoe of hard steel. This is the only substance yet found capable of retaining a considerable proportion of the magnetism conferred upon its molecules. Or the magnet may consist of a bar or a horseshoe of soft iron, around which an electric current is caused to circulate. The former type is called a "permanent" magnet, because it retains the polarized condition, although no magnet is truly permanent. The latter case represents an electro-magnet—a coil of insulated wire surrounding a soft iron core—but its polarized or magnetic condition rapidly decreases after the stoppage of the current.

An interesting fact has recently been brought to light with reference to steel, that an admixture of as small a proportion of manganese as twelve per cent. will render steel almost indifferent to magnetism; it cannot be magnetized or attracted by a magnet.

ELECTRIC PHAETONS AT THE WORLD'S FAIR.

Besides navigating the lagoons at the World's Fair on electric boats, it is probable that electric power will be used to carry passengers around on land in vehicles. A concern in Indianapolis has sent to Chicago an electric phaeton designed for this purpose. Our information is to the effect that 6 cells of battery and a one-half horse-power motor will constitute the electrical equipment, and each phaeton will carry two passengers besides the driver.

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Electric Bells.

If there is any one piece of electrical apparatus that the public is more familiar with than another, it is the electric bell. It is, without doubt, by far the most extensively used electrical instrument of all, and yet, notwithstanding this fact, remarkably few people have taken the pains to study its working. The only mysterious thing about the operation of an electric bell is the electricity that causes it to work ; everything else about it and its accessories are simple enough for a child to understand.

The fact that there is something mysterious about electricity need not, however, deter any one from studying its various applications. We know how to produce it and how to control it, so what we can make it do for us is that which now concerns us most.

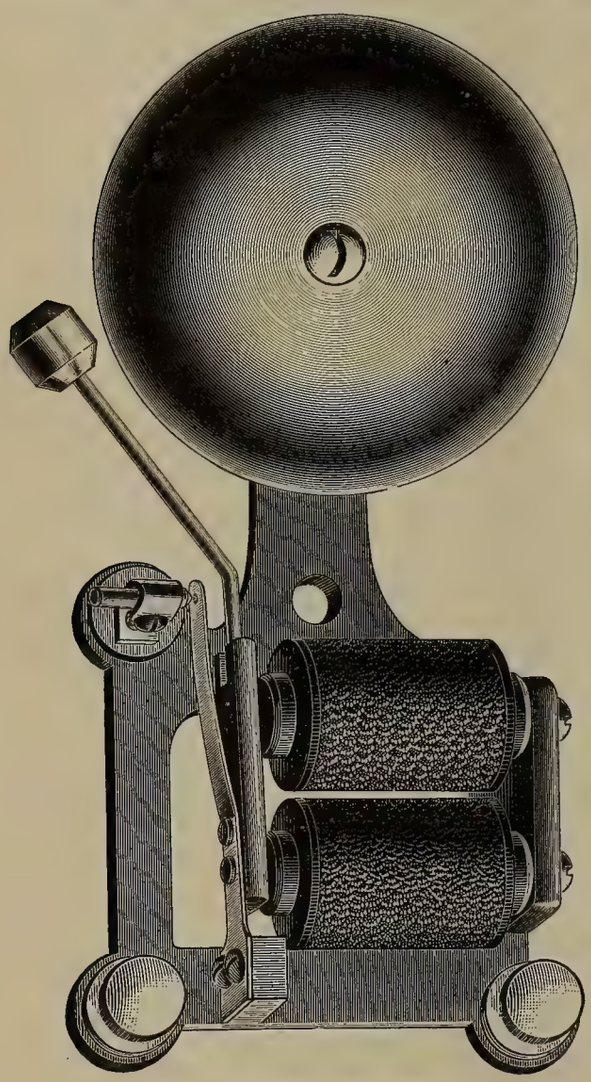


FIG. 1.—ELECTRIC BELL.

Fig. 1 shows one form of an electric bell. There are many styles made, but they are all alike in essential features. They all possess electro-magnets, gong and hammer, and how these parts are assembled makes no great difference in the results.

The magnets and armature are of the ordinary form. At the back of the armature is placed a tongue-shaped spring with a contact-point at one end which opens and closes the circuit as it leaves and touches the corresponding contact-point which is firmly attached to the bell-frame.

With the armature in the position shown there is a contact between these two points, hence the circuit at that point is closed; but the wire connections in the bell are such that when a current is sent through the magnet-coils the armature is drawn towards the core in the usual manner, and the tongue following it causes its contact-point to leave the one on the bell-frame. This breaks the circuit and causes the current flowing through the magnet-coils to cease. The armature then flies back to its original position and closes the circuit again, which energizes the magnets once more, only to repeat the operation. The result of this cycle of changes is to cause a very rapid vibratory movement of the armature, and as the bell-hammer moves with the armature it strikes the bell each time the armature is drawn towards the magnets.

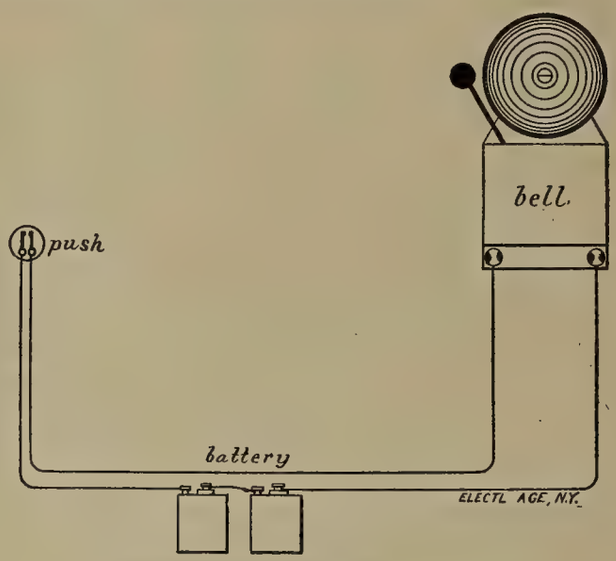


FIG. 2.—SIMPLE BELL CIRCUIT.

At the lower corners of the frame are two binding-posts to which the bell wires are attached (see Fig 2).

Let us now trace the course of the current through the bell itself. Starting from the right-hand post the current passes through the two magnets successively, then along the tongue-piece at the back of the armature, through the contact-points, thence to the other binding-post, then out.

Fig. 2 shows a simple bell circuit complete, including the bells, battery and push-button.

Two cells of battery are generally used. Any open-circuit battery is adapted to bell circuits, and there are many good ones on the market, the Lelanche being the oldest and best known, and many think the most serviceable.

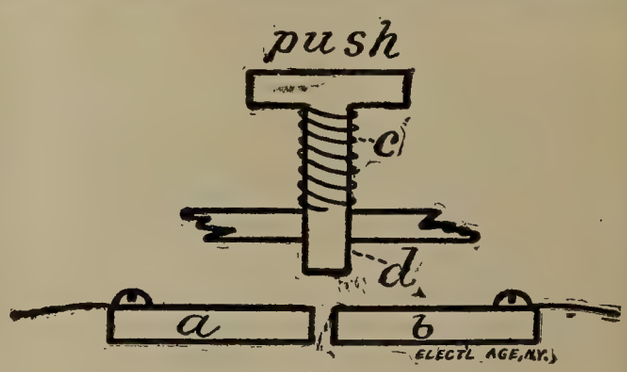


FIG. 3.—PRINCIPLE OF PUSH-BUTTON CONSTRUCTION.

In connecting the battery with the rest of the system, one of the wires must be connected with the zinc of one cell and the other wire with the porous cup of the second cell; and the porous cup of the first cell and the zinc of

the second must be connected with a short piece of wire.

The wire connections must be tight and firm, otherwise considerable waste of current may occur. It is advisable to scrape the ends of the bare wire prior to making the connections in order to remove any foreign substance that thereon might interfere with making a good connection.

Push-buttons are as variable in form as bells are. Like the bells, however, they are all about the same in principle. A push-button essentially is a device which provides for the closing of the circuit by the pressure of a finger or the hand, and when the pressure is released the circuit will open again.

Fig. 3 shows the principle of push-button construction. *a* and *b* represent the wire terminals, which are slightly



FIG. 4.—ORDINARY PUSH-BUTTON.

separated. When the push *d* is pressed down it comes into contact with the ends of the wire terminals and bridges over the gap, thus closing the circuit. As soon as the pressure or the push is removed the spring *c* restores the push to its normal position and opens the circuit in consequence.

The ordinary form of push-buttons is shown in Fig. 4. The white central projection is the push, to which pressure from the finger is applied. The wooden case, which screws on to the base, covers and protects the mechanism, and at the same time admits of ready access thereto in case of necessity, by simply unscrewing the cap. Many push-buttons are made of metal and handsomely finished.

Another form of push button is shown in Fig. 5. It is known as a "floor push," and is designed to be placed in a hole bored in the floor. This style is used principally in dining-rooms, to call servants to the table, and is located within easy reach of the foot of the person sitting

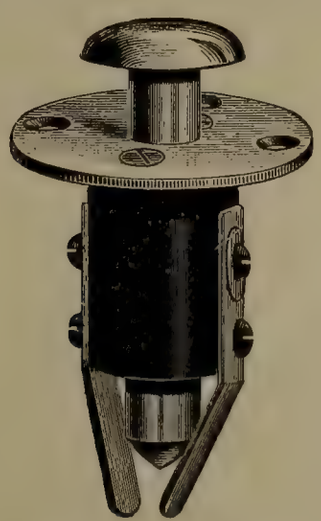


FIG. 5.—FLOOR PUSH.

at the head of the table. It will be seen that it is in principle the same as a door push, the only difference being in form.

Very frequently it is desired to arrange call-bell wires so that the bell may be rung from the upstairs halls or from any room in the house, besides from the front door. Such an arrangement is shown in Fig. 6.

The various tap circuits are connected with the main wires in the manner shown, and the bell will ring when any one of the push-buttons is pressed by the finger. These taps may be run to any part of the house desired, and such an arrangement saves a great many steps and a great deal of running up and down stairs. The two wires of each tap are connected with the main wires so as to form a bridge. This method of connecting is called "multiple arc," and it is on account of the multiple arc connection that it is possible to ring the bell from different points. The taps are connected in multiple arc always, but there is one connection in a system of this kind that is not—it is the push-button farthest away from the bell. All tap wires must invariably be placed between the end push-button and the battery, and the battery must be placed on the circuit at a point between the bell and the push-button connection nearest thereto.

There are a great variety of ways of running bell circuits, and many others than those illustrated will suggest themselves to the student and amateur.

WHAT IS NOT PATENTABLE.

Anything new, but of a hurtful or injurious nature, is not patentable in this country. The following are a few examples of inventions which the law does not contem-

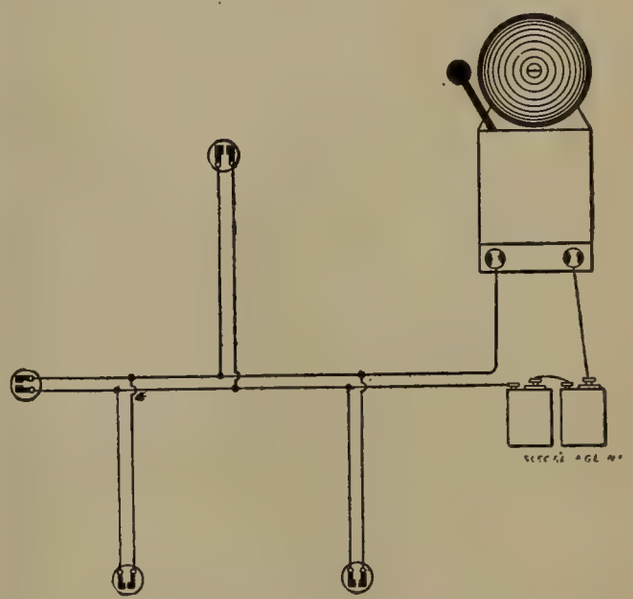


FIG. 6.—BELL CIRCUIT WITH BRANCH PUSH-BUTTONS.

plate patenting: A man asked for a patent for a minnie-ball, made hollow and filled with a fulminate which would explode if it struck a bone. Another asked for a patent on a policeman's baton, which was so constructed that when used to bring refractory persons into subjection spikes, concealed within, would protrude; and another man desired a patent on a compound which contained a deadly poison, but which might be used in the hands of a scientific physician with safety.

THE ELECTRIC CLUB'S AFFAIRS.

After a period of nearly six months of depression, during which period the board of managers of the New Yo k Electric Club have succeeded in liquidating the greater portion of the indebtedness of the club, the members have been notified by Assistant Secretary Geo. F. Porter that the restaurant and other full service of the club will be resumed on September 1. Mr. W. V. Carter will be the new caterer of the club.

THE LOVELL MANUFACTURING COMPANY, limited, of Erie, Pa., has just issued a very interesting illustrated pamphlet descriptive of the celebrated "Niagara" dynamos and motors manufactured by it.

HOW TO WORK ALUMINUM.

About a year ago the subject of aluminum, its uses, etc., was one of the main topics of discussion in trade and other papers, but lately little has been said about it. It has passed from special notice not because of any fault it possessed as a utilizable metal but rather because the ground had thoroughly been gone over in the papers, and because other matters of transient importance, in the nature of things, came to the front, and aluminum had to take a back seat, as far as public notice was concerned.

We frequently receive requests for information concerning this metal, however, showing that it still receives attention. It is but a few weeks ago that we published a communication from a gentleman in this city who had constructed a sewing-machine entirely of aluminum. Before he undertook the task he, in order to facilitate matters, endeavored to secure some information regarding the working of the metal. He could not get any definite instructions from any one, so he finally determined to inform himself in a practical way, and attacked the problem at once. He found that the manipulation of the metal was a much less difficult task than he anticipated, and all the mystery that seemed to enshroud the metal dissolved before his determination to find out all about it.

For the benefit of those who are desirous of manipulating the metal for any industrial purpose, we publish the following directions, which come from no less an authority than Mr. C. M. Hall, president of the Pittsburg Reduction Co., which is the leading aluminum producer in this country.

Annealing.—A very low and even temperature should be maintained in the muffle. Aluminum melts at about 1,300 degrees Fahrenheit—a very dark red. The inexperienced, therefore, cannot judge the proper annealing temperature by the eye alone without danger of fusing the metal. When the metal has been heated enough to char the end of a pine stick, thus leaving a black mark in the wake of the stick as it is drawn across the metal, it is sufficiently annealed. The metal should then be withdrawn from the furnace and allowed to cool slowly in the air. For some work, such as stamping and drawing, it is sometimes better not to heat the metal so hot as to leave a dead black mark with the stick, but just enough to show a dark brown mark instead. Very thin sheets or wire can be annealed sufficiently for some purposes in boiling water.

Dipping and Pickling.—Remove the dirt and grease from the plates by dipping in benzine. To whiten the metal, leaving on the surface a beautiful white mat, the sheet should be first dipped in a strong solution of caustic potash. The metal should then be dipped in a mixture of concentrated acids, two parts nitric acid to one of sulphuric acid; then in a solution of undiluted nitric acid; then in a mixture of vinegar and water, equal parts; then washed thoroughly in water and dried as usual in hot sawdust.

To Polish.—Use a fine polishing composition, or rouge, or tripoli, and a sheepskin or chamois-skin buff, although it is often polished with an ordinary rag buff. For fine work, to polish aluminum, use a mixture of equal parts, by weight, of olive oil and rum, made into an emulsion by being well shaken together in a bottle. The polishing stone is dipped in this liquid, and the metal is polished without using, however, too much pressure. Aluminum may be easily ground by using olive oil and pumice. The surface of aluminum, treated with varnish of four parts oil of turpentine to one of stearic acid, or with a mixture of olive oil and rum shaken in an emulsion, allows an engraving tool to work on aluminum as on pure copper.

For Burnishing.—Use a bloodstone or steel burnisher. For hand-burnishing use either kerosene oil or a solution composed of two tablespoonfuls of ground borax dissolved in about a quart of hot water with a few drops of ammonia added.

For Lathe Work.—The burnisher should wear upon the finger of his left hand a piece of Canton flannel, keeping it soaked with kerosene, and bringing it in contact with the metal, supplying a constant lubricant. Very fine effects can be produced by first burnishing or polishing the metal and then stamping it in polished dies, showing unpolished figures in relief.

Scratch Brushing.—Polish or burnish the surface and then use a fine steel scratch-brush. A very fine finish is attained by rubbing with ground pumice-stone and water. In spinning aluminum plenty of oil should be used, to prevent the clogging of the tool and to make it cut smooth in the turning and to assist in the spinning.

To Solder Aluminum.—Soldering the metal in large surfaces has not been successfully accomplished up to the present. Small surfaces of the metal can be readily soldered by the use of pure zinc and Venetian turpentine. Place the solder upon the metal with Venetian turpentine and heat gently with a blowpipe until the solder is melted. It will then be found to have fixed itself firmly to the aluminum. The trouble with this, as with other solders, is that it will not flow on the metal; therefore large surfaces are not easily soldered. In cold-rolling aluminum, upon a roll designed for cold-rolling hard crucible steel, it has been found possible to reduce aluminum through the same sections as hard steel. The aluminum required, on the average, five annealings, where the steel required three, to satisfactorily withstand the same work.

Sand Castings.—Use open but very fine sand and bake the mould. Large feeding-gates should be provided and the mould should be well vented. Pour the metal quickly at a temperature but little above the melting-point. Use plumbago crucibles.

PATENTABLE COMBINATIONS.

Patent law defines a combination as where two or more elements are brought together which co-operate to produce a new and useful result. If some new combination be added to an old machine to produce new effects, or a useful effect, the right to a patent is limited to the new combinations. The same patent cannot be for a combination of different machines and for distinct improvements of each.

THE MANUFACTURE OF OZONE.

Mr. Fahrig, in England, makes ozone commercially. He employs an alternate current, which works a transformer, that gives a high electric force. Air is first drawn through an apparatus which is supposed to separate the nitrogen by diffusion. The air is then led through the ozonizers. These consist of piles of corrugated metal plates with sheets of celluloid between them. They are alternately positive and negative, being connected to the high-pressure side of the transformers. There is thus an alternating discharge from the corrugated electrodes to the celluloid sheets, so that the air is ozonized in passing through.

Messrs. Siemens & Halske employ ozonizers of the more usual form. Two concentric glass tubes are used. One electrode is inside the inner, and the other is outside the outer tube. High-pressure transformers are employed, and the air, or oxygen, is partly converted into ozone on its way there.

ACCUMULATORS IN TELEGRAPHY.

In a paper recently read before the British Association, Edinburgh, Mr. W. H. Preece described the method of working telegraph wires from accumulators which has been in use in the London office for the past seven years.

Accumulators supply current to two large groups of circuits, one group consisting of 110 single needles, and the other of 100 Morse inkers and sounders.

To provide a ready means of replacing the battery in case of failure, the leads from the working and reserve cells are first led to the test-board in the instrument-room and there joined to a switch, thence the leads are again led to the test-board in the battery-room, where the two groups are split up into sub-groups of ten circuits each. The connections are made in this manner for two reasons: first, for facilitating a change of a faulty battery; and, second, to prevent a general stoppage of the whole group in the event of a short circuit at any one of the instruments; the resistance of the leads between the instruments and subdividing connections in the basement being sufficient to prevent more than three ampères being taken from the battery by any one of the instruments, even when a short circuit is on. To prevent any damage to the instrument, or risk of fire, fuses are placed in the battery leads at each instrument. The circuits on the groups mentioned are all metropolitan, and are all, approximately, of the same resistance, no equalizing resistances being, therefore, necessary. The current in each circuit ranges between 17 and 20 milliampères. The E. M. F. for the single needle is 20 volts—10 cells positive and 10 negative, with earth in the centre. For Morse working the E. M. F. is 18 volts.

A considerable extension of the accumulator system has recently been made. Since October 17, 1891, the whole of the continental circuits from the general office have been operated by currents from secondary cells. There are 59 continental circuits, and these are divided into four groups, each circuit taking a current of 100 volts.

All the cells are kept well charged, and the E. M. F. is not allowed to fall below 1.95 volt per cell.

Accumulators are also used for working the telephone circuit in Paris. Their E. M. F. is so constant that they are found to be eminently adapted for the purpose.

FOREIGN NOTES OF INTEREST.

The City and South London Railway (electric underground) is now on a sound dividend-paying basis. During the first half of 1892 there was an increase in the number of passengers carried of 20 per cent. as compared with the same period last year, and an increase in the gross receipts of nine per cent., while the expenses were three per cent. less.

Owing to the strike of bricklayers engaged in the erection of the electric-light station at Bristol, the citizens of that place will not enjoy the advantages of electric light this winter as they expected to.

Three new cables have recently been laid across the river Irrawaddy, in India. This makes eight cables in all crossing this river.

The Allgemeine Elektricitäts Gesellschaft, of Berlin, will erect a central station in the suburbs of Berlin. The kilowatt-hour for lighting purposes will be charged for at the rate of 6¼ d., and for power purposes at the rate of 1¼ d. Rebates will be given to large consumers.

The contracts for the supply of machinery and apparatus for the new electric-light station in Melbourne, Australia, have been secured entirely by American companies. The electrical apparatus will be supplied by the Thomson-Houston Electric Co., the boilers will be furnished by the Babcock & Wilcox Co., and the International Okonite Co. will supply all the cables and wire.

A company has been formed in Barcelona, Spain, to establish an electric tannery on the Groth system. If this enterprise proves successful similar tanneries will be established in various other Spanish cities.

M. Carsten Tank Nielsen, director-in-chief of the Norwegian telegraphs, died recently in Christiania at the age of 74 years.

Earth-currents, contemporaneous with those in America July last, caused considerable annoyance to the operation of the telegraph wires in India. The disturbances were felt most on wires running southeast and west-northwest, and in some instances lasted for several hours at a time, the currents sometimes attaining a strength of 10 milliampères.

The overhead trolley system of electric railway is rapidly growing in popular favor in Germany. An electric line was recently opened in Bremen, and the Allgemeine Elektricitäts Gesellschaft, of Berlin, has contracts for the construction of two others—one for the Berlin Lokal und Strassenhahn Gesellschaft, Chemnitz, and the other at Breslau; the latter with a total length of about 18 miles.

The Railway Electric Reading Lamp Co., London, has closed a contract with the Metropolitan District Railway Company, to install over 10,000 reading-lamps in the cars of the latter company. These reading-lamps are operated on the penny-in-the-slot principle. By dropping a penny in the slot and pushing a knob an electric light is obtained and burns for half an hour, at the end of which time it is automatically cut off from the source of current supply. These lamps are intended for the use of individual passengers who desire to read while on the train. Other railway companies are negotiating for the use of the device. The current for these lamps is supplied by accumulators carried on the cars under the seats. Six cells are placed under each seat, in series, and they have a capacity of 72 ampère hours. The lamp mechanism is contained in a box 5 inches by 3 inches.

NEW BOOKS.

ELECTRIC LIGHTING SPECIFICATIONS, for the use of engineers and architects, by E. A. Merrill, 176 pp. The W. J. Johnston Co., Ltd., New York. Price, $1.50.

This work is intended to give outlines to aid in the construction of specifications for individual installations. The subject-matter does not in any way conflict with the rules and regulations adopted by insurance companies and electric-light associations, but, on the contrary, depends almost entirely upon such rules for the details of method.

Every system of installation is provided for and carefully considered, and no doubt the book will be of great value to electrical engineers.

Marginal indices are a valuable feature of the book, and will greatly facilitate the finding of any desired subject.

LIVERPOOL'S ELECTRIC RAILWAY.

It is expected that the electric railway in Liverpool will be completed in October next. The generating plant is far advanced, and the engines are in course of erection. The rails are laid as far as the viaduct is finished, and good progress is being made in the work.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, August 27, 1892.

THE HEINE SAFETY BOILER COMPANY, of St. Louis, Mo., has appointed Mr. John MacCormick as its sole representative in New York, with offices at 45 Broadway.

MR. F. C. MASON, superintendent of the Brooklyn police telegraph department, is on a three-weeks' vacation. He will visit Nova Scotian and other cities in the East, and, incidentally, will test the biting propensities of the finny tribe in Eastern waters.

H. WARD LEONARD & Co., 136 Liberty street, have secured the contract for the wiring and installation of the electric plant for the Havemeyer Building. Over 3,000 lamps will be installed, and no expense will be spared to have the equipment first-class in every respect.

THE HALL SIGNAL CO., 50 Broadway, will equip the Shore Line division of the N. Y., N. H. & H. R. R. with its tower system of signals. This company always has on exhibition in its New York and Western offices its various systems of railway signals, and invites railway officials to call and inspect the same.

THE BROOKLYN CITY RAILROAD COMPANY, of Brooklyn, has contracted with the Babcock & Wilcox Company, of New York, for 20 boilers to be used in its power-plant for the Eastern District, at a cost of over $200,000. A contract has also been closed with the Allis Steam Engine Company, of Milwaukee, Wis., for engines costing $300,000.

THE BISHOP GUTTA-PERCHA CO., 420–426 East 25th street, city, has recently issued its illustrated catalogue and price-list of the celebrated insulated wires and cables made by it. This company manufactures highly insulated electric wires, flexible cords, aërial, subaqueous and subterranean cables, insulated with gutta-percha, india-rubber, balata and their compounds.

EINBIGLER & ADLER, 430–432 Seventh avenue, have contracted to suppy the following theatres with electrical equipment: New Court Square Theatre, Springfield, Mass.; Empire Theatre, New Britain, Conn.; Hyde & Behman's Theatre, Brooklyn, N. Y. This firm makes and deals in all kinds of electrical supplies and also contracts for electrical work of every description.

C. J. FIELD, of the Field Engineering Company, 143 Liberty street, which has the contract for the construction of the trolley system on the Catharine and Bainbridge street branches of the Philadelphia Traction Company, has commenced work. This is the first electric-railway system to be constructed in the city of Philadelphia, and may be well looked upon as the forerunner of the rejuvenation of the antiquated street-car systems in that city.

THE E. P. GLEASON MANUFACTURING COMPANY, 93–99 Commercial street, Brooklyn, manufacturer of electrical appliances and glassware for arc and incandescent lighting, has reopened its works, which have been shut down since July 1, in accordance with the regulations of the Glassblowers' Association. The company improved the opportunity by overhauling everything and adding two new furnaces so as to be in first-class trim for the fall trade.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	63 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	207 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	117 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*107
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	100 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	118 00
General Electric Co., 5s	4,000,000		*105
General Electric pref.		100 00	117 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 25
Laclede Gas pref.	2,500,000	100 00	65 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	57 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	14 00
Postal Telegraph	10,000,000	100 00	78 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	99 00
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	36 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 50
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

All pointers designate a very active fall business for the New York Stock Exchange and Wall street generally. The importance of electric securities as a factor has been proven during the summer, and they have reached a permanent position. For years the telegraphs alone held the field, and the work of extending the

lines, training expert operators, educating the public to its convenience, and the investors as well as the speculators to the sure and steady profits; increasing both expenses and income, absorbing competitors, obtaining patents or inventions, erecting buildings and consolidating the mass of equipment, has nearly all been completed. The capital stock and bonds were increased, until now the entire machinery is perfect and a stage in the financial condition reached where, after providing all these, the common stock is dealt in, as it stands, at *par*. To those who have fought adverse criticism, the public, and a moiety at least of the press, this result is highly satisfactory, the investors and quasi permanent shareholders having received their regular dividends, not always as large as expected, to be sure, still up to the safety mark, combined with increased valuation of principal, flatter themselves on their astuteness, and, like the proverbial clam (also just rising in man's estimation) keep their own counsels, serenely enjoying the situation. A new move is now in order. Certainly the brains which have hewed out this result have accomplished their end, and it is not in nature that they should be permitted to enjoy the result in any other way than to dispose of their interests and apply themselves to other conditions, or by improving the system they aimed at and have perfected, to fail most absolutely, reaching the opposite end of the line and grounding in the slough of despondency and poverty, involving character, reputation, honor, wealth and all that men hold most dear. The rule which applies to a private firm, keeping within the lines of a specialty where a world-wide honorable reputation may be gained and held for a few generations, does not apply to a corporation doing a public business, such as the Western Union Telegraph Company, through its management. Dame Rumor declares that what is popularly known as the Philadelphia Syndicate has concluded to control the rapid transit, general electric-light, heat and power, as well as the telegraphic business, first of New York, then of the country. In nearly every case they will wait until the business is as firmly established locally as the Western Union is generally, then occupy and direct the affairs. Any new extensive departure, including the introduction of the useful matters lying in the strong rooms of the Western Union Telegraph Company must, to continue successful, either be exploited by new and younger heads or by the conservative rules of the post-office department. Financial disaster is the only other result. Improvement all along the line will proceed for the benefit of the public and world at large in either case. The stock at par is a purchase for investors, and for modern speculators it makes little difference, as they outguess themselves anyway, being found always on the wrong side of the market. General Electric common, after reaching $120 per share, receded to $116 in sympathy with the regular business of the Exchange, but it is now recognized as a leading factor and could be used either to bull or bear the general market. Perhaps as strong a showing as could possibly be made is their five per cent. bonds selling regularly at 105% and better, while many well-known railroad six per cent. bonds can be had in the eighties which have and no doubt will continue to pay their coupons regular upon maturity. Edison Illuminating of New York continues quite a feature on 'change. After touching par it declined to 97, but their 5% bonds stand as firm as Gibraltar at 107%. Westinghouse is improving; the interest on the scrip issued has been paid, the preferred seven per cents. touched par, and are practically at that point or better to-day. A little more time will designate its permanent position among financial securities. Bell Telephone remains above $200 per share. We must soon have some grand practical improvements in that direction, or great will be the fall therein. Local electric railroads, with their long line of industrial connections, are always a purchase. There should be a large sum of money safely placed by investors between this and Christmas. Use discretion but don't delay.

PHILADELPHIA NOTES.

THE many friends of Mr. C. E. Trump, of the Electric Novelty Co., this city, deeply sympathize with that gentlemen in the recent death of his wife.

PHILADELPHIA'S electrical men do not make much noise or fuss in the world but they do lots of business. A large amount of business is being done in isolated lighting, and all the electrical houses are loaded with work up to the muzzle.

NOVELTY ELECTRIC COMPANY, 54 North Fourth street, has a fine exhibit of small fan-motors for dynamo circuits. The company has an excellent small fan and motor combined to run from batteries that ought to command a big sale. Its new incandescent lamp-circuit switch is having a ready sale, also the new insulating joint for fixtures.

W. H. WESTON & Co., 838 Filbert street, furnish estimates on switches and switchboards, stage and field regulators, and special electrical work of any description. They are just completing a number of large electric-light rheostats to go with a big switchboard of marbleized slate for a large building in this city. The firm is as busy as ever making switches.

QUEEN & Co. have an establishment so vast that few outsiders have any conception as to its magnitude. They employ nearly 1,000 men in the various departments of their factory, over one-half of whom are engaged in the manufacture of electrical instruments. In their laboratory, where they have about 400 hands employed, they calibrate fine instruments. They are operating their factory to its fullest capacity on electrical goods.

THE PARTRICK & CARTER CO., 125 South Second street, is manufacturer and dealer in all kinds of electrical supplies. It is the sole proprietor of the patent needle annunciators, and makes a specialty of bells, disque Leclanche batteries, gas-lighting apparatus, bronze goods and full line of supplies for hotel and house work. This house was established in 1867, and enjoys a well-deserved popularity with the electrical fraternity.

THE electrical bureau has been doing some pretty good work during this summer. Arch street, from Broad street to the Schuylkill, is lit up by electricity; connections have been established between the West Philadelphia hospitals, stations, sub-stations, engine-houses, etc., with the City Hall. Preparations are being made to clear Market and Broad streets of everything but electric-light poles. The bureau is also supervising the erection of the trolley on Catharine and Bainbridge streets.

MR. LA ROCHE, of the La Roche Electrical Works, has all he can attend to. The company's quarters are entirely too small to meet the requirements of greatly increased business. A big dynamo and switchboard were being gotten ready for shipment when your representative called, and they looked like a giants in a garret. A large number of dynamos are turned out of this place, and that they give satisfaction is fully proven by none having ever been returned. Nearly $100,000 worth of work is being done at the works.

O. D. PEIRCE & Co., 806 Walnut street, contract for all kinds of electrical work and make a specialty of installing electric-light plants and wiring for incandescent systems. The firm is agent for Perkins' lamps. It has an excellently prepared display of electric-light specialties in its

salesrooms. Among some recent plants completed and under way are the wiring for 600 lamps for the Drexel Institute of this city; 1,000 lamps for the Lycoming Opera House, Lycoming, Pa., which is said to have one of the finest electric-light plants in the country; and the private residences of Joel J. Bailey, in Lansdown, and J. C. Strowbridge, in Germantown.

VALLEE BROS. & Co., 17 North Sixth street, were found as busy as ever when your representative called. They carry a large stock of electric-light specialties, and I do not believe there is another house in Philadelphia that can handle big orders with the same ease as this firm of active young men. They are alive to the wants of the trade, and are always ready to go out of the way to please a customer or fill an order promptly. Their perfect mica insulating joint is the pride of Philadelphia. This house is headquarters for incandescent lamps, and the firm can fill an order for any quantity at once. It handles nothing but a first-class line of goods.

THE CUTTER ELECTRICAL AND MANUFACTURING COMPANY, 27 South Eleventh street, makers of the popular C-S specialties in flush switches, reflector shades, portable lamp-stands and flexible brackets, report a large trade in these goods. The company is doing an extensive line of construction work. A complete isolated electric-light plant for the Pennsylvania University in this city is being installed by the above company, including dynamos, engines and boilers. All of the various makes of popular dynamos will be put in, and there will be from four to five thousand lamps in the various buildings, which are to be connected by an underground system designed by the Cutter Company. This plant will be used for educational as well as practical purposes.

W. T. H.

THE CARPENTER ENAMEL RHEOSTAT COMPANY.

The Carpenter Enamel Rheostat Company now has its works at Bridgeport, Conn., in full operation. The extreme cheapness and evident advantages of this rheostat have been the cause of an unexpectedly large business, although the works have only been in operation a short time. Orders have already been received from over fifty different concerns, one order alone being for one thousand rheostats.

The capital stock of the company is $100,000, fully paid. The officers of the company are: H. Ward Leonard, pres.; Geo. H. Finn, vice-pres.; Charles E. Carpenter, sec'y and treas. Several prominent and wealthy New York gentlemen are financially interested.

The manufacture of the rheostats involves a great many trade secrets, which, together with several strong patents and extremely low prices, and a progressive business policy, is likely to soon make the coiled-wire rheostat a thing of the past.

The company promises some startling developments in the patent situation at an early date.

ADDRESS WANTED.

If any of our readers should know the address of Mr. Andrew T. Creelman, lately of Tulare, Cal., they will oblige us by sending his address to this office.

GALVANOMETER FOR SALE.

Tangent galvanometer, very best make, almost new, for sale at a bargain. Address ELECTRICAL AGE office, World Building, New York city.

AMERICAN PROTECTION.

Mr. Allen R. Foote read an address before the Takoma Park Republican Club, of Maryland, on August 3, on "American Protection for American Industries the Foundation of American Industrial Independence." His arguments are strong and logical. Mr. Foote is president of the association.

FORREST SILVER BRONZE PACKING.

EMERSON, MICH., June 18, 1892.

FORREST SILVER BRONZE PACKING CO.

Gentlemen: Enclosed find check to pay for enclosed bills. Packing has proved all right so far. Shall send you in a few days a list of rods which we wish packing for. Respect. yours,

(Signed,) CHESBROUGH BROS.

"WARD" ARC LAMPS.

The following speaks for itself:

THE EDISON ELECTRIC ILLUMINATING CO.,
CUMBERLAND, MD., June 25, 1892.

THE ELECTRIC CONSTRUCTION AND SUPPLY CO.,
NEW YORK.

Gentlemen: In reply to your favor of the 24th, it affords me pleasure to state that this company has been using the "Ward" lamp on its incandescent current since June, 1891.

We have at present sixty-two "Ward" lamps in service, all giving good satisfaction. Have had no parts to trouble or burn out. In the past year we have had two lamps of another make, both of which have given trouble. When we need more lamps will certainly order yours.

Yours truly,
J. B. G. ROBERTS,
Prest. and Gen. Mgr.

SALES OF DYNAMO BELTS.

Mr. A. B. Laurence, New York manager Shultz Belting Co., reports sales of dynamo belting to the following-named concerns:

Citizens' Lighting Co., Far Rockaway, L. I., N. Y., one 8-inch; Boonton Electric Co., Boonton, N. J., one 9-inch; New Hartford Cotton Mills, New Hartford, N. Y., one 12-inch; Delhi Electric Co., Delhi, N. Y., one 12-inch; Astor Building, N. Y. City, one 10-inch; Kingsford Foundry and Machine Works, Oswego, N. Y., one 10-inch; International Navigation Co., Jersey City, N. J., one 6-inch; William Burton's Sons, Waterford, Conn., one 10-inch; Delhi Electric Co., Delhi, N. Y., duplicate order, one 10-inch; New York Industrial Exhibition Co., N. Y. City, N. Y., one 30-inch; Laboratory of Thomas A. Edison, Orange, N. J., one 9-inch; New Mexico Electric Co., New Mexico, 200 feet 15-inch; Mather Electric Co., Manchester, Conn., two 6-inch; American Exchange National Bank, N. Y. City, one 10-inch; Cambridge Hotel, 334 Fifth ave., N. Y. City, one 10-inch.

In addition to the above the company has just received from the New England Engineering Co., of Waterbury, Conn., the order for the Elizabeth electric-light station, which is as follows: one 52-inch sable rawhide dynamo belt; one 18-inch sable rawhide dynamo belt; one 16-inch sable rawhide dynamo belt; one 14-inch sable rawhide dynamo belt; one 11-inch sable rawhide dynamo belt; two 8-inch sable rawhide dynamo belts.

Also for the Stamford Electric Light Co., of Stamford, Conn., one 34-inch sable rawhide dynamo belt.

The Shultz Belting Company is getting out a new catalogue, also a calendar.

AN IMMENSE INDUSTRY.

The *Chronicle*, of Bound Brook, N. J., in its issue of Friday, Aug. 19, contains an illustration and highly interesting description of the splendid machine plant of the American Engine Company which is located at that place.

At the head of this company's affairs is Mr. Elmer A. Smith, to whom probably more than any one else the company is indebted for the wide popularity attained by its celebrated "American High-Speed Engine."

The company has invested $400,000 in the plant, and gives employment to a large number of skilled machinists.

P. & B. PIPE-COATING COMPOUND.

The Standard Paint Co., 2 Liberty street, New York city, has been given the contract for the coating for the entire line of pipe to be furnished by the National Tube Works Co., of McKeesport, Pa., to the Waukesha Hygeia Mineral Springs Co., of Chicago. This line is to convey the Waukesha Hygeia water from Waukesha, Wis., to the World's Fair grounds at Chicago, a distance of about one hundred miles. The coating employed is the No. 1. P. & B. Pipe-Coating Compound, which is a complete preservative for iron, and it is absolutely tasteless and odorless and unaffected by contact with acids or alkalis. Parties or corporations in need of a similar material are invited to correspond with the company.

GENERAL NOTES.

Mr. Cobb, of the Chicago Insulated Wire Co., of Wilmington, Del., has just returned from a trip through the West, where he succeeded in securing some very large orders for his company.

Smith & Wallace is the name of a new firm established in Boston, August 22 last. A. Otis Smith and J. Edw. Wallace compose the firm, which will deal in all supplies needed in the equipping and operation of electric railways. The headquarters of the new firm are at 8 Oliver street.

The National Water-Tube Boiler Company, of New Brunswick, N. J., has just completed a shipment of its boilers to the United States Electric Lighting Co., Washington, D. C. Fifteen large freight cars were required to transfer the boilers. This steam plant will be a duplicate of that furnished the same company last year, and when erected the full boiler plant will be among the largest in use in electric-light stations in the country.

Queen & Co., Philadelphia, have laid in a big stock of Deprez-Carpentier ammeters and voltmeters. These instruments are strictly dead beat, so that readings can be taken very quickly, and the scales are graduated from zero up. Being mounted in compact nickel-plated metal cases, they are adapted for portable testing as well as for switchboards. The prices are very moderate, and a considerable number have already been sold. For alternating currents the Cardew voltmeter is recognized as a standard switchboard instrument, while an essential feature is its equal correctness when used on continuous circuits. Queen & Co., who own the American patents, are making these voltmeters in quantity to supply the demand, and have also reduced the prices considerably, which announcement is of importance to intending purchasers. The merits of the Cardew instrument are fully set forth in price-list No. 290, which can be obtained from the makers for the asking.

The Electrical Age's Illustrated Patent Record.

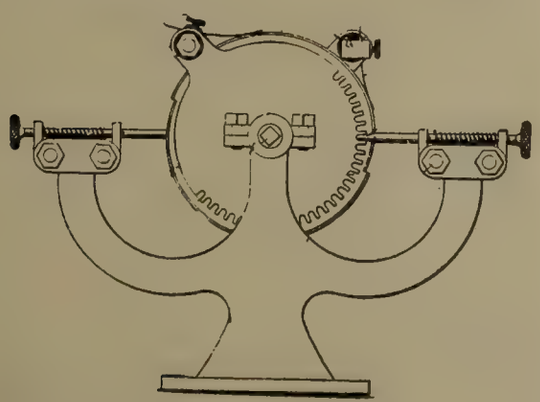
Issued August 23, 1892.

481,220. Electric Motor and Generator. Charles S. Bradley, Avon, N. Y., and James J. Wood, Fort Wayne, Ind. Filed Aug. 22, 1891.

481,247. Telegraphy. James G. Smith, New York, N. Y. Filed Nov. 2, 1889.

481,281. Circuit-Changing Apparatus. Almon D. Page, Newark, N. J. Filed May 14, 1892,

481,284. Telephone. Adolf Rettig, Saarbrücken, Germany. Filed Feb. 17, 1892.

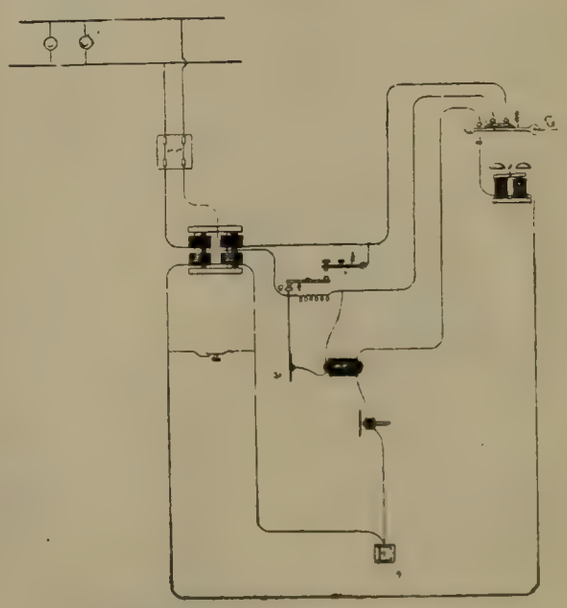


481,281.—CIRCUIT-CHANGING APPARATUS

481,285. Shade for Incandescent Electric Lamps. Charles J. Salick and Edward Sipp, Watertown, Wis. Filed April 10, 1891.

481,288. Reflecting-Shade for Incandescent Electric Lamps. Lucius T. Stanley, Brooklyn, N. Y., assignor to the Cutter Electrical and Manufacturing Company, Philadelphia, Pa. Filed Oct. 22, 1891.

481,291. Electric Water-Heater. Thomas Ahearn, Ottawa, Canada. Filed April 9, 1892.



481,483.—TELEPHONE SYSTEM.

481,293. Arm-Rest for Telephones. Joseph R. Bailey and Levi C. Lincoln, Woonsocket, R. I., assignors to the Woonsocket Edge Tool Company, same place. Filed Jan. 25, 1892.

481,297. Electric Switch. John H. Clark, Boston, Mass., assignor to the Whittier Machine Company, same place. Filed Sept. 29, 1891.

481,378. Reflecting-Shade for Incandescent Lamps. Lucius T. Stanley, Brooklyn, N. Y., assignor to the Cutter Electrical and Manufacturing Company, Philadelphia, Pa. Filed Feb. 29, 1892.

481,386. Electric Elevator. William Baxter, Jr., Baltimore County, Md. Filed July 19, 1888. Renewed Oct. 31, 1890.

481,401. Trolley for Electric Railways. Wilton F. Jenkins, Richmond, Va., assignor of five-sixteenths to Louis Euker and William E. Shelley, same place. Filed Sept. 5, 1891.

481,402. Trolley for Electric Railway Conduits. Wilton F. Jenkins, Richmond, Va., assignor of five-sixteenths to Louis Euker and William E. Shelley, same place. Filed Sept. 5, 1891.

481,403. Conduit for Electric Railways. Wilton F. Jenkins, Richmond, Va., assignor of five-sixteenths to Louis Euker and William E. Shelley, same place. Filed Sept. 5, 1891.

481,430. Pneumatic Electric-Circuit-Controlling and Interlocking Apparatus. William W. Slater and Harry C. Barnes, Oakland, Cal. Filed Oct. 24, 1891.

481,457. Insulator. Arthur J. Wylie, Rome N. Y. Filed Jan. 18, 1892.

481,474. Magnetic Separator. Gurdon Conkling, Glens Falls, N. Y. Filed July 23, 1891.

481,483. Telephone System. Richard N. Dyer, East Orange, N. J., assignor to the American Bell Telephone Company, Boston, Mass. Filed Oct. 30, 1890.

481,529. Telephony. John W. Gibboney, Lynn, Mass. Filed Feb. 8, 1892.

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ELECTRICAL AGE

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THE CLEVELAND CONVENTION.

NO CHANGE OF DATE.

The impression having become general that the date of the annual meeting of the American Street Railway Association, to be held in Cleveland, Ohio, next month, would be changed on account of the simultaneous occurrence of the Columbus celebrations in New York and Chicago, we made inquiry of Mr. W. J. Richardson, the secretary of the association, to learn definitely whether there would be any change of dates or not.

The following is the reply received to our letter:

BROOKLYN, N. Y., Aug. 29, 1892.

T. R. TALTAVALL, ESQ.,
EDITOR ELECTRICAL AGE.

DEAR SIR: The secretary of the association, Mr. Richardson, has left town for a few days. Just before going he wished me to write to you to say that there will be no change in the date of the annual meeting. It will be held, as announced, October 19–21, 1892.

Very truly yours, T. E. CROSSMAN.

DEATH OF F. N. GISBORNE.

Following closely the death of Cyrus W. Field, of Atlantic cable fame, comes that of Frederic N. Gisborne, superintendent of the Canadian telegraphs, who, it is said, was really the father of the Atlantic cable. It was he who conceived the idea of uniting the old and new worlds by telegraph, but to Mr. Field undoubtedly belongs the credit of putting the idea into practical execution.

Mr. Gisborne stood high in the esteem of his contemporaries, and his name will occupy an honorable place in the history of telegraph.

A SELF-SUSTAINING STORAGE BATTERY.

A "wonderful discovery" is reported from Springfield, Ohio, in the shape of a self-sustaining storage battery. A Dr. W. S. Bryan of that place has, so the report goes, produced such a battery, that will generate a current which will last from 3 to 5 years continual use. Very little of the secret of this discovery has yet been given to the public, consequently the only thing the electrical fraternity can do is to await further developments and not get excited.

It is stated that the battery has been exhibited before representatives of various interested concerns in Cincinnati, but what impression was made is not reported.

This is but a step from perpetual motion, and if Dr. Bryan has got so near to perpetual motion he may be considered a lucky man.

WHAT THE SOCIALISTS WANT.

The Socialists of the United States held a national convention in Boston on Sunday, August 28, for the purpose of nominating candidates for the offices of President and Vice-President of the United States. As it is the custom to adopt a platform on the occasion of meetings of this character, our socialist friends, however antagonistic their views on things in general are to those of most people, for once fell in line with the "heathen" in the matter of political procedure and adopted a platform.

We quote two of the planks of the platform:

"Municipalities to obtain possession of the local railroads, ferries, water-works, gas-works, electric plants and all industries requiring municipal franchises.

"Inventions to be free to all, the inventors to be remunerated by the nation."

In view of the near approach of election, we commend these "demands" to the careful consideration of our readers.

THE BRUSH INCANDESCENT DYNAMO AND THE BRUSH SYSTEM IN JAPAN.

The great popularity achieved by the incandescent-light dynamos manufactured by the Brush Electric Company, of Cleveland, Ohio, and their extensive adoption in all quarters of the globe, is a sufficient guarantee of their sterling qualities.

Much care and labor has been expended in their construction to embody only the best principles known to modern science. They are of the closed-coil type, and entirely new in design. The improved ring armature has many bobbins with few turns of wire; the commutator is of the bar type, made of copper and mica, is entirely sparkless and indestructible.

We will consider the machine in the light of its various parts:

Field-Magnets.—Soft iron is made use of owing to its well-known properties of high permeability. A very thin layer of wire, such as is employed for a small current, is used in winding. As the parts cannot become heated, there is no such thing as burning of insulation. These magnets are compound-wound to rise from 100 to 105 volts, and from no load to full load. In order to excite the magnets about three per cent. of the output is required.

Armature.—The armature is of entirely new design and make, consisting of the smooth-ring type with iron spacing lugs only. Very thin iron ribbon, wound like a tape, is used in making this armature. The section of the armature-ring is about as large as the rest of the magnetic circuit. There are 36 bobbins in the armature, each entirely separated from the other. The ends of these bobbins are connected with 36 bars in the commutator by means of wires passing directly from the armature to the commutator outside the shaft.

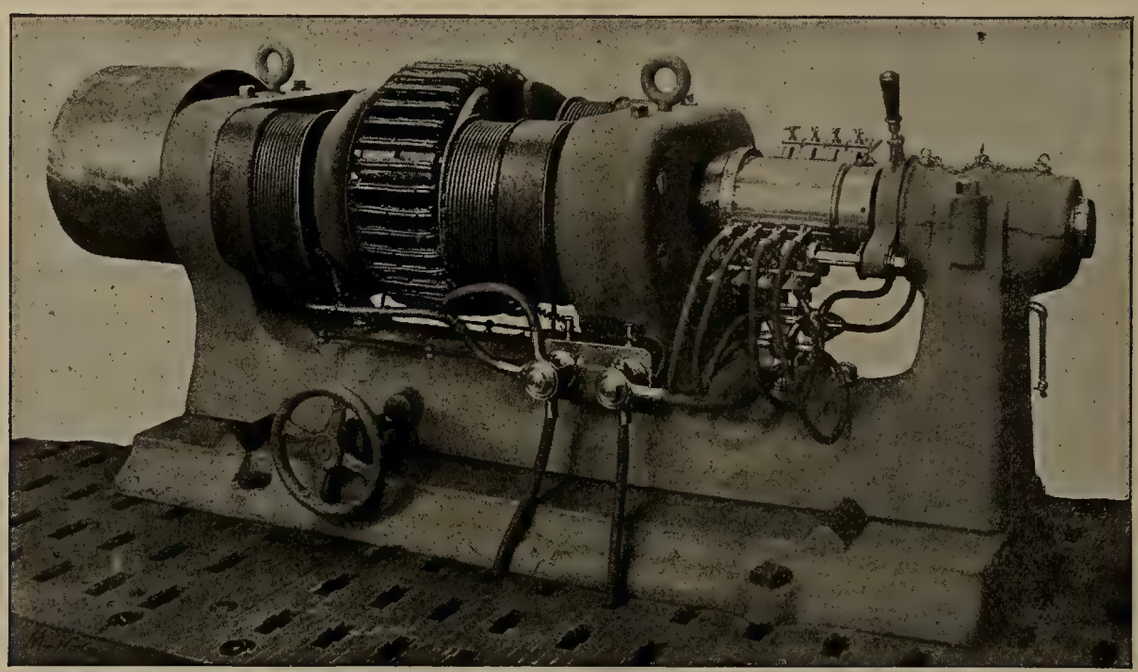


FIG. 1.—BRUSH INCANDESCENT DIRECT-CURRENT DYNAMO.

Frame. — This part of the machine is cast in one piece, in this way dispensing with the necessity of screws or bolts to hold it together, and is fitted on to V's that have been made on the bed-plate in one solid piece. A screw wheel or lever is employed to move the frame backward or forward, so that the belt can be tightened or loosened as may be necessary.

Bearings.—New features have been introduced into this portion of the machine. Each end of the frame is bored out to receive the adjustable ball-bearings on which the shaft of the armature is set. Instead of these bearings being split, as is common to other machines, they slip over the shaft, and are provided with ring oilers, which dip into large pockets in the support of the frame. These pockets are filled with oil, thus doing away with the necessity of employing oil-cups, and as a matter of course, this part of the machine does not have to be attended to in any manner.

Commutator and Brushes.—The commutator consists of 36 bars made of pure copper, which are fastened between two heads, and each bar is completely insulated from the other by the use of mica. The brushes, which consist of alternate layers of fine copper wire and thin sheet copper, are about one-half an inch thick. They are placed in adjustable brush-holders so arranged as to insure an easy and even pressure on the commutator against which they are pressed at an angle. If well taken care of the commutator, which becomes polished, will remain in a bright condition, operating without heating or sparking and with but little wear. No rocking of the brushes from one position to another will be caused by a change of the load, and the machine will not be affected in any manner by slight changes.

It is claimed that these machines will require less attention and render greater service at less cost than any similar machine on the market.

(Continued on page 560.)

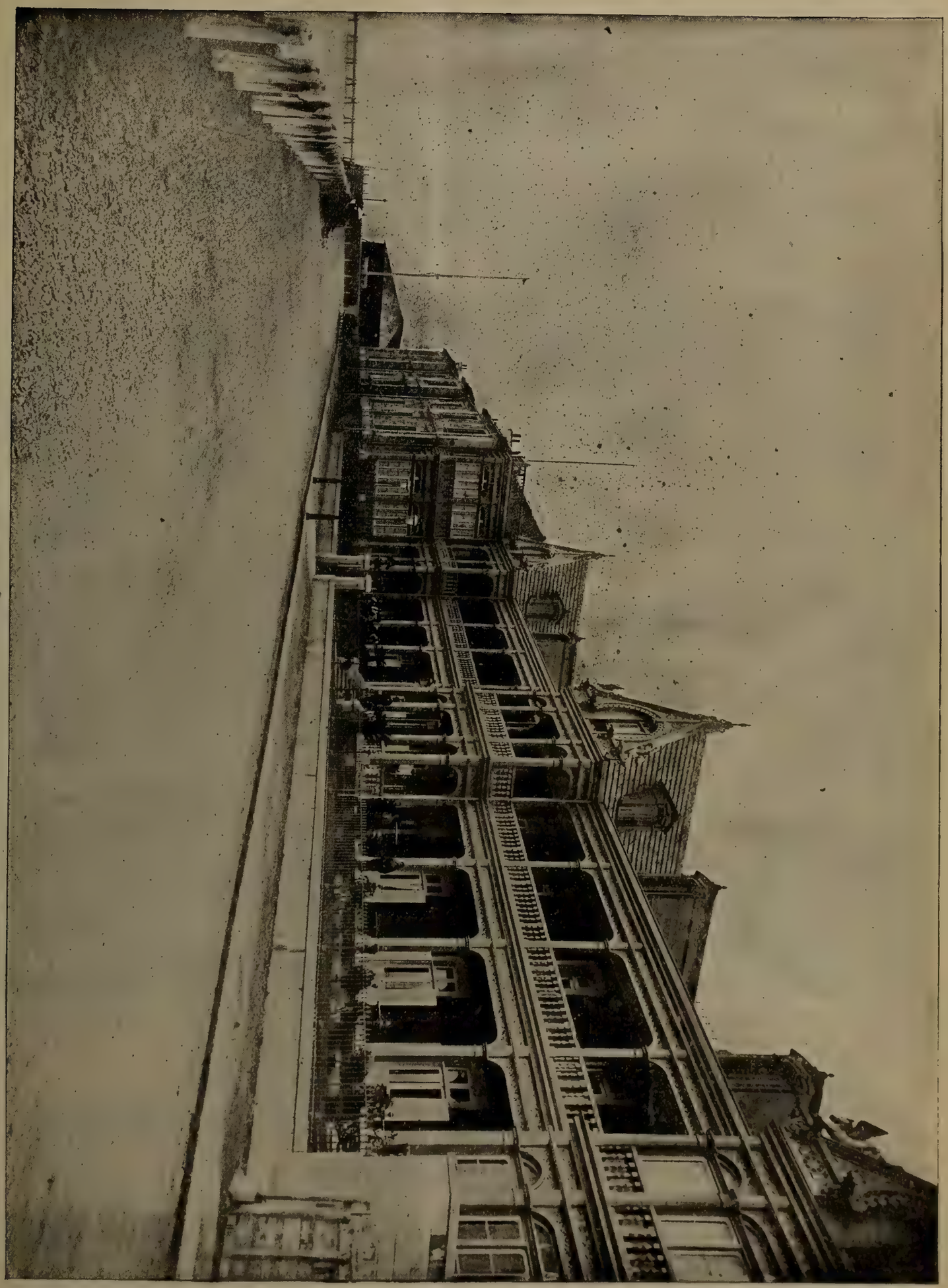


FIG. 2.—FRONT OF GRAND HOTEL, YOKOHAMA, JAPAN.

ELECTRICITY AT THE WORLD'S FAIR.

Inasmuch as electricity will play a very large and important part at the World's Fair in Chicago next year, everything pertaining thereto has more or less special interest to the electrical fraternity.

Electricity and electrical appliances will also be a feature in the civic celebration attending the dedication of the World's Fair buildings on October 20, 21 and 22 next, as will be seen from the following programme of the three days' celebration:

THURSDAY, OCTOBER 20.—THE CIVIC CELEBRATION.

The first day will witness an imposing procession, indicative of peace, contentment and prosperity, participated in by civic organizations, which will be reviewed by the President of the United States, his cabinet, the Congress and other honored guests.

In the evening, at Jackson Park, amid myriads of electric lights and other displays, a water pageant, "The Procession of the Centuries," will move through the beautiful water-ways of the Exposition grounds, illustrating with beauty and historic accuracy some of the great facts of history connected with the discovery of America, such as the condition of this country prior to the landing of Columbus; striking events in the life of the great discoverer; important epochs in American history and the world's progress in civilization. The vessels upon which these tableaux will be represented vary from 40 to 53 feet in length, modelled after the naval architecture of the period represented; for example, "Columbus before the Court of Spain" will be represented upon a vessel modelled after the lines of the *Santa Maria*.

The following subjects will be illustrated:

1st. Aboriginal Age; representing the American Indians.

2d. The Stone Age; representing the Cliff Dwellers.

3d. The Age of Metal; representieg the Aztecs, their religious rites, manners and customs.

4th. Columbus at the Court of Ferdinand and Isabella.

5th. Departure of Columbus from Palos.

6th. Discovery of America.

7th. Columbus before the Court of Ferdinand and Isabella, presenting natives and the strange products of the new country.



FIG. 3.—HOTEL FUJI, MIANOSHITA, JAPAN.

8th. English Cavaliers and the settlement of Jamestown.

9th. Hendrick Hudson; discovery of the Hudson river; Dutch settlement of New Amsterdam.

10th. Landing of the Pilgrims, and illustrations of early Puritan life.

11th. Ferdinand de Soto; discovery of the Mississippi.

12th. The French explorers. Pierre Marquette. Chevalier La Salle and the Northwest.

13th. Washington and his generals.

14th. Signing of the Declaration of Independence.

15th. Union of the colonies; the thirteen original states; the sisterhood of the Great Republic, welcoming the territories to the constellation of the states.

16th. "Westward the course of empire takes its way."

17th. The genius of invention; application of steam, etc.

18th. Electricity and electrical appliances.

19th. War; representing valor, sacrifice, power, death, devastation.

20th. Peace; representing tranquillity, security, prosperity, happiness.

21st. Agriculture.

22d. Mining.

23d. Science, Art and Literature.

24th. The universal brotherhood of man; equal rights, law of justice; Liberty enlightening the world.

FRIDAY, OCTOBER 21.—DEDICATION DAY.

The national salute at sunrise will inaugurate the ceremonies of Dedication Day. The President of the United States, his Cabinet, members of the Supreme Court, members of the Senate and the House of Representatives, distinguished foreign guests and governors of the different states and territories with their official staffs, will be escorted by a guard of honor composed of troops of the United States Army, detachments of the United States naval forces and regiments from the various state National Guards, to the Manufactures and Liberal Arts building, in which the dedicatory exercises will be held.

At one o'clock in the afternoon in this building the following dedicatory programme will be carried out under the direction of the Director-General:

1st. Columbian March. Written for the occasion by Prof. John K. Paine.

2d. Prayer by Bishop Charles H. Fowler, D.D., LL.D., of California.

3d. Dedicatory Ode. Words by Miss Harriet Monroe, of Chicago; music by G. W. Chadwick, of Boston.

4th. Presentation of the master artists of the Exposition and their completed work, by the Chief of Construction.

5th. Report of the Director-General to the World's Columbian Commission.

6th. Presentation of the buildings for dedication by the President of the World's Columbian Exposition to the President of the World's Columbian Commission.

7th. Chorus, "The Heavens are Telling."—Haydn.

8th. Presentation of the buildings for dedication by the President of the World's Columbian Commission to the President of the United States.

9th. Chorus. "In praise of God."—Beethoven.

10th. Dedication of the buildings by the President of the United States.

11th. Hallelujah chorus from "The Messiah."—Handel.

12th. Dedicatory oration, Hon. Wm. C. P. Breckinridge, Kentucky.

13th. "The Star Spangled Banner" and "Hail Columbia," with full chorus and orchestral accompaniment.

14th. Columbian oration, Chauncey M. Depew, New York.

15th. National salute.

At the close of this programme a special electric and pyrotechnic display will be given, with a repetition of "The Procession of the Centuries."

SATURDAY, OCTOBER 22.—THE MILITARY CELEBRATION.

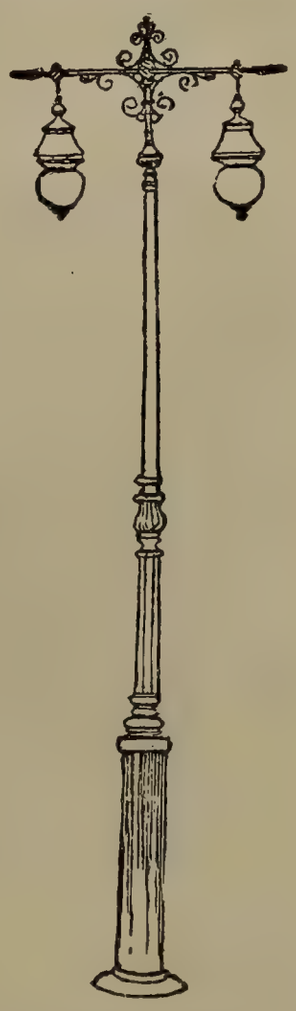
A series of military manœuvres and parades will constitute the main portion of the day's programme. In the evening attractive and appropriate celebrations will be provided, followed by a magnificent display of fireworks.

A number of brilliant social entertainments will be given by the citizens of Chicago during the three evenings of the dedication celebration.

ARTISTIC LIGHTS FOR FIFTH AVENUE.

Fifth avenue, New York city, the best-known residence street in America, is to be electrically lighted in a manner that will surpass any and every effort made in street lighting in this country. Heretofore the avenue has been lighted at night by the common and old-fashioned gas lamps, which look sickly indeed compared with the extremely more brilliant electric lights which can be seen from almost any corner along the avenue.

The Edison Illuminating Company, of New York city, on August 31 secured the contract from the Gas Commission to light Fifth avenue from Washington square to 59th street, and to do so it will introduce new and improved lamps and posts.



ARTISTIC LIGHTS FOR FIFTH AVENUE.

The lamp-posts will be handsome affairs. There will be two lamps on each pole, the lamps being in series and connected to the underground Edison mains in the usual manner—in multiple arc—so that the lamps on any one pole will be practically independent from those on any other pole, and can be controlled with as much facility as the incandescent lamps now are.

A cross-arm is placed near the top of each pole, from each end of which the lamps are suspended. The poles complete are of very artistic design, and will present a very ornamental appearance along this celebrated thoroughfare. They are made in two sections—a base and a shaft—the total height being about 15 feet. They will cost about $41 each. They are adapted, with slight modifications, to gas lighting or any other system of electric lighting, so that in case the contract for lighting the street should be awarded to another company within

the next five years, the same posts can be used. In case they are taken over by some other company, or by the city, within this period the cost of the poles, plus 10 per cent. for expenses, is to be refunded to the Edison Electric Illuminating Co.

Should a contract be made with the Edison Company from year to year, or otherwise, for more than five years, the city is to take over the posts at 10 per cent. discount from actual cost for each year beyond five years, so that at the end of fifteen years, in case the contracts are made with the Edison Company from year to year, or otherwise, for that period, the posts would become the property of the city without any payment on its part.

Within the hollow poles will be a device for lowering the lamps for trimming, repairs, etc., and all mechanism will be out of sight. A small door in the base of the pole will give access to the lowering apparatus, and the key thereof will be kept in the possession of some authorized person. These handsome poles were designed by Mr. R. R. Bowker, second vice-president, and Mr. J. Van Vleck, the company's electrician.

The lamp, which is designed for use on low-tension circuits, is the invention of Mr. Sigmund Bergmann, president of the New York Electric Equipment Co. It is very handsome in appearance, and possesses many novel features. The globe, which is of ground glass and of special design, is surmounted by artistic brass finishings. There is nothing at the bottom of the globe to cast a shadow, as in the ordinary street lamp, and no wires will be visible about the pole or lamp.

Fifty posts with two lamps each are to be distributed along the avenue within the limits named.

This will be the first instance in this country where arc-lamps on low tension circuits have been used for street lighting, and the appearance of Fifth avenue after dark with these twin lamps will be extremely attractive. It is expected that the lamps will be ready to be burned on or before October 12 next, and the Edison Company has contracted to furnish the lights for one year from the date of first lighting at the rate (for current, carbons, trimming, etc.) of 50 cents per night, from dusk to dawn, for each pair of lamps. The lamps will consume approximately 5 ampères of current at a voltage of 120 or thereabouts, which is equivalent to 10 ampères at the voltage required for each lamp, and together they will possess illuminating power not less than the standard single street-lamp.

Much credit is due to Mr. R. R. Bowker for the development of this system of lighting. It was under his special supervision that the scheme was carried forward to a successful issue, and the result of the practical test will be awaited with a great deal of interest.

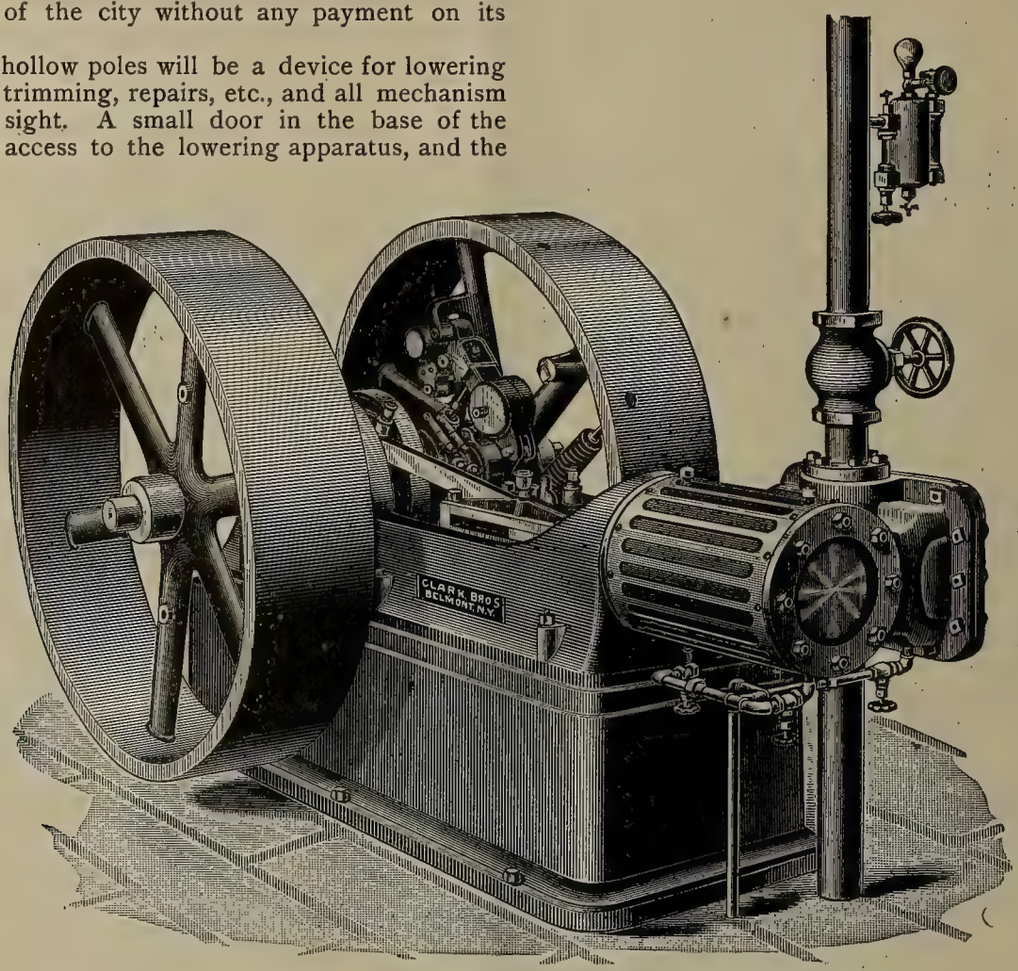


FIG. 1.—BELMONT AUTOMATIC ENGINE.

BELMONT AUTOMATIC ENGINE.

With the development of electricity for light and power purposes, a corresponding demand has been occasioned for improvements in the speed of steam-engines, which are a necessary requisite for the generation of the electric current.

Innumerable are the efforts that have been made to accomplish the desired results, and many have been the failures. Yet still these failures have served a valuable purpose in so far that they have been the means of guiding into the proper path the labors of those who have eventually become successful. Among the latter class may be mentioned Messrs. Clark Bros., of Belmont, N. Y., builders of the Belmont automatic engine, described and illustrated herewith.

One of the chief features of this engine consists of an automatic-shaft governor, wherein the weights are composed of thin discs of metal, so fitted in a casing that a change of speed is attained by increasing or decreasing the number of discs, instead of changing the leverage of the weight or the tension of the spring. This, in combination with knife-edge bearings, which eliminate the friction of cylindrical bearings, and an inertia weight

and dash-pot for stability, necessarily leads to a sensitive and constant governor—at least so far as theory goes. A correct idea of the mechanical necessities of these theories seems to have been carried out in practice. In one particular case—an 8 × 10 centre-crank, running at 250 revolutions, one wheel belted to a 300-light dynamo —the variation in reading of a voltmeter was hardly perceptible when a dynamometer pressure of 20 horse-power was thrown instantly on or off the other wheel. This was undoubtedly a very severe test.

Another prominent feature in this engine consists of a balanced slide-valve with a riding cut-off, so fixed as to insure a constant travel of both main and cut-off valves; in this way there will be a constant and equal wear all over the valve surfaces, the result being that with continuous use their fit and tightness will be more perfect. A neat scientific principle is brought into play to produce this result, which although it at first appears to be a little complex and confusing, is extremely simple. To regulate a point of cut-off by the *time* of travel

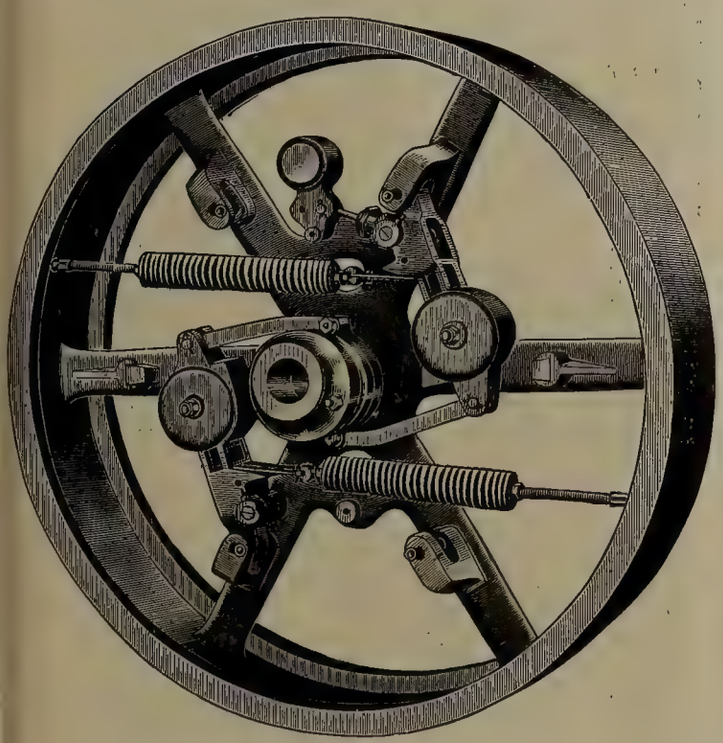


FIG. 2.

and not by the *length* of travel has been the study of valve designers for some time. This question has been solved by doubling the eccentrics. Like many subjects in life, "there is a wheel within a wheel," so in the valve question here, there is an eccentric within an eccentric. The *length* of travel of both main and cut-off valves remains constant, and the *time* of their relative travel does the cutting off. Just as changing the angular advance of an ordinary slide changes the lead, so the changing of the position of the cut-off eccentric, by the variation of the shaft governor, changes the point of lead of the cut-off valve. This amounts to cutting off the steam where desired to obtain the speed requirements, while the main valve operates the other points in the cylinder cycle. The valve is double ported, so that the travel required is small, permitting the motion to be a direct lead from the eccentrics, without bell-crank or link motion. The main eccentric is also secured to the shaft by tangent set-screws, so that its position is subject to easy and exactly accurate adjustment, thus giving absolute control of lead, exhaust opening and compression. Combining these two requirements for a successful engine, with heavy cast base and bed, heavy locomotive slides of large area and easy means of adjustment, bearings that are set to exact position by wedge and screw motions, and carefully determined counterbalances, must necessarily produce an engine that, although under a new

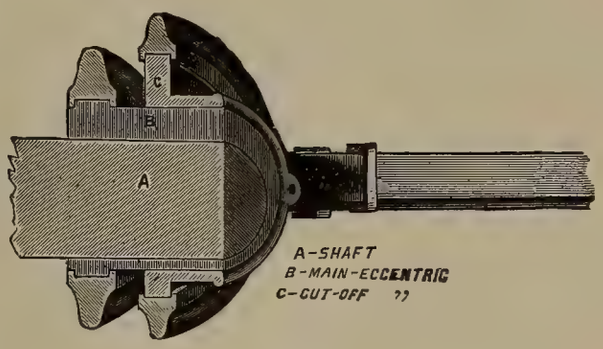


FIG. 3.

name, is but a careful embodiment of the best principles of older practice.

In the accompanying illustrations Fig. 1 presents a general view in perspective of the centre-crank type of engine; Fig. 2 is an elevation of the governor; in Fig. 3 will be seen a cross-section of the eccentric gear, and Fig. 4 gives a view of main bearing with adjusting wedges. A few of the minor points worthy of mention are: A valve-chest bonnet that is secured by through-bolts; a throttle-valve that opens wide at one revolution; exhaust-ports that run below the bottom of the cylinder-bore, so that the perfect alignment or variation of the shaft may be seen at a glance.

Some of the more important of the various designs manufactured are: The centre crank, side crank Tangye and box beds, simple-compound and tandem-compound. One of the latest engines of a decidedly novel character is a self-contained side-crank engine on one base-plate, outer-bearings and all. This engine was designed to be used where plenty of space is afforded, as, owing to its peculiar construction, it is more readily accessible than other types of engines. A tandem-compound that can be stripped without making a connection is one of the firm's specialties.

The manufacturers claim superiority for their engines on the following grounds: Absolutely close regulation, a balanced slide-valve with riding cut-off that becomes tighter and tighter through continued use, and never needs to be replaced, and an economical showing of 24 to 30 pounds of water per horse-power per hour.

Messrs. Clark Bros. have sold an immense number of these machines during the past fifteen years, and they

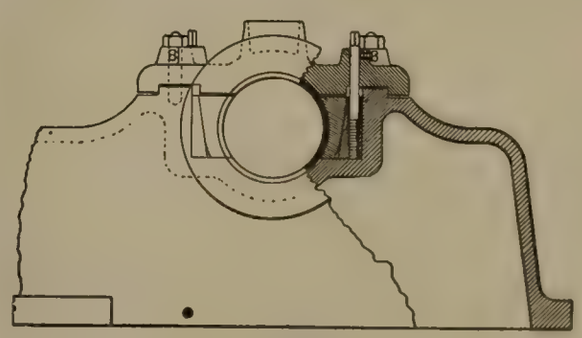


FIG. 4.

keep constantly growing in favor, especially for use in electric-light and street-railway plants, where they have given every satisfaction in the performance of the work required.

The New York office of Clark Bros. is at 121 Liberty street.

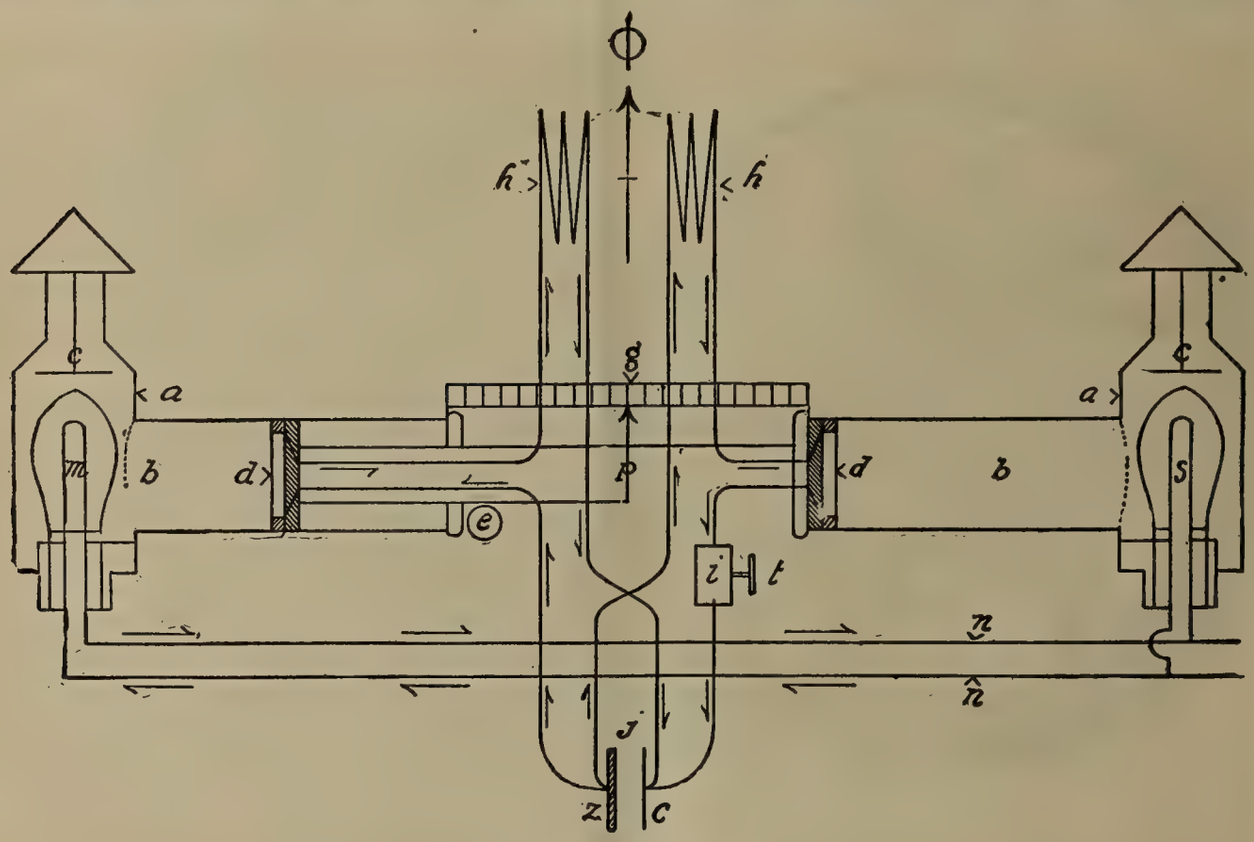
A NEW PHOTOMETER.

In all photometric measurements what is known as the "personal equation" constitutes a constant source of error, for the reason that no two persons have their sense of sight developed alike. The accuracy of the measurements, therefore, depending upon the sense of sight of the operator must necessarily be impaired to a more or less degree on account of the existence of this source of error, which cannot be eliminated except by the use of purely mechanical methods of arriving at the desired results. A reliable instrument for the accurate measurement of light is therefore an absolute necessity, and various methods have been suggested to avoid the uncertainty of ordinary photometric measurements.

Mr. S. F. Van Choate, of Boston, has devised an apparatus which seems to surpass anything of the kind yet produced for the accurate measurement of light.

In this instrument, says the *Scientific American*, a selenium cell is employed to receive the light beam, and to thus vary the electric current which is made use of to give the visual indications. The instrument, a diagram of which is given herewith, is in the nature of a balance connected with a differential galvanometer, the standard light being arranged to affect one side of the balance, and the light of unknown strength being placed upon the opposite side of the instrument. The tubes, *b*, of two lanterns, *a*, are preferably arranged axially in line. In the right-hand lantern is placed the light, *s*, to be tested, above which is suspended a disc, *c*, for preventing the escape of light. In the other lantern is placed the standard lamp, *m*, and in the tube, *b*, upon the same side of the apparatus is fixed an adjustable selenium cell, *d*, which is moved along the length of the tube, *b*, by the pinion, *e*. To the selenium cell, *d*, is attached an index, *p*, which slides in front of the scale, *g*. If the standard lamp and the lamp to be tested are electric lamps, they are connected up in an electric circuit in the usual way.

In the upper portion of the diagram is shown a differential galvanometer which is connected with a battery, *j*. The right-hand coil of the differential galvanometer is connected by one of its terminals with the zinc plate, *z*, of the battery, while the remaining terminal of the coil is connected with the selenium cell, *d*, which in turn is connected through the rheostat, *i*, with the carbon plates, *c*, of the battery. In a similar manner one terminal of the left-hand coil of the galvanometer is connected with the carbon plate, *c*, and the remaining terminal is connected with the adjustable selenium cell, *d*, from which a wire extends to the zinc plate, *z*, of the battery. The two branches of the battery circuit are placed in electrical balance by means of the rheostat, *i*. The selenium cells, *d*, being alike, if the lamps, *s*, *m*, are equal, the distance between the selenium cells, *d*, and their respective lamps will be the same. If, however, the lamp to be tested is inferior to the standard lamp, the selenium cell, *d*, which faces the standard lamp, will be moved until the galvanometer indicates equilibrium. The difference in the distance between the selenium cells and the lamps, as indicated on the scale, will give the basis for the calculation of the relative intensities of the light from the two lamps, calculations being made according to the law of inverse squares.



ELECTRIC PHOTOMETER.

This instrument can be used in measuring the intensity of light from other sources by simply adapting the lanterns to the kind of light used for standard and for testing.

ELECTRIC BOAT FOR MR. ASTOR.

One of the members of the Astor family has, according to a despatch from Newburg, N. Y., leased the electrically propelled boat "Electron," which was fully described in the ELECTRICAL AGE during the early part of last summer.

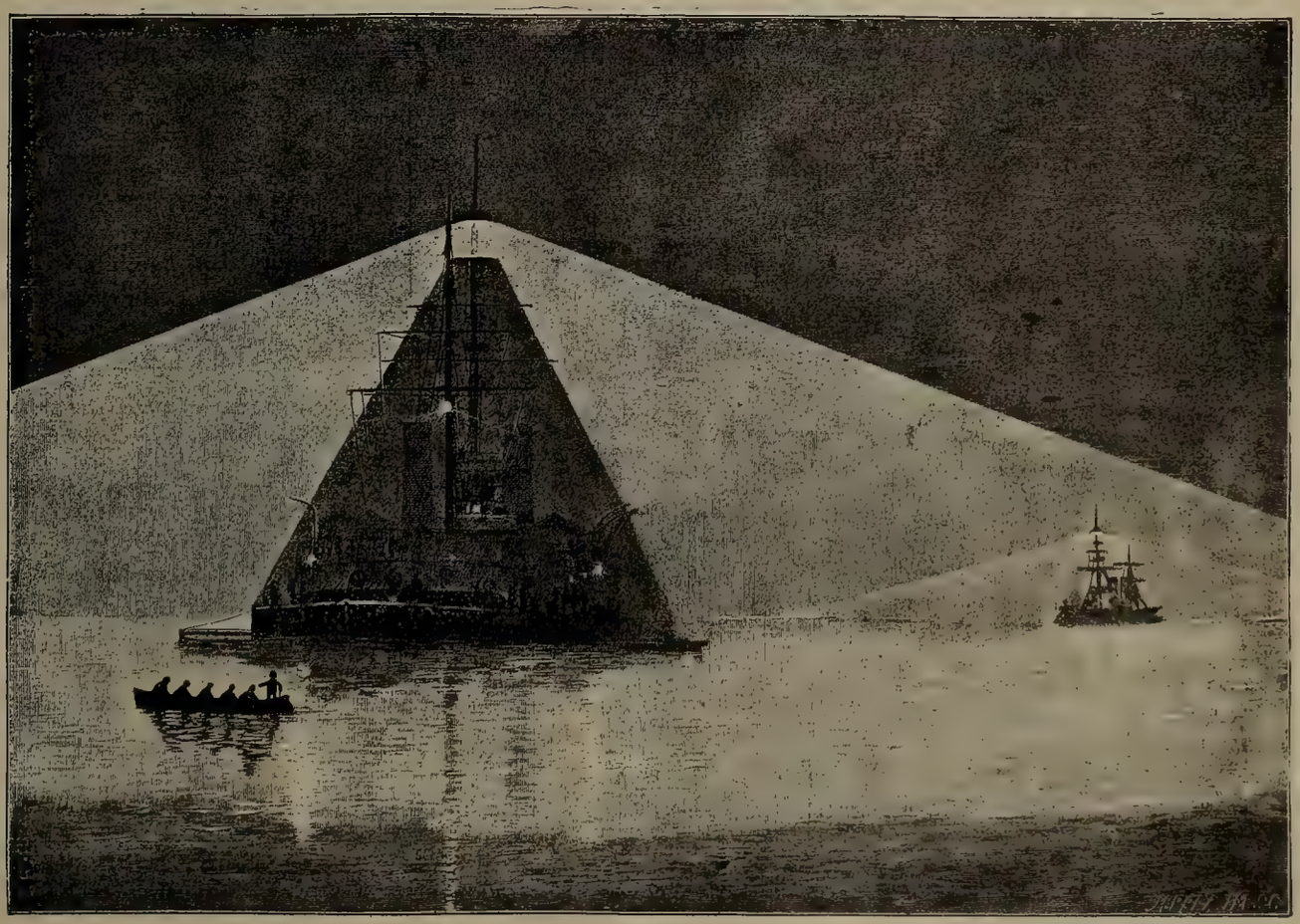
The "Electron's" power is supplied by storage batteries, and she is probably the largest boat of this class in the world. She will be used by Mr. Astor at Newport for pleasure purposes.

ELECTRIC LIGHT FOR MAST-HEADS.

A recent number of the *Engineer*, of London, contained an interesting story written by W. Laird Clowes, and entitled "The Captain of the 'Mary Rose': a tale of to-morrow." In it Mr. Clowes gives every detail of action in naval combats supposed to have taken place between the war vessels of England and France, which countries are supposed at war. The defects and strong points of the modern war vessels are well brought out in the narrative, which is well illustrated.

One of the illustrations, which we reproduce herewith, shows a mast-head electric light designed for use on some of the battleships engaged in this supposititious war, and intended to strongly illuminate a large area around the ship, while the ship herself remains in darkness.

We give the author's own words in describing this novel light:



ELECTRIC LIGHT FOR MAST-HEADS.—AN INTERESTING SUGGESTION.

"Mast-head electric lights of novel design are being fitted to some of the larger battleships. These are so arranged as to shed a zone of illumination all around the vessel, but to leave the craft herself in comparative darkness, and it is confidently expected that they will be of great value should our squadrons be obliged to anchor at night within raiding distance of the enemy's torpedo-boats. Some experienced officers, however, are of opinion that a ship which desires to remain exempt from attack should on no account exhibit a light of this kind, since it must of necessity be visible from a considerable distance to the foe, and they do not hesitate to say that, even if they be supplied with it, they will not use it. The advantage of the light lies in the fact that no ship so long as she employs it can possibly be closely approached by any enemy that does not expose himself to a very dangerous extent. On the other hand, it is pointed out that the apparatus is large, and offers so fine a mark for machine-gun fire that it could doubtless be easily extinguished by moderately good gunners at 3,000 yards, or even more. Experts here are loud in their regrets that this device, which is quite new, in common with other electric lighting devices which are much older, has not been properly experimented with in peace time, and that, in consequence, no certainty exists as to either its practical utility or its vulnerability."

NIAGARA'S POWER FOR HAMILTON, ONT.

What will probably be the first attempt to use power from Niagara on a large scale and at long distances is likely to materialize very shortly in Hamilton, Ont.

A company has been formed there with a capital of $3,000,000 to construct some 200 miles of electric railway in distances of 25 to 60 miles, and to supply light, heat and power to the towns and cities along each line.

It is intended to make Hamilton the centre of the system, and carry the power there at a very high voltage, possibly 25,000, which is recommended by Messrs. Brown, Boveri & Co., after their experience at Lauffen Falls, Germany.

The company will, as far as possible, use existing roads, fencing off what is required for single tracks, and using large trolley cars and trailers. The lines have been partly surveyed, and it is expected that the whole system can be completed early next summer. Considerable attention will be devoted to the supply of power for manufacturing, and the company will also endeavor to introduce the electric current largely for cooking and heating.

(Continued from page 552.)

Our illustration, Fig. 1, gives an excellent perspective view of this machine.

Fig. 2 gives a view of the front of the Grand Hotel, Yokohama, Japan, which is lighted inside and out on the Brush system. The approaches of the hotel are located directly on the Yokohama harbor, and are lighted at night by Brush arc lights. The court-yard and corridors are also lighted by arc lamps, while in the interior of the hotel there are 800 incandescent lamps supplied with current from two compound-wound Brush dynamos of the latest pattern.

The proprietors of this hotel are perfectly satisfied with the operation of this plant, which is a complete and handsome one.

Fig. 3 gives a view of the Hotel Fuji, Mianoshita, Japan, a fashionable Japanese mountain resort, which is lighted throughout on the Brush system. The bath-house as well as the hotel itself is lighted by incandescent lamps, and the electric light has added a considerable attraction to this otherwise charming place.

The Brush system of lighting is much favored in Japan, and we find Brush lights in all of the large central stations, many isolated plants, on the government docks and in the grounds surrounding the Mikado's palace.

FEEDER CABLE FOR WASHINGTON, ALEXANDRIA AND MOUNT VERNON ELECTRIC ROAD.

The accompanying illustrations, Fig. 1 and Fig. 2, show respectively perspective and cross-sectional views of a submarine cable specially made by the Bishop Gutta Percha Co., of New York, for the Washington, Alexandria and Mount Vernon Electric Railway. It forms a part of the feeder system and is to be laid at the drawbridge on the line, located below Alexandria.

This submarine feeder will carry a current of 550 volts and is 300 feet long.

In Fig. 2 the construction of this cable is shown. The protective armor is composed of steel wires No. 4 gauge, and the area of the core is 450,000 circular mils.

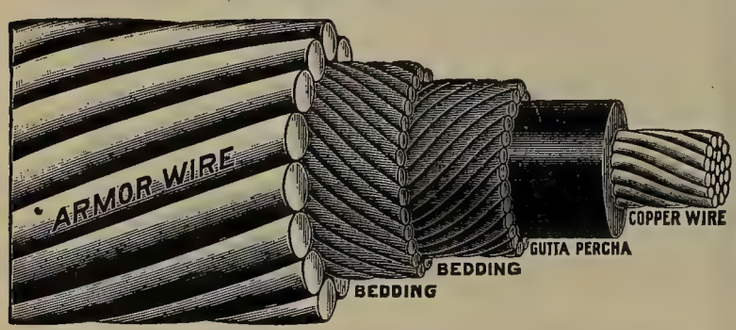


FIG. 1.—PERSPECTIVE VIEW OF SUBMARINE FEEDER CABLE.

In this connection a general description of this road will be of interest to our readers.

The portion of the line now being constructed runs from Alexandria to Mount Vernon, and is twelve and one-half miles in length. It will be ready for operation on September 15 and will in many respects be a unique road.

Mr. C. H. Davis, the well-known consulting electrical engineer, of New York, designed this road in every detail, and when it is opened on the date above mentioned, it will be just two months after Mr. Davis began his work of planning the installation. Two months in which to design and construct an electric road and get it into operation seems like a remarkably short time, but almost any task can be accomplished these days with the best of engineering skill, as is evident in this case. The road is, moreover, one of the most substantially constructed in the United States, and every feature of the work has been most carefully attended to.

The power-house, which is now in course of erection,

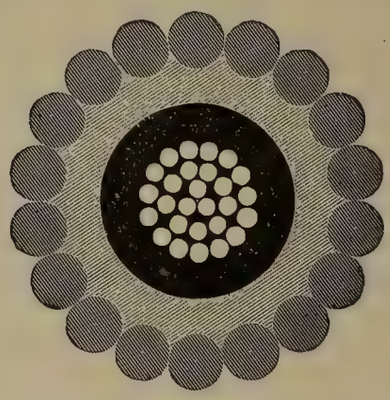


FIG. 2.—SECTION OF CABLE.

is located in the suburbs of Alexandria. It is built of brick and will be the power-house and car-shed combined. The roof will be of iron covered with slate.

In the construction of the road considerable engineering work was necessary to overcome the natural difficulties met with. One mile of water trestle-work had to be built at one portion of the line where it crosses a stream, and heavy cuts were necessary in other portions, involving the removal of about 50,000 cubic yards of earth. On the trestle-work a drawbridge of 100 feet span is located, and it was to carry the feeding current past this draw that the cable above described and illustrated was manufactured. The drawbridge, which is on the plate-girder principle, was constructed and erected by the Passaic Iron Works, of Passaic, N. J. It is very wide, and besides the track has a driveway and a path for pedestrians.

Each of the cars will be equipped with two 30 H. P. high-speed, single-reduction Thomson-Houston motors, and the generating plant will consist of two 150,000 watt Edison Compound generators, which will be belted to the engines.

There are two 200 H. P. Green engines made in Providence, and Messrs. W. R. Fleming & Co., of New York, selling agents of the Harrisburg Foundry and Machine Works, of Harrisburg, Pa., put in the entire steam-generating plant, consisting of boilers, pumps, condensers, etc.

The trolley wire was furnished by Wallace & Sons, of New York, and the feeder wire was made at the Edison Schenectady works. All the iron wire used on the road, for ground connections, etc., was made by the Roeblings. The size of the feeder wire is 000 and its length is 125,000 feet.

The car equipment will consist of six 34-foot Brill cars, with Brill's maximum traction trucks under them. Heavy Georgia pine ties are used throughout, and in the city work Wharton girder rails are laid, while on the rest of the line T rails are used, weighing 50 lbs. to the yard. The latter rails were made by the Pennsylvania Steel Co., and are of the standard pattern.

The poles used were furnished by The H. M. Loud & Sons Lumber Co., Oscoda, Mich., and are of the octagonal pattern. The speed on this line will be 30 miles an hour. This high speed has been adopted with the object of keeping down the operating expenses, although to do it there will be an increased coal consumption.

This line when completed will cost about $200,000, and it is well ballasted and is said to be first-class in every particular, no expense being spared to make it so.

The Washington section of the line will not be constructed at the present time.

OBITUARY.

FREDERIC NEWTON GISBORNE.

Following closely upon the death of Cyrus W. Field comes the announcement of that of Frederic Newton Gisborne, at Ottawa, Canada, on Tuesday, August 30.

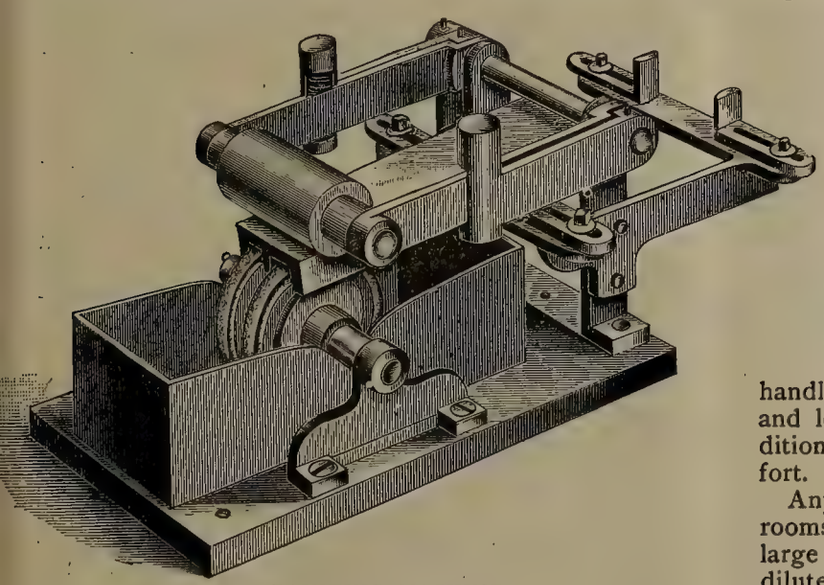
Mr. Gisborne was born at Broughton, Lancashire, England, March 8, 1824, and was consequently 68 years old when he died. His education was received at Warslow, Staffordshire, Toxteth Park, Liverpool, and Cheadle, Cheshire.

Mr. Gisborne made a trip around the world in 1842, and in 1845, with his brother Hartley, settled in Canada, where he purchased a farm near St. Eustache. The successful operation of the telegraph in the United States and England forcibly impressed itself on the mind of Mr. Gisborne, who became one of the first operators of the Montreal Telegraph Company and opened its first office in Quebec.

Mr. Gisborne subsequently became interested in various telegraph enterprises, the principal one of which was the laying of the Atlantic cable; after that he was engaged in mining engineering and railroad construction. In 1862 he was acting commissioner at the London Exhibition in the interests of Newfoundland, and held a similar position at the Paris Exhibition in 1867.

In 1879 Mr. Gisborne was appointed superintendent of telegraphs for the Dominion of Canada, which position he occupied at the time of his death. Mr. Gisborne has made a great many inventions besides being associated in a number of others. He was a Fellow of the Royal Society of Canada, and a member of the Council of the Canadian Society of Civil Engineers.

Without detracting any from the fame of Mr. Cyrus W. Field, it is but just to say that the idea of a submarine cable was originally conceived in the brain of Mr. Gisborne, who confided it to Mr. Field, by whom it was developed and carried through to a successful issue.



PAINTING MACHINE.

PAINTING MACHINE.

In nearly all of the large cities throughout the country the various boards of fire underwriters require that all mouldings through which electric wires are to be run must be coated inside and out with a fire and water proof insulating compound. To perform this work is an exceedingly laborious operation, and it was to lighten the labor of those engaged in it that the Standard Paint Company, of 2 Liberty street, New York, set about to devise some mechanical method of accomplishing the task. Its efforts in this direction have proven entirely successful, and it has recently put on the market the machine illustrated herewith, by the use of which, it is claimed, a boy can coat in one day as much moulding as a man would by hand in three.

The machine does its work thoroughly, takes up but little room, and being such a labor and time saver, will surely commend itself to every one. These machines are already being largely used in connection with the celebrated P. & B. water and acid proof compound made by the Standard Paint Company and giving every satisfaction.

VENTILATION OF ENGINE AND BOILER ROOMS.*

BY ALFRED R. WOLFF, M.E.

THE proper ventilation of engine and boiler rooms, though usually neglected, is a matter of great importance. The heat generated in these rooms from the combustion of the fuel, from the radiation of the furnaces, boilers, steam pipes, heaters, engines and dynamos, is intense. Furthermore, there is a smell of oil, and of escaping vapors of steam and of paint under high temperature. The detrimental effect of these conditions is felt in various ways. Heat and noxious vapors are transmitted to rooms adjoining and above the boiler and engine rooms, and are offensive to the occupants of the building. Frequently ducts which are presumed to transmit cold air to other rooms in the building pass through the engine and boiler rooms, and thus the air is heated in transit, and enters these rooms warm instead of cold, as desired, and the beneficial effect is lost. Again, in electric plants, the dynamos become inefficient when the temperature of the room is excessive. Lastly, and not least, the engineer force suffers exceedingly, which is not only annoying and detrimental to health, but results in less efficient handling of the plant, for men cannot do their best work and look out for their employer's interests under conditions which cause them physical and mental discomfort.

Any proper system of ventilation of boiler and engine rooms, especially if the rooms are located in cellars of large buildings, requires the bringing in of fresh air to dilute and cool the atmosphere in the rooms, and requires, at the same time, the exhaust of air from these rooms. Either system alone will not answer. If air is supplied under pressure and no proper exhaust provided it is true the room will be somewhat cooled and freshed, but the still heated air and noxious vapors will be distributed with greater force to the rest of the building. If an exhaust system alone is used, and it is sufficiently powerful, the heat and the noxious vapors will be partially removed and will certainly not distribute elsewhere than in the room, but the air which will be drawn into the boiler and engine rooms will not necessarily be pure air and certainly not cold air, and thus the temperature of the room will not be fresh enough. If one system alone is to be used, the exhaust is the best, but neither system alone really meets the need.

The most satisfactory way of bringing in the air is to distribute it by means of galvanized-iron ducts to various portions of the room, not as is frequently practiced, by having one large inlet at one end of the room. These

*Cassier's Magazine.

galvanized-iron ducts should have outlets at those places where the men are principally at work, for instance, near the engine cylinders, near the dynamos, near the furnaces, and preferably, the horizontal transmitting ducts being near the ceiling, there should be funnels with registers or dampers led to a height just above the men's heads. The transmitting fresh air ducts in the engine and boiler rooms should be well covered with non-conducting material, for it is essential, especially in the summer time, that the air which enters the boiler and engine rooms be pure air from without, and not of higher temperature than the external atmosphere. To create a proper circulation, the exhaust system from the boiler and engine rooms should also be arranged with corresponding outlets at the various parts of the room, these outlets connected by galvanized-iron ducts with the main exhaust flue. Thus is insured a circulation and distribution of air to all parts of the room. The galvanized-iron vent ducts do not, of course, need to be covered with non-conducting material. All the inlets and outlets should have their separate shut-off registers or dampers, so as to be easily under control of the engineer.

There can be no better investment for the owner of a steam and electric plant than to have the engine and boiler rooms properly ventilated. The first cost of such an institution will bear him a handsome return in the smooth running of the plant, a greater fuel economy, in the increased comfort of the tenants, and the greater welfare of his employés.

DATA CONCERNING PLATINUM.

Baker & Co., gold, silver and platinum refiners, 408–414 N. J. R. R. avenue, Newark, N. J., have just issued a neat pamphlet giving some valuable data concerning platinum. The information is mainly in the form of tables. These tables give the approximate weight and capacity of platinum crucibles, dishes, etc., the weight of platinum wire (all sizes), per foot, in Troy and French weights, and weights per square inch of platinum, sheet or foil. Other useful tables are also given.

These data will no doubt be of great service to those dealing in platinum.

ELECTRIC WIRES ON THE BROOKLYN BRIDGE.

The Brooklyn bridge offers an excellent support for telegraph and other wires between New York and Brooklyn. They are absolutely safe from external trouble, such as damage by storms, etc., but it is well known to electricians that this great highway developed a tendency of its own to cause other troubles to the electric circuits conveyed across the river by it.

The vibration of the big bridge, while almost unnoticeable to passengers, has a telling effect after long periods on the integrity of the cabled wires. The movements are slight, but continuous, and they gradually disintegrated the earlier-laid cables.

Five of the lead-covered cables, containing many of the telegraph wires connecting New York and Brooklyn, which were manufactured by the Norwich Insulated Wire and Cable Co., were recently abandoned on account of the damage wrought upon them by the incessant vibrations of the bridge. In their place five new cables have been put in by the United States Cable and Wire Co., in a manner that is thought will secure entire immunity from damage. The cables are suspended from the girders of the foot-path, where, it is believed, the effect of the vibrations is the least.

Each cable contains 100 conductors, and paper is used as the insulating material. The old cables were also paper-insulated.

PATRIOTIC ACTION.

All fair-mined people denounce the action of some individuals and concerns in this city and elsewhere in the State in discharging from their service those of their employés who were members of the militia and who were called out for military duty during the recent strike in Buffalo.

Several cases of this sort have occurred in this city alone, and to say the least, it is indicative of utter want of patriotism and of extreme selfishness.

On the contrary, those who held the places open for their employés who were called out, stand out in striking and shining contrast with the unpatriotic action of those who took a different view of the situation.

Among those patriotic concerns who consider order the first law of government and trade, and who lend their aid to its maintenance is the Q. N. Evans Construction Co., 41 Dey street, New York. This firm is well known in the electric trade through its installations of complete steam plants for electric light and power purposes, and it deserves special praise for the manner in which it "stood by" one of its employés, who was a member of one of the regiments called to Buffalo. This man's name is A. P. Thomas, and while on duty in Buffalo he received an injury to one of his arms. On his return to New York he reported for duty, but on account of his injured arm Mr. Evans told him to lay off until it got well; that his salary should go on just the same.

This action on the part of this concern was most exemplary, and shows in plain light the difference between broad and narrow mindedness, and patriotism and lack of it.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

A very full programme is announced for the coming meeting of the American Electro-Therapeutic Association, which is to be held in New York, at the Academy of Medicine, 17 West 43d street, October 4, 5 and 6.

There will be two interesting discussions: one upon "The Relative Fœticidal Value of the Different Currents and Their Application to Ectopic Gestation," to be discussed by many prominent gynecologists and electricians, and another upon "Cataphoresis and Its Practical Application as a Therapeutic Measure."

Among the many papers to be read will be one by Dr. Wellington Adams, of St. Louis, and Dr. J. Mount Bleyer will give an instructive lecture with demonstrations entitled "The Phonograph and Microphonograph, the Principles Underlying Them and Their Uses in the Sciences."

In connection with the meeting there will be an exhibition of modern medical electrical apparatus, all the prominent manufacturers being represented.

The social part of the programme includes many pleasant surprises.

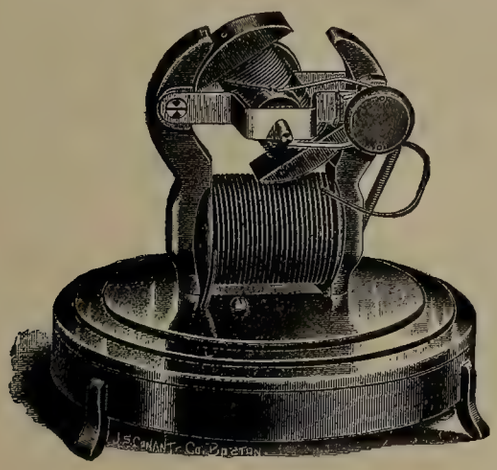
ELECTRIC-LIGHT PLANT WANTED.

A Georgetown, Ky., correspondent informs us that that city is desirous of having an electric-light plant established. There is a good opening presented here for any capitalist or company to make money. The city is willing to pay $2,000 per year for 25 arc lights of 1,200 candle-power, and no difficulty will be experienced in installing from 900 to 1,000 incandescent lights for commercial and private purposes.

Georgetown has a population of 4,000 and plenty of money, but Southerners are proverbially slow to invest their capital, and lack the energy and enterprise characteristic of Northerners. They are, however, willing to pay for conveniences. Full particulars may be obtained by addressing either S. S. Davis, chairman board of trustees, or J. W. Keller of that city.

TOY ELECTRIC MOTOR.

The accompanying illustration shows a neat little motor handled by R. H. Ingersoll & Bro., 65 Cortlandt street, New York. All of the underlying principles of its big brother are contained in this motor, so that not



TOY MOTOR.

only will it afford pleasure to young children but also a great deal of instruction. Its price is such as to bring it within the reach of all. Mechanical toys can be operated by the motor.

doing everything within their power to construct electric battery outfits for medical purposes on the simplest lines possible, so that their operation shall be thoroughly understood without any special knowledge of matters electrical.

The efforts of Messrs. J. C. Vetter & Co., 104 East 23d street, New York, seem to have been particularly successful in this direction, and we take pleasure in illustrating and describing their portable dry Leclanche faradic battery.

In construction special attention was directed to the obtaining of the most efficient service in the simplest form. The current is derived from a dry cell, which commends itself as being a deliverance from the use of the various forms of acid batteries, which have unquestionably proved very troublesome.

This cell is patterned after the style invented by Leclanche, with many improvements added with a view to producing the highest efficiency. Its life is practically unlimited, but in case of accident or after long-continued use it can be readily renewed at a very slight cost. The coil is made of the best material. The interrupter is very nicely adjusted, and all possibility of its getting out of order is precluded by the lever which throws it into action. By the use of a graduated scale the strength of the coil is calculated, thus enabling an accurate record to be kept of doses previously had or given.

Different combinations of current may be obtained through the medium of the three binding sockets for the cord tips. If for any reason this should not prove minute



PORTABLE FARADIC BATTERY OUTFIT.

PORTABLE FARADIC BATTERY OUTFIT.

The use of the electric current as a curative agent has become so extensive that manufacturers have been

enough for scientific purposes, the finest fraction of gradation can be reached by the additional use of the sliding movement of the sleeve with its attached pointer.

The battery is handsomely polished and made in antique quartered oak; its dimensions when closed are $9 \times 6\frac{3}{4} \times 3$ inches.

FIRE.

Messrs. Chas. A. Schieren & Co., the well-known manufacturers of leather belting and lace leather, 45–51 Ferry street, New York, suffered a damage by fire on the night of August 27, to the extent of about $40,000.

The damage was confined principally to the raw leather stored away in No. 51 Ferry street. The firm is again in shape for business, however, and their facilities for turning out belting, etc., are as good now as they ever were.

WATER-POWER.

The Santa Cruz Electric Light and Power Company, of Santa Cruz, Cal., has acquired from Henry Cowell his right to the use of the waters of the San Lorenzo river, commencing from Cowell's line near the Big Trees to the line of the California Powder Company, which is about three miles above the city. The flow of water, which is 26,000,000 gallons a day, with a fall of 110 feet, affords an excellent water-power.

The method of utilizing this power will be by the construction of a dam across the river below Big Trees, and carrying as much of the stream as may be required through a flume to an island situated in the river in the vicinity of Rincon, and just above the powder-mills. This flume will be 5 by 8 feet in size, and 7,600 feet long. On the island will be located the necessary machinery for the generation of electrical power, the capacity of which will be sufficient to operate 5,000 incandescent lights, and 40 electric cars at present in use in Santa Cruz.

Work will be commenced with all speed possible. The river after being used at this island, will be diverted to its natural channel, and will in no way interfere with its use for power by the powder-mills which are located but a little ways below.

TO OWN ITS ELECTRIC-LIGHT PLANT.

The city of Seattle, Wash., is desirous of owning the plant for the lighting of the city by electricity, and requested the city electrician to furnish an estimate of the cost of such. In compliance with the request of the board of public works, an estimate of $80,000 has been submitted for the complete plant as follows:

509 double-arc lights, 300 hoods, 125 miles No. 6 B. & S. weather-proof wire, 300 pole ratchets for suspending lamps, 600 pulleys for suspending lamps, 7,200 feet of cable, 600 pins and insulators, 300 globes, construction and labor, 300 horse-power engines (two of 150 horse-power each), and 3,000 thirty or thirty-five foot cedar poles.

In the above amount is also included the expenses for freight and necessary labor for the installation of the plant.

BALTIMORE NOTES.

Trial trips on the Gilmore and Fayette street routes of the Baltimore Traction Company were made on the night of Thursday, August 25. A speed of ten miles an hour was made, but when the road is formally opened the regulation speed will be 11½ miles an hour.

Residents on Bond street, south of Eastern avenue, are dissatisfied with the way the Central electric line is laying its tracks, claiming that not enough space will be left for wagons or carriages to stand between the curb and track.

The citizens of South Baltimore are still violently opposed to the introduction of the trolley system in their section of the city, and at a recent meeting of the Business Men's Association encouraging reports of the general opposition were received.

The Suburban Railway Company has awarded the contract for the material for the equipment of its Highland and Point Breeze branch to the Johnson Company, of Johnstown, Pa.

President Bowie, of the Baltimore City Passenger Railway Company, said that upon investigation he found the statement made by a member of the South Baltimore Business Men's Association that insurance rates would be raised in that section of the city if the trolley system was introduced, had no foundation in fact, as no action whatever had been taken by the insurance people on the subject.

PERSONAL.

Mr. T. W. Hill, for several years past manager of the Western Union Telegraph Company, Cleveland, Ohio, has received the appointment of cashier of the Cleveland National Bank. Mr. Hill is a very popular gentleman, and his large circle of friends will be glad to learn of his good fortune.

THE DIRECT UNITED STATES CABLE.

In order to afford greater facilities to the mercantile community in and around Mark Lane, London, and especially to produce and milling brokers, The Direct United States Cable Co. has opened a new chief office at 39 Mark Lane. This office will always be open for business, and is directly connected with the cable terminus on the other side, between which and New York there is only one transmission.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, Sept. 3, 1892.

Mr. John E. Wright, electrical engineer, expects to leave for Europe September 17, on special business.

Mr. Nikola Tesla has returned to this city after an absence abroad for several months. He is looking remarkably well.

Mr. J. C. Francis, the well-known electrician, gave us a pleasant call during the week. Mr. Francis was formerly connected with the Magneto Electric Manufacturing Company, 520 W. 35th street.

Mr. Orlando Monroe, late superintendent of the Safety Insulated Wire and Cable Co.'s factory, has been appointed assistant general manager, and Mr. Marquette, late foreman of the same factory, succeeds Mr. Monroe.

The National Tube Works, of Pennsylvania, are manufacturing 100 miles of iron pipe, which will be used to connect the Hygeia Springs at Waukesha, Wis., with the World's Fair at Chicago. These pipes will be coated inside and out with the P. & B. compound of the Standard Paint Company, 2 Liberty street, this city.

The Zucker & Levett Chemical Co. 10–14 Grand street, claims that its Giant dynamos take less power to do an equal amount of work than any other machine. The company reports that sales of Hercules dynamos and motors for light and power purposes are steadily increasing, showing that their reputation is established on a solid basis.

The New York Equipment Co. is getting up an inferior arc lamp which will possess some novel features. It

will be a short lamp, and so designed that servants can trim it with as great facility as a regular lamp-trimmer. This can be done with impunity, as there is no dangerous current to fear, the lamps being designed for use on Edison circuits.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Brooklyn, will build a new plant, and has accepted the plans tendered by the Berlin Iron Bridge Company, of East Berlin, Conn. The dimensions of the building will be 74 x 100 feet; the walls will be of brick and the roof will consist of the Berlin Company's anti-condensation corrugated iron construction.

THE EMPIRE CHINA WORKS, 144–156 Green street, Greenpoint, Brooklyn, cannot be beaten for the general excellence of the staple articles of hard porcelain manufactured by them for electrical purposes. The varieties of articles are being constantly increased. The company possesses every facility for turning out rapidly any of the specialties on which it is extensively engaged.

MR. CHAS. D. SHAIN, formerly district manager Edison General Electric Company, has opened an office at 136 Liberty street, and will carry on an electrical engineering business, and act also as manufacturers' agent. Mr. Shain has been appointed selling agent for the Weston Electrical Instrument Company, of Newark, N. J. He is making arrangements to represent other well-known concerns.

THE PHILADELPHIA TRACTION COMPANY has placed a large order with the Standard Underground Cable Company, of Pittsburg, Pa., for wires and cables to be used on the new electric railway system now under course of construction in that city by the Field Engineering Company of this city. These wires and cables will be insulated with the P. & B. compound made by the Standard Paint Company, 2 Liberty street.

B. W. PAYNE & SONS, Cortlandt street, has received an order from the Elmira Silk Company, of Elmira, N. Y., for a complete steam-plant consisting of one 150 H. P. improved Payne Corliss engine and two 100 H. P. boilers to be used for power and lighting purposes in the mill. Other orders lately received were: A complete steam-plant of one 125 H. P. Payne Corliss engine and one 100 H. P. boiler for the central station of the Cornwall (N.Y.) Electric Light Company; one 300 H. P. triple-expansion Payne Corliss engine for the Elmira Railway Company, Elmira, N. Y.; one 100 H. P. Payne Corliss engine for the Hotel Balmoral, New York, to be used for lighting purposes.

T. J. MURPHY, 136 Liberty street, has an order for an Italian marble switchboard for the Mail and Express Building, the size of which will be 11′ 11½″ x 7′ x 1½″ thick, made in four pieces, each piece of a different width, and all 7 feet long. The reason for making it in this way is, it avoids the crossing of switches where there are marble joints. A small bevel is to be put all around, which will prevent any chipping in handling, and adds considerably to the appearance of the board. He has also received the order for a switchboard for Boston, 18′ long, 6½′ high, made in six pieces, each piece 3′ x 6′ 6″ x 1″ thick. This board is to be marbleized slate, and all the drilling for switches, which are to be mounted directly on the slate, will be done at the quarries before the slate is marbleized. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	205 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	116 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y.	6,500,000	100 00	100 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	109 00
General Electric Co., 5s	4,000,000		*104
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	23 00
Laclede Gas pref.	2,500,000	100 00	65 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	57 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co	39,767,200	100 00	12 75
Postal Telegraph	10,000,000	100 00	78 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Ongley Electric Co., N. Y.	250.000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	94 00
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	34 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	48 50
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

A most important forward movement has been made in New York this month, and one which will be felt by the electric-light stockholders in all parts of the country

for a great many years. I allude to the contract granted to the Edison Illuminating Company for illuminating Fifth avenue up to Central Park, through its incandescent circuit with low-tension arc lamps. The price obtained is most satisfactory, twenty-five cents per lamp per night or fifty cents for the pair, as by this system two lamps are required to overcome the heat of the electric current. I believe this is the first contract for public street-lighting the Edison company has made with any large city or for public arc-lighting from an incandescent generator. Its commercial system has been in existence only about a year and has given perfect satisfaction. Where a medium amount of illumination is desired the Edison arc system brings in more profit to the company than any other. It is in fact the happy medium between the arc and incandescent light, commanding a price very nearly up to the arc, and giving often better satisfaction. The wires are of course underground in Edison ducts, which, once in place, practically control the territory, being able to supply everything required except the two thousand candle-power light. It will be seen by referring to the quotations that there is small chance for the stock to drop back to the eighties again for many years. The price at which the five per cent. bonds are sold—109—speaks volumes. It means that permanent investors have concluded to put money In the security and let it lay there, for there is no speculation in buying a local 5 per cent. electric bond at 109 where there is so much opposition or competition as in this business in the city of New York. There are plenty of railway 5 % bonds which have, and no doubt will continue, to pay their coupons regularly, that are selling to-day in the eighties; and this reminds me that I am offered sixty shares of the parent Brush electric stock (Cleveland), dividends guaranteed by the Thomson-Houston Co., at $40 per share. Here is a chance for either investment or speculation. The stock is some of that which was not turned over when the Brush company sold out, and consequently the dividend was guaranteed to enable the purchase to be completed and the dividends have been regularly paid. General Electric is slowly but steadily mounting the hill, the top of which will soon be 100 per cent. premium for the common stock, the preference standing firm at 120 and the five per cent. bonds at 105; as to how long the discrepancy between the two 5 % bonds will remain I will not venture an opinion beyond the fact that I personally prefer the Illuminating. The Westinghouse seven per cent. preference shares having crossed par are a solid purchase at par, and will be quoted much better before the year is out. While other lines of business will no doubt have extraneous circumstances to contend with, the extension of electrical industry in its various forms must increase rapidly and continuously for several years. The usual number of new enterprises, or additions to those already inaugurated, are offering. I hear this week of an electric railway company with franchise, etc., after capital; and also a party desirous of purchasing a street-car line in any settled community. The general electric business is all that could be wished.

TRADE NOTES.

The Brown & Sharpe Manufacturing Company, Providence, R. I., has just issued a new edition of the illustrated pamphlet descriptive of the well-known Universal cutter and reamer grinder made by it. The subject-matter has been entirely rewritten, and a number of new cuts have been introduced. The book may be obtained upon application.

A. Remhof, 375–381 Kent avenue, Brooklyn, is the sole owner and manufacturer of the "Remhof" ring-locking shade-holder for incandescent lamps. The principal feature in this shade-holder is that no screws whatever are employed to fasten it to the socket, and thus the annoyance of small screws is avoided. It is made to fit standard and special size sockets. The manufacturer claims that it is the best, strongest, cheapest and handsomest finished shade-holder in the market.

The Electrical Signal and Alarm Company has been incorporated at Birmingham, Ala., to manufacture an electric device for the prevention of collisions on railroads, invented by F. P. Slosser. Capital, $200,000. Incorporators: F. P. Slosser, M. Maloney and C. P. Jones.

WATER AND STEAM FOR ELECTRIC WORK.

Goshen, Ind., July 18, 1892.

James Leffel & Co., Springfield, Ohio.

Gentlemen: We are using a 66-inch wheel of your make, and it works very well indeed. We use it to drive a thousand-light dynamo, as well as to run our 500 bbl. mill. We have a governor furnished by you, and the regulation is as near perfect as can be made.

We use steam as an auxiliary power when the water is low. The steam-power is also very uniform and steady, as we have a Parallel Compound-Condensing Corliss engine of 300 H. P. When we change from steam to water power the users of light cannot tell the difference.

Truly yours,

(Signed,) The Goshen Milling Co.
F. E. C. Hawks, *Sec'y and Treas.*

ONE HUNDRED "WARD" ARC LAMPS ON ONE CIRCUIT.

Wilmington, Del., June 25, 1892.

Electric Construction and Supply Company,
18 Cortlandt street, New York city.

Gentlemen: We are pleased to say we are now operating about one hundred Ward lamps on our constant-potential circuits, with good results both to ourselves and customers. Very truly yours,

The Wilmington City Electric Co.,
C. R. Van Trump, *Eng. and Mgr.*

TESTED ON ITS MERITS.

Biddeford, Maine, June 9, 1892.

Forrest Silver Bronze Packing Co.,
115 Liberty street, New York city.

Dear Sirs: Yours of May 31 came to hand promptly, but the delay was caused by the writer's absence from home. I cannot approve the bill until something like the 60 days' trial that you promised we should have in your letter of April 5.

The packing is doing splendid work, and we shall undoubtedly want more of it; but I am a little cautious about approving new things on short trials. The Katzenstein packing answered quite well for 30 days and afterwards proved worthless. We will be prompt with the payment and further orders. Yours truly,

Pepperell Mfg. Co.

All books on electrical subjects including electric railways, can be obtained at the office of The Electrical Age Publishing Co., New York.

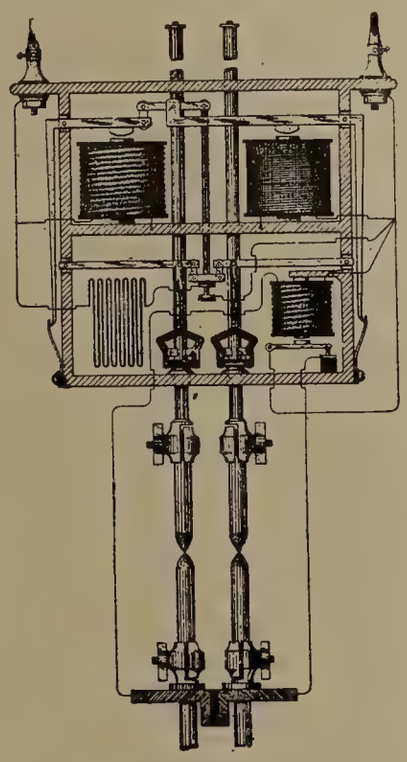
The Electrical Age's Illustrated Patent Record.

Issued August 30, 1892.

481,560. Secondary Battery. William W. Griscom, Haverford College, assignor to the Accumulator Company, Philadelphia, Pa. Filed Nov. 16, 1891.

481,573. Volt-Ammeter. Fredrick A. La Roche, Philadelphia, Pa. Filed Sept. 1, 1891.

481,590. Auxiliary Fire-Alarm System. Joseph Sachs, New York, N. Y. Filed March 29, 1892.



481,677.—DUPLEX-ARC LAMP.

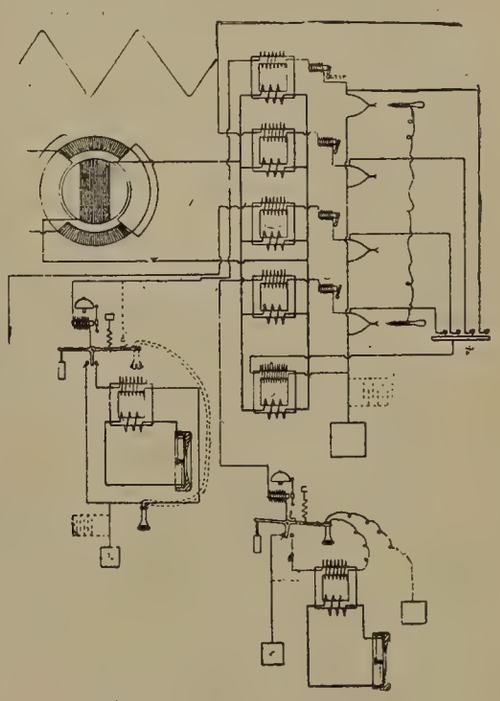
481,613. Signal-Timing Apparatus. Henry A. Chase, Boston, Mass., assignor to Albert Watts, same place. Filed May 11, 1892.

481,617. Lightning-Arrester Cut-Out. James P. Freeman, Washington, D. C., assignor of two-thirds to Marvin C. Stone and Philip T. Dodge, same place. Filed Dec. 24, 1891.

481,646. Electric Fan. Franklin H. Beers, Newark, assignor to himself, William M. Tallman, Plainfield, N. J., and Erastus Hayes and Al. R. Brandly, New York, N. Y. Filed Feb. 26, 1892.

481,664. Galvanic Battery. William J. Engledue, Byfleet, England. Filed March 23, 1892.

481,665. Safety Attachment for Electric Conductors. Rudolph Furgang, Boston, Mass. Filed Jan. 18, 1892.



481,878.—SYSTEM OF TELEPHONY.

481,666. Safety Attachment for Electric Conducting Wires. Rudolph Furgang, Boston, Mass. Filed Jan. 25, 1892.

481,677. Duplex-Arc Lamp. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 3, 1888.

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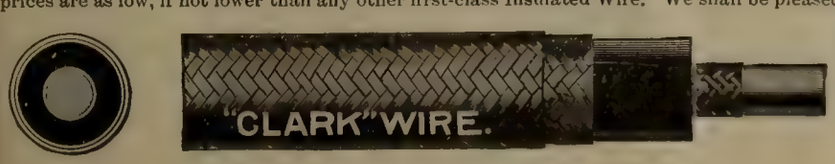
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PATENTS.—Continued.

481,678. Multiple-Switchboard Telephone-Exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 22, 1889.

481,679. Telephone-Exchange. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 16, 1891.

481,692. Electric Cigar-Lighting Lamp. William J. Eastman, Waterville, N. Y. Filed Feb. 8, 1892.

481,701. Electric Motor or Dynamo-Electric Machine. Robert Lundell, Brooklyn, assignor of two-thirds to Edward H. Johnson, New York, N. Y. Filed March 14, 1892. Patented in England.

481,711. Electric Door-Alarm. Merton W. Bessey, Waterville, Me. Filed Nov. 14, 1891.

481,726. Electrically-Controlled Stop-Motion for Knitting-Machines. Veeder S. Clute, Cohoes, N. Y., assignor of one-half to William W. Stevenson, same place. Filed Oct. 28, 1891.

481,739. Electric Motor and Regulating Device Therefor. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Filed April 29, 1889.

481,775. Electrically-Driven Machinery for Cutting Coal. Llewelyn B. Atkinson and Claude W. Atkinson, London, England. Filed Aug. 18, 1891.

481,781. Rheostat. Charles E. Carpenter, Minneapolis, Minn., assignor of one-third to W. S. Andrews, New York, N. Y. Filed Feb. 18, 1891.

481,785. Electric-Lighting System. Pitt Cravath, Whitewater, Wis. Filed May 31, 1892.

481,817. Trolley-Carriage for Conduits. Stephen L. Platt, Elgin, Ill. Filed June 18, 1891.

481,842. Magnetic Brake. Armand de Bovet, Paris, France. Filed Oct. 24, 1891.

481,847. Fire-Alarm Telegraph. Andrew J. Coffee, Portland, Oreg. Filed May 12, 1892.

481,878. System of Telephony. Elihu Thomson, Swampscott, Mass. Filed Feb. 15, 1892.

481,904. System of Electric Lighting. Ernest Huber, New York, N. Y. Filed Oct. 7, 1891.

481,905. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Sept. 21, 1891.

481,912. Conduit for Electric Conductors. Augustus Noll, Mount Vernon, N. Y., assignor to Abner J. Tower, trustee. Boston, Mass. Filed April 28, 1892.

481,913. Conduit for Electric Conductors. Augustus Noll, Mount Vernon, N. Y., assignor to Abner J. Tower, trustee, Boston, Mass. Filed April 28, 1892.

481,914. Electric-Circuit Connection. Augustus Noll, Mount Vernon, N. Y., assignor to Abner J. Tower, trustee, Boston, Mass. Filed April 28, 1892.

481,916. Electric Central Clock. Nicolaus Prokhoroff, Kiev, Russia, assignor of one-half to Nicolaus Fahlberg, same place. Filed Sept. 4, 1891. Patented in Germany, in Belgium, in France and in England.

481,919. Electric Guest-Call. Franklin Benner, Minneapolis, Minn. Filed Oct. 26, 1891.

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ELECTRICAL AGE

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INIMICAL TO GOOD MORALS.

A new use has been found for fan-motors by those members of the New York Produce Exchange who have their bump of speculation developed to an abnormal degree. Transactions in produce have evidently lagged in activity recently, and to supply the need for excitement in some form or another, some of the gay and festive members conceived the plan of turning the fan-motors into gambling apparatus. The *modus operandi* was to mark the blades of the fan, and by the manipula- of the switch the fan was made to perform the duties of a roulette wheel. The actions of the members of the Exchange are regulated by by-laws, but the chairman could find nothing in the code to cover this form of sport, so that official was powerless to stop it.

A MASTER OF HIS SUBJECT.

For comprehensiveness and clearness the article headed "The Electric Transmission of Power," by Capt. Eugene Griffin, which is published on another page, we think is entitled to first rank. He tells in a few words the limitations of the use of electric power and its advantages over other forms of energy, and he also dwells upon the very common error of supposing that electricity will eventually take the place of steam.

Capt. Griffin considers, in an able manner, the various methods of producing electricity, the conditions necessary for the transmission of power by electricity, and describes notable electrical power-transmission plants. He has such an easy way of describing things that it requires no apparent effort on the part of hearers and readers to thoroughly understand his subject.

WAS THIS A FRAUD?

A few days ago a press despatch from Boston announced the arrest at Wiscasset, Me., of the Rev. G. S. Chadbourne in an action of tort brought by Boston parties to recover $11,000 damages. According to the despatch, the Rev. Chadbourne organized a company in Maine, with a capital of $100,000, to manufacture an electric motor with a storage battery. He states that he had no intention of defrauding any one, and that he requested all purchasers of stock to investigate the character of the investment before purchasing. On the other hand, it is said that he disposed of the stock in every direction for what it would fetch.

The reverend gentleman was placed in jail pending the furnishing of bail.

THE CHOLERA.

Another example of the availability of electricity for the needs of humanity, whether in times of happiness or distress, is furnished in the unfortunate state of affairs now existing in New York harbor. Several ocean steamships having cholera aboard are in quarantine in the lower bay. The patients are taken from these vessels to the hospital on Swinburne Island, which is located within the quarantine grounds, and there properly cared for. Prior to the appearance of the cholera in our harbor there was no other communication with Swinburne Island than by tug, but under the present extraordinary circumstances other more reliable and swifter means of communication became imperative. To meet the necessities of the case the Western Union Telegraph Company laid a special cable to the island and placed an operator in charge of the office, and now the quarantine hospital, which is practically completely isolated from the rest of the world, as far as personal communication is concerned, is bound by an electric tie with the mainland. The health officers by this means are enabled to keep posted as to the progress of the disease among the unfortunate ones. The resources of the Western Union Company are unlimited, and it takes an occasion of this sort to show what an influential factor it is in matters pertaining to the welfare of the people.

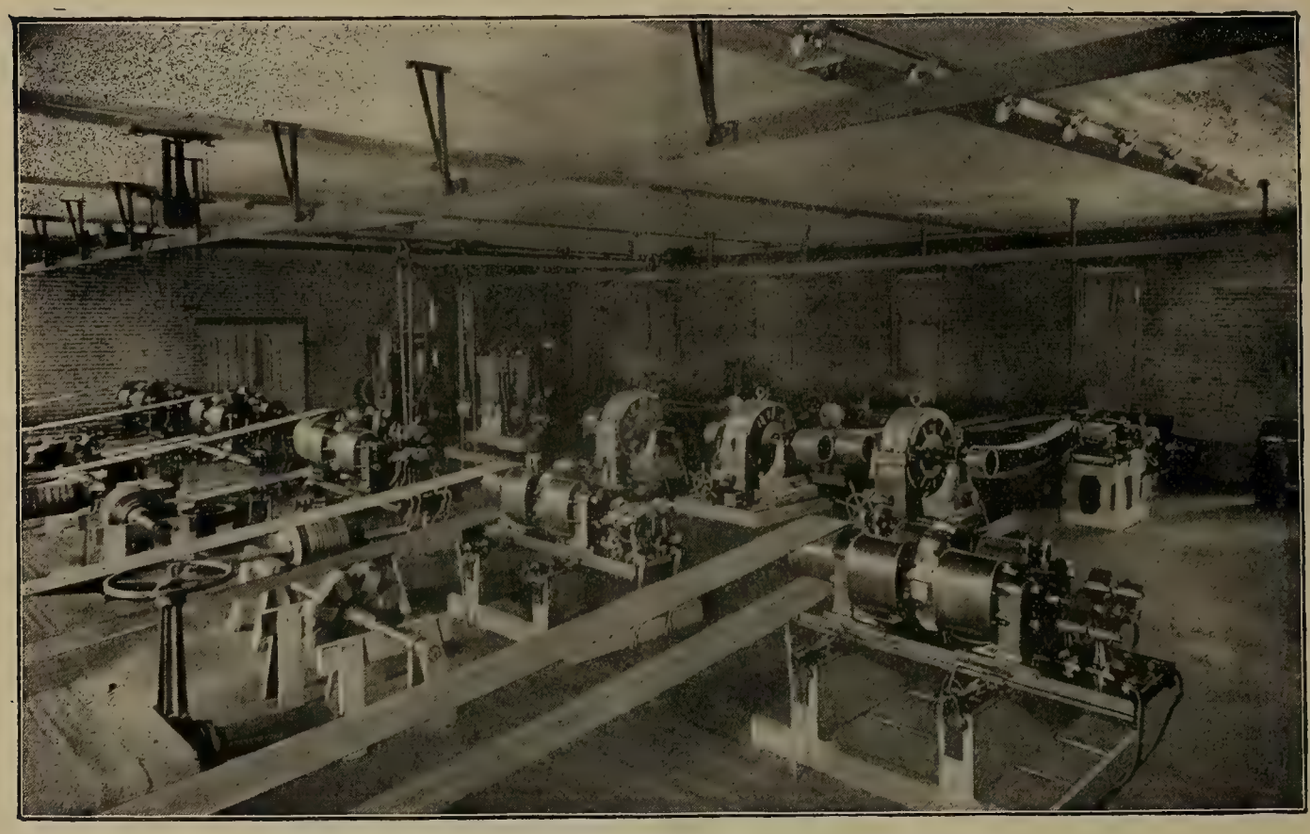
ELECTRIC POWER IN MINING.*

BY IRVING HALE.

There is a genuine fascination in the modern applications of electricity to the needs of business and social life—to the transmission of messages over continents and seas by means of the telegraph, to the transference of the human voice, with all its individual peculiarities and inflection, through the telephone, and to the illumination of cities by electric currents distributed from a single station. But none of these appeal as strongly to the imagination as the transmission of power by this mysterious force. When we watch a ponderous engine, with its strong rods and cranks of steel and massive fly-wheel, anchored to a foundation of solid masonry to resist the vibrations produced by its mighty efforts, it is easy to appreciate the enormous power that is being developed; but when we are told that all this power is required to revolve a bundle of wires in the open space between the poles of a magnet, and that in those wires nine-tenths of this mechanical energy is converted into electrical energy and passes out of the building on a few small wires which undergo no strain and give no visible evidence of the work that is being done within them, and that this electric energy can be transmitted for miles and reconverted into mechanical power, we cannot fail to be impressed with the remarkable nature of this transformation and the possibilities which it involves.

The advantages of producing power where it can be done at comparatively small expense, either with water-power or cheap coal, and transmitting it to places where water-power is not available and fuel is expensive, are so evident as to require no discussion, and it is obvious that there are few places offering better fields for such operations than the mining districts, where water-power is generally available within a few miles, but seldom at the mine or mill, and where the cost of coal is almost always great. Moreover, electricity is peculiarly adapted to underground work, where steam is objectionable on account of inconvenience of pipes, loss by condensation, and heat produced, while the transmission of power by compressed air is inconvenient, expensive and wasteful.

Indeed, so striking are the advantages and possibilities of electric transmission of power that there has been a strong tendency to exaggerate and to allow the spirit of prophecy to override conservative judgment. For instance, while it is theoretically possible to run the factories of Chicago by power transmitted from Niagara Falls, and while it is possible that a small plant of this kind may be installed at the World's Columbian Exposition as an illustration of what can be accomplished, still in the present state of the art such an enterprise would not be commercially feasible, nor is it likely, with all the improvements that will be made for many years to come, that the power of Niagara will be felt beyond a radius of a hundred miles. It is not intended to imply that this distance is necessarily the limit of successful and profitable transmission of power by electricity. It is quite possible that in the near future plants may be in commercial operation over even greater distances, but they will be in localities where fuel is sufficiently expensive to make the saving pay interest on the large investment required.



ROARING FORK ELECTRIC COMPANY'S PLANT, ASPEN, COLORADO.

The question is frequently asked, "How far can water power be successfully and profitably transmitted by electricity?" The answer depends upon many conditions. In one situation it might not pay to transmit power a mile, while in another it might be transmitted fifty miles and pay large dividends on the investment. The principal conditions affecting this question are the cost of water-power, cost of fuel where power is to be used, amount of power required and number of hours used per day; and lastly the voltage or electrical "pressure" that can be employed satisfactorily. When it was discovered that the dynamo, which generates an electric current when its armature is revolved by some extraneous power,

* *Engineering Magazine*, September, 1892.

becomes a motor and will do work when a current is sent through it from another dynamo, and that this action can take place regardless of the distance between the two machines, the feasibility of transmitting power by electricity was at once recognized. In the enthusiasm over this discovery and its possible effects there has been quite a general tendency to overlook the important question of dollars and cents, which is the criterion by which the fate of every purely engineering or business enterprise must be determined. The manner in which the financial aspect of the question is affected by distance, voltage, and the other conditions named can be more clearly shown by a brief examination of some of the principles governing electric transmission of power.

The total efficiency of an electric-transmission plant (ratio of power delivered on motor pulley to power required to run dynamo) is usually between 60 and 70 per cent., there being a loss of 10 or 12 per cent. in converting mechanical into electrical energy in the dynamo, a similar loss in reconverting electrical into mechanical energy in the motor, and a loss in the line depending on the relation between the size of wire and the current transmitted. This line loss (due not to leakage, which is insignificant in a properly-insulated line, but to the waste of energy in overcoming the resistance of the conductor) may be made as small as desired, no mattter how great the distance, by using sufficiently large wire, but this involves additional expense, and it is evident that for each case a point will be reached where farther increase in size of wire would be inadvisable, as the interest on additional cost of copper would exceed the value of the power saved. In most cases the best loss in line, all things considered, will be between 10 and 20 per cent., which, with the losses in dynamo and motor, will give a total efficiency of 60 to 70 per cent.

The energy lost in line is dissipated in the form of heat, and the amount of energy so dissipated is equal to the square of the current multiplied by the resistance of the wire, this law being expressed by the equation $H = C^2 R$, in which H represents energy converted into heat (measured in watts), C represents current (in ampères), and R resistance of wire (in ohms). As the resistance of a wire varies directly as its length and inversely as its cross-section, this resistance (and consequently the line-loss) will increase with the distance, unless the cross-section of wire is increased as rapidly as its length, which means that the weight of wire will increase as the square of the distance, and that its cost will soon become prohibitory. To keep the weight of wire constant as distance increases, the area of cross-section must be correspondingly decreased, which will make the resistance increase as the square of the distance. To keep the line-loss constant, the equation shows that C^2 must be correspondingly decreased, which requires it to vary inversely as the square of the distance or C to vary inversely as the distance. How can this be done and still transmit the same amount of power? The answer to this question is suggested by the formula for the energy of an electric current, W (energy) = C E, E representing electromotive force, commonly called voltage or "pressure," measured in volts. This equation shows that the same energy may be transmitted by a small current, provided the "pressure" is correspondingly increased (an analogy to water-power), and from what precedes it is evident that, if the electromotive force increases in the same ratio as the distance, a given amount of energy can be transmitted with the same loss and the same total weight of wire, regardless of the distance.

This apparent avenue of escape from the difficulties of long-distance transmission is again blocked by the objectionable features of the high-voltage or "high-tension," current, chief among which is the difficulty of manufacturing dynamos and motors which will be proof against the almost uncontrollable desire of such current to puncture insulating materials, produce "short-circuits," "grounds," and "burn-outs," and make uncalled-for pyrotechnic displays around the commutator.

A partial solution of this difficulty is expected from the "three-phase" system recently experimented upon in Germany, where power was successfully transmitted from Lauffen to Frankfort, a distance of 108 miles. In this system the dynamo generates an alternating "three-phase" current of large "quantity" and low "pressure" or voltage, which is converted by a transformer into a current of small quantity and enormously high voltage (20,000 to 30,000 volts if necessary), that can be transmitted over a comparatively small wire and reconverted at the other end into a low-voltage current which operates the motors. The advantage of very high voltage in transmission is secured while avoiding its disadvantages in dynamos and motors. While the Lauffen-Frankfort installation was a scientific experiment rather than a commercial enterprise, still the results obtained are regarded as very encouraging, and the development of this method is expected to exert a powerful and beneficial influence on long-distance transmission. It must not be forgotten, however, that the transformers at both ends of the line add materially to the cost of the plant, and that the pole line and labor for such a distance, regardless of size of wire, become a serious item of expense, and that consequently electric transmission to very long distances must still be limited to cases where fuel is comparatively expensive and the saving is sufficient to pay interest on the required investment.

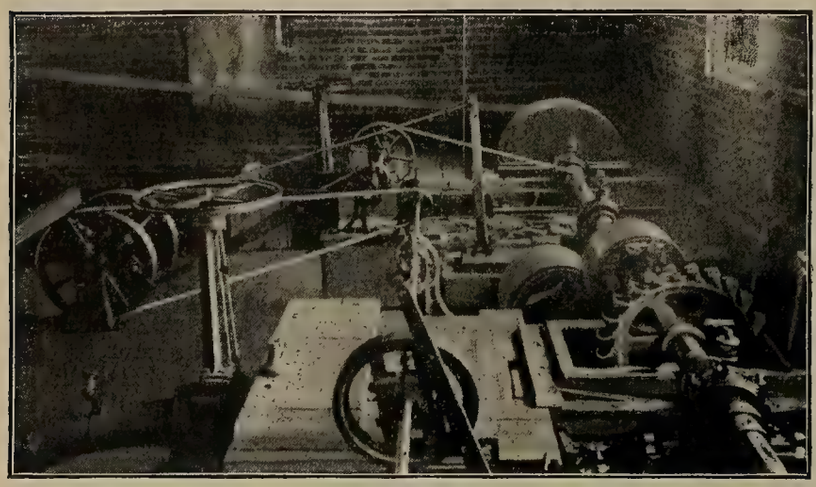
The foregoing discussion shows how the distance to which power can be transmitted profitably is affected by the question of voltage. The other conditions mentioned as affecting this problem require no detailed discussion, as it is evident that the saving effected by water-power over steam will be greater when water-power



PLANT OF THE OLYMPIA LIGHT AND POWER COMPANY.

is cheap, fuel dear, and the work continuous, than when reverse conditions exist, and that the greater this saving the greater will be the justifiable investment in electric plant and the distance to which power can be profitably transmitted.

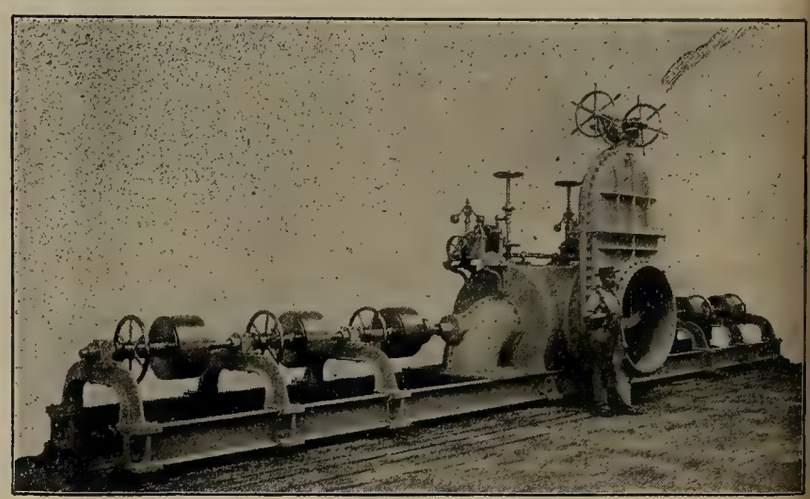
Equations and curves have been deduced showing in a general and approximate manner the cost and operating expenses of electric-transmission plants and the limits within which they will be profitable (pay 20 per cent. on investment) under various conditions. A few examples may be of interest here. If coal costs $4 per ton and power is used ten hours per day, 200 horse-power can be electrically transmitted four or five miles at 1,000 volts E. M. F., and pay 20 per cent. per annum on the investment. If used steadily twenty-four hours per day, it can be transmitted eleven or twelve miles under the same conditions. If 2,000 volts can be conveniently used, these distances will be nearly doubled; in fact, the limiting distance will increase almost in proportion to the voltage employed. Looking at the question from another standpoint, it may be shown that if coal costs $6 per ton at a mill where 100 horse-power is used twenty-four hours per day, and water-power can be developed at moderate cost at a distance of five miles from the mill, and there is no objection to using an E. M. F. of 2,000 volts, the saving effected by using electric power will pay 50 to 60 per cent. per annum on the cost of the plant. If, however, this mill is in a locality where slack coal can be obtained for $1 per ton, and power is used only ten hours per day, it would not pay to install an electric plant if water-power could be had within a quarter of a mile, as the saving would not pay interest on cost of water-power, dynamo and motor, without any line whatever. Examples might be multiplied indefinitely, but the instances mentioned are sufficient to show how impossible it is to give a general answer to the question: "How far can power be profitably transmitted by electricity?" and how necessary it is to carefully weigh all existing conditions. The cases cited show, however, that, whatever may be the limiting distance to which power may eventually be transmitted profitably by electricity, there is at present a wide field for enterprises of this kind, presenting an attractive investment for capital, and nowhere are the advantages of electric power more striking than in the mining districts.



ROARING FORK ELECTRIC COMPANY'S PLANT.

Aspen, Colorado, is entitled to the name of the pioneer camp for electric-mining machinery. The first electric hoist was installed there in 1888 and consisted of one of the earliest types of Sprague street-car motor geared to a flat-friction hoist. It has been in use ever since and is still giving satisfactory service. There are now at Aspen five electric hoists, three electric diamond drills, three electrically driven blowers for ventilating, a 20 horse-power motor running the sampling works, and several smaller motors used for various purposes, while many of the mines are lighted by incandescent lamps. The Aspen Mining and Smelting Company operates its own plant, consisting of two 50-horse-power dynamos supplying current for three hoists, one diamond drill, one motor driving a blower, and another running a machine-shop, as well as lights for the tunnels and workings. The other electric machinery, together with more than a hundred arc-lights and nearly 3,000 incandescents for town and mines, are supplied from the plant of the Roaring Fork Electric Light and Power Company, which is one of the most interesting on the continent and is a good example of the mountain style of water-power and electric plant.

The mining town of Aspen is situated on Roaring Fork at its junction with Hunter creek, a small stream that tumbles down the ravine on the northwest side of Smuggler Mountain, on which are situated such famous mines as the Smuggler, Johnston, Della S., and the fabulously rich Mollie Gibson. On Hunter creek, about two-and-a-half miles from its mouth, a small dam is built, the principal objects of which are to give a sufficient body of water to avoid stoppage by surface and anchor ice and rubbish, and to provide a small reserve of water to tide over the early morning hours, when mountain streams fed from the melting snows are lowest. From this dam extends a flume twenty-four by eighteen inches, a distance of 9,000 feet to a point on Smuggler Mountain, 876 feet above the power-house, which is located near the bank of Roaring Fork a little above the mouth of Hunter creek. From the end of the flume a wrought-iron pipe 4,500 feet long extends straight down the mountain and across the gentle slope at its foot to the power-house, where it supplies water through nozzles to eight two-foot Pelton wheels, rated under this head of 876 feet at 175 horse-power each, which run the dynamos for supplying light and power. In the small view of the power-house is also shown the water-wheel governor, designed by Mr. Doolittle, manager of the company, which, by means of differential gearing, utilizes the dif-



VICTOR TURBINES ON HORIZONTAL SHAFT.

ference in speed between a wheel with steady load and the wheel to be governed to move the nozzle of the latter wheel and vary the amount of water delivered against the buckets.

The quiet little stream flowing from the power-house gives no indication of the vast power that it has just been the means of generating, but this power can be appreciated by raising the covers from the wheels and looking at the water as it is hurled from the nozzles against the buckets, and if any further evidence of its terrific force be required, it can be obtained by attempting to pinch one of these little jets between the thumb and forefinger. The spray on its surface presents a velvety feeling to the touch, but when the fingers have sunk into the jet a sixteenth of an inch, it is as hard and impenetrable as if it were frozen, and it is said to be impossible to cut it with an axe.

Probably the most remarkable electric plant in the country, all things considered, is the one at the Virginius mine, near Ouray, Colorado. The water-power is located on Red Cañon creek, nearly four miles from the mine, which is near the top of Mt. Sneffles, far above timber-line in the region of perpetual snow, and at an altitude of 12,700 feet above the sea. The idea of transmitting this water-power to the mine by means of electricity, at a time when such an undertaking was regarded as a somewhat doubtful experiment, was very forcibly suggested by the fact that coal had to be packed to the mine on burros and cost delivered about $20 per ton, or $100 per day for the amount of power used at that time.

The power plant is similar in its general features to the one at Aspen, just described. From the power-house the line extends for some distance up the cañon through dense timber, where the wires are subject to the danger of falling trees blown down by the terrific wind storms which prevail in that locality. Leaving the cañon, the wires are carried up a precipitous bluff, ornamented here and there with the carcasses of burros which have slipped or been crowded from the narrow trail known as "the zigzag," effectually disproving the commonly-accepted theory that it is impossible to kill a burro. From timber-line, at the top of this bluff, the line is built across a rocky plateau, where the snow during the first winter covered the tops of some of the poles, which were at that time only twenty feet high, but which have since been replaced by longer ones. For the last half mile or so the poles are set along the base and on the sides of high cliffs, to avoid as far as possible the destructive snow-slide. The current is carried down the mine by the best water-proof cables, boxed for mutual protection of wires and men, the electric pressure (800 volts) being a little too strong to suit the taste of the average miner. The power (about 250 horse-power in all) is distributed among two pumps, one hoist, one blower, and two mills. It will be seen that this plant comprises nearly all kinds of machinery employed in mining operations, and encounters every difficulty to which electric plants are heir, including the worst enemy of electric machinery, lightning, in its most violent form. It is not surprising that troubles were experienced in the early operation of the plant, but the gratifying facts that these have been remedied and that the plant is running in a perfectly reliable and satisfactory manner are evidence that electricity in mining has come to stay.

It is a conservative statement that there are, in Colorado alone, hundreds of mines using steam-power produced by very expensive fuel that are sufficiently near to good water-power to be operated by electricity at a saving that would pay from 40 to 100 per cent. per annum on the investment, and it is not a wild prophecy to say that within the next three years scores of such plants, developing thousands of horse-power, will be installed.

The effect of such enterprises will be powerful and widely felt. By decreasing the cost of mining and treating ores, mines which now pay will pay better, while many properties which, on account of low-grade ore or remoteness from railroads and fuel supply, cannot now be worked without a loss can be made by means of electric power to yield satisfactory profits. The effect will be to increase the metal output, give employment to more men, build up the mining towns, exert a beneficial reflex influence on the commercial cities, and in general benefit the entire mining districts.

Next to the silver question, the introduction of electric power is at present the most important factor affecting the development of the mining industry, and, unlike free coinage, electric power is not dependent on legislative action, but is entirely under the control of the mining men themselves.

OLD-TIMERS AND MILITARY TELEGRAPHERS.

The twelfth reunion of the Society of the United States Military Telegraph Corps and Old-Time Telegraphers' Association took place in Omaha, Neb., on the 14th and 15th instants.

The president of the Old-Timers, Maj. E. Rosewater, editor and proprietor of the Omaha *Bee*, conceived the idea of holding the reunion in his own city, in which he has great pride, and the members of the association are proud of its president. Maj. Rosewater is known throughout the country through his position with reference to the Postal-Telegraph bill in Congress. He is a



MAJOR EDW. ROSEWATER.

Bohemian by birth, and came to this country in 1854. He is a man of undaunted energy, and through this spirit has acquired for himself a name and position that is very rarely attained these days. He is thoroughly sympathetic with all popular movements and enters into them with great zeal. He was a telegraph operator at one time during his career, and it is on this account that he is so closely identified with telegraphers and their interests. He served in the war, and afterwards resumed commercial telegraphy. He is now editor and propri-

etor of the *Bee*, which is of his own creation and one of the most influential daily journals of the country.

Maj. Rosewater was a member of the Nebraska legislature in 1870. He was born in Prague, Bohemia, on January 28, 1841.

A FINANCIAL FAILURE.—While the electrical exhibition which was recently held at the Crystal Palace, London, England, was a perfect success, so far as the exhibits were concerned, it was a failure financially, the expenses exceeding the receipts by nearly $5,000.

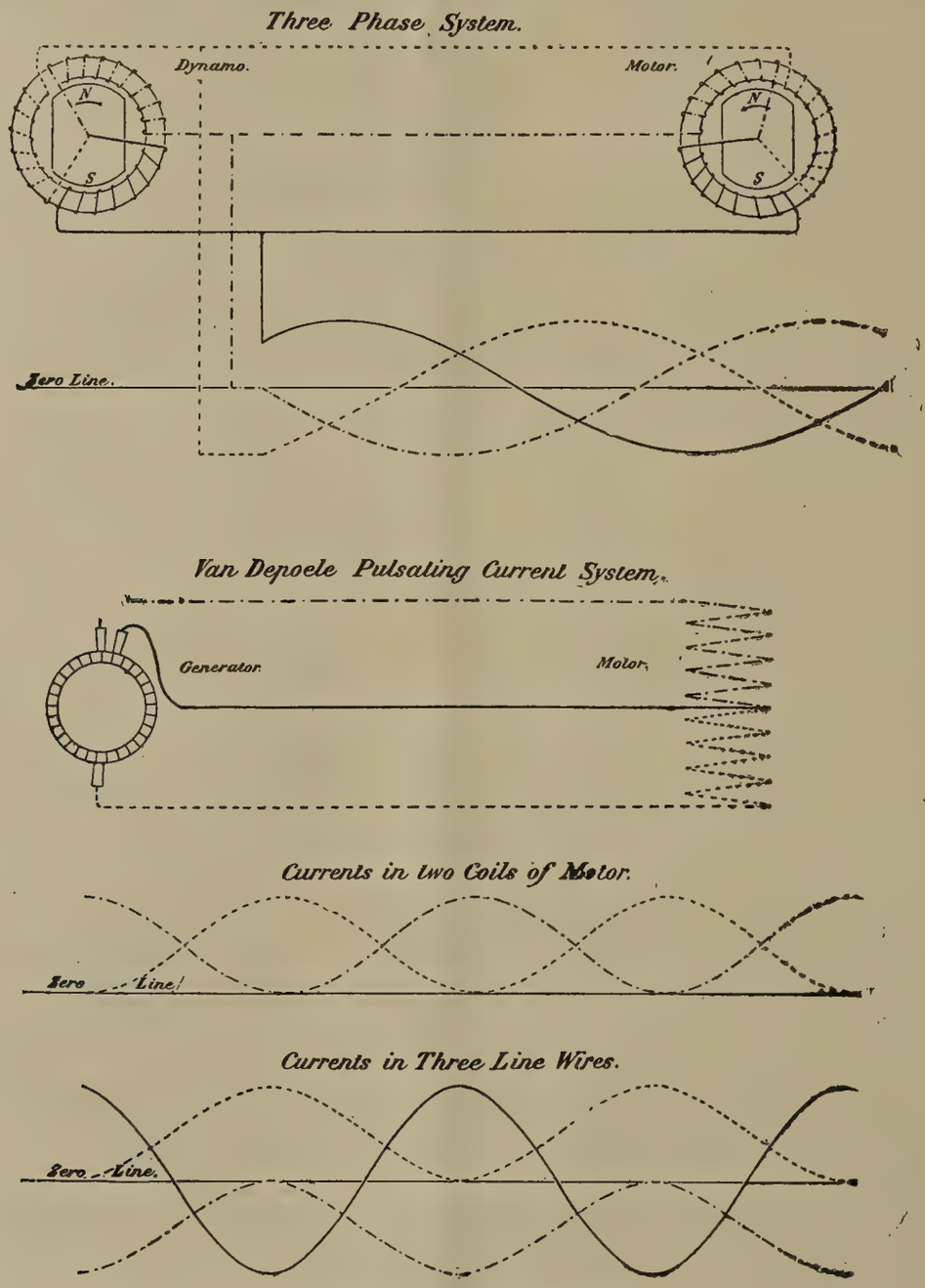
IN NEW BRITAIN, CONN.

Some time ago Messrs. Dolan Brothers, proprietors of the Tramway Company, applied to the common council for permission to adopt the trolley system on their road, and in order to show its merits invited that body to take a trip over the system of the Springfield Street Railroad Company, after having made arrangements for the use of a special car. The invitation was accepted, and after the trip the general opinion was that the trolley was perfectly safe and practicable.

THE ELECTRIC TRANSMISSION OF POWER.*

BY EUGENE GRIFFIN.

Although the use of electrity for power purposes has increased enormously during the past three years—and there are few, if any, who do not daily see this power in operation—it is a surprising fact that many, perhaps the majority of mankind, do not realize that electricity is not an initial power, but only a convenient form into which energy may be transformed for transmission to some distant point. The newspapers speak of electricity supplanting steam. This is not true in the sense in which the words are used. Electric motors may supplant steam locomotives as the immediate power for hauling cars on railroads, but the steam-power is simply transferred from the locomotive to a large stationary engine



DIAGRAMS OF VARIOUS CLASSES OF ELECTRICAL IMPULSES.

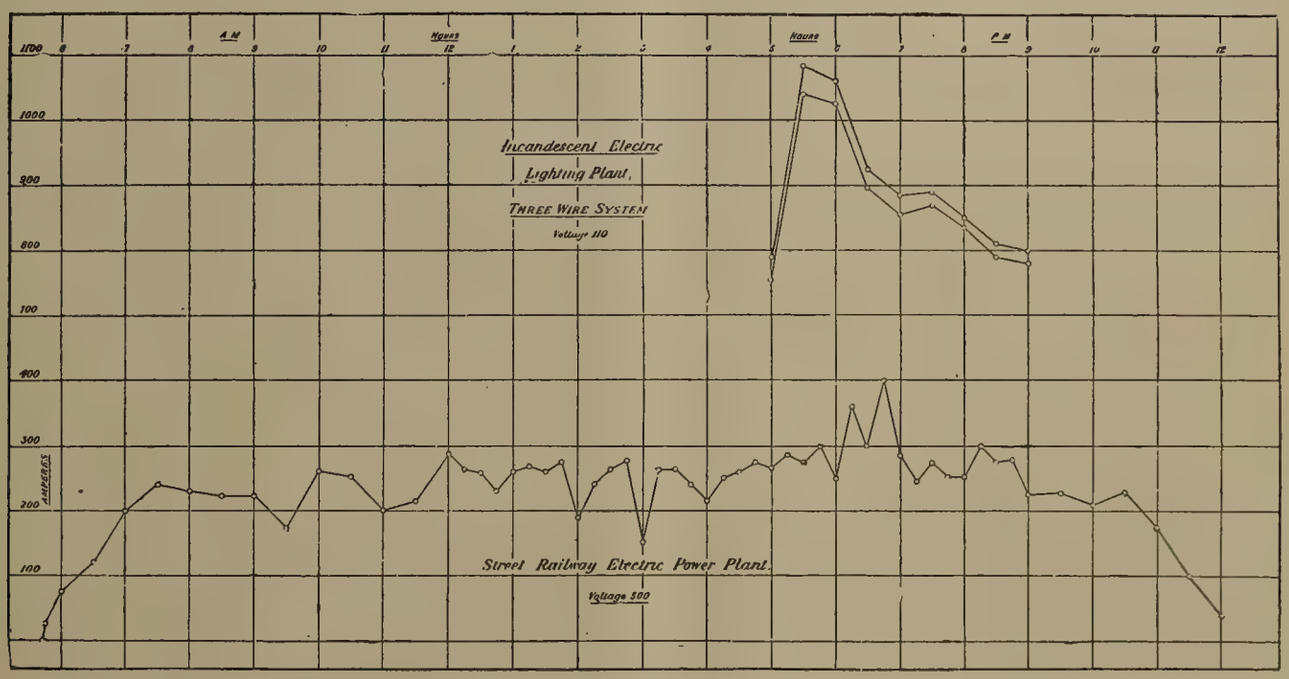
* A lecture delivered before the Franklin Institute, Philadelphia, February 29, 1892.

at some central station where it runs the dynamos, and is by no means eliminated from the problem.

The average layman does not reflect that we must have some means of generating electricity, and that the usual method is the application of steam-power to a dynamo. In one sense we must go back to the sun as the original source of energy. For thousands of years the sun has been storing up energy in the form of coal, and we are now using this stored energy for practical purposes. Every lump of coal contains the potentiality of a given quantity of horse-power, or rather from this coal may be obtained a given amount of energy which we measure in units of horse-power. We convert this energy into steam in the boilers, we again convert it into mechanical motion in the engine, again it is changed into electricity in the dynamo and goes out over the wires to be once more transformed into light, heat or motion.

The advantages of generating power in one place to use in another or in several other places, are too many and too obvious to require consideration. In many cases it is absolutely necessary to generate the power at some distant point. In case of waterfalls we have the power existing and running to waste, and it is only necessary to utilize it as it is. We may, by pipes, canals and conduits, conduct this water-power to the place where we want to use it, but we can only conduct it down hill. Steam-power can be converted into mechanical power and by belts and shafting carried in any direction, but the distance is limited and the loss in power rapidly increases with the distance. Electric power can be carried in the wires in any direction, up or down, around corners, underground, in the air, wherever the conditions are most favorable, and can be carried longer distances with less loss than any other form of energy. These advantages are so manifest and so important that it is only surprising that electric energy is not more generally used than it is.

Electrical energy is manifested in many ways and is generated by numerous methods; but the only practical method of generation with which we need be concerned is the dynamo, *i.e.*, closed wire coils revolving in a magnetic field. There are dynamos and dynamos, and it may be well to consider for a moment the different kinds of current which they generate. Dynamos are classified in many ways, as shunt-wound, self-exciting, separately excited, etc., but the only differences that I care to examine now are those which affect the character of the current produced. The alternating machine is a dynamo in which electric currents are generated in the armature coils, as these coils approach, come opposite to and recede from the magnetic fields of one or more magnets. The ordinary machines have six or more electric magnets placed around the periphery of the frame, and the armature turns in close proximity to the magnets and the field coils which surround the iron cores and form part of the magnets. The electrical impulse of current generated in the armature coil as it approaches a magnet is in one direction, and as it recedes from the magnet is in the other direction; and so we have a series of impulses alternating in direction, and which for comparative purposes we call positive and negative. Assuming a neutral line, we represent an alternating current graphically by a wave line with equal ordinates above and below the axis. In the direct-current dynamo we commutate the current; *i.e.*, we so arrange the contacts or connections with the wire that leads the current away from the dynamo that these contacts change as the impulses change, so that the impulses are always in the same direction in the lead wire, and we have a constant or direct current which we represent graphically by a straight line.



CURRENT OUTPUTS OF INCANDESCENT STATION, AND OF ELECTRIC RAILWAY POWER STATION.

If the constant-current dynamo with its two fixed brushes be supplied with a third brush so arranged that it revolves about the commutator with greater or less rapidity, we have a peculiar result which we call a pulsating direct current. This is used practically to operate a rock-drill constructed on the solenoid principle, as follows:

The upper and lower brushes are fixed; the third or revolving brush is shown in its neutral position. When in this position, or when it has revolved 180° from this position, there is manifestly no current in the third or middle wire. As the revolving brush approaches the upper brush, the middle wire takes part of the current of the upper wire, and as it approaches the lower brush, it takes part of the current of the lower wire. The result is an alternation of pulsations through the upper and lower halves of the solenoid, varying in rapidity directly with the rapidity of rotation of the third brush. The drill in the solenoid is drawn up and down with rapidity dependent upon the rapidity of the electrical impulses. This peculiar current is graphically represented on accompanying plate.

You have all doubtless heard of the long-distance power transmission installation recently exhibited at the Frankfort Exhibition in Germany. In this installation still another kind of current is used, called the three-phase current. Three separate impulses are generated in each revolution of the armature, each lagging 120° behind the previous impulse. This dynamo is practically an alternating dynamo, and the current generated bears somewhat the same relation to the ordinary alternating current as the pulsating direct current does to the ordinary simple constant current obtained from a two-brush machine. The three-phase current is graphically represented on accompanying plate.

In the electrical transmission of power are involved four elements :

(1) The original power.
(2) The generator.
(3) The line.
(4) The motor.

(1) *The Original Power.*—The original power is usually steam ; sometimes water. If the power consumed at the other end of the line is constant, *i.e.*, if the load on the engine is constant or if the changes in load are gradual, the problem is simple, so far as the steam-engine is concerned, and any of the ordinary types of engine will do the work. For street railway and similar work where the loads are variable, especially strong engines are required to stand the enormous strains resulting from the sudden and very violent fluctuations. The same build of engine which did good work in an electric-lighting station was found to be too light for railway work.

Engineers are not yet agreed as to whether high or low speed engines are preferable for power stations, but the weight of opinion seems to be in favor of slow speed. High-speed engines with direct belting gives one engine to one, two, or sometimes three and even four generators, independent units which can be shut down or started, one after another, to meet the demands on the station, and permits of multiplication of units so that a breakdown of one unit, either steam or electrical, only throws out of service a small fraction of the station capacity. Against this lies the fact that injury to the engine throws out the dynamos as well as *vice versa*. With large, slow-speed engines, and counter-shafting, any dynamo or group of dynamos can be run from any engine. Against the greater coal economy of the slow-speed engine is to be urged the loss of power in the counter-shaft and belting. Of late the method of direct coupling, making the engine and dynamo practically one machine, is meeting with more favor, and for large-sized generators this method undoubtedly has a future. The engine and dynamo are mounted on the same shaft.

The latest types of dynamos are built to run with slow armature speed, and in this respect the electrical manufacturers are gradually approaching the engine-makers.

Uniform armature speed is essential to maintenance of constant potential and the engines should have perfect governors. Many faults attributed to the electrical apparatus have been found on investigation to be really due to poor engines, imperfect governors, slipping belts, low-steam pressure, or other cause remote from the electrical apparatus.

Engines work most economically under full load. Unfortunately constant loads are not the rule in electrical work, and as the loads vary the mean must be somewhat below full load. A mean of several electric-railway power stations shows the average load to be about sixty per cent. of the maximum, and in lighting stations running for twenty-four hours the changes are, of course, much greater. In the latter case it is imperative that the steam plant be divided into numerous units which can be gradually brought into service according to the demands. Arc-lighting work is fairly constant. Street lights burn all night or on moonlight schedules, and are all started and stopped at the same time. Commercial lights may burn till midnight. The limitations are known and can be provided for. Incandescent work, particularly with meters, is more variable. Referring to the plate of curves shown herewith, the upper lines show the current output in ampères during four hours for an incandescent station having a maximum capacity of 4,000 lights. This is probably a fair sample of this service. The lower line shows the current output in ampères of an electric-railway power station for eighteen hours.

From this it appears that, the average being well below the maximum, the engines are not working to the best advantage and the greatest coal economy is not attainable. In Europe, this is obviated to some extent by adding a storage battery to the station equipment. The steam plant is then proportioned to the mean demand for power and runs constantly at full load. When the demand for power falls below this mean, the extra current generated is directed into the storage battery. When the demand exceeds the capacity of the engines and dynamos the extra current is supplied from the batteries. The cost and maintenance of the batteries in this method must be balanced against the cost and maintenance of the extra steam and generator plant in the first method, and the less economical operation. It is a striking fact that storage batteries are used to a very large extent in foreign stations (not necessarily in all cases in the way above indicated) and rarely, if at all, used in this country. One would suppose that the actual results would long since have determined in which method true economy is to be found, but so far the engineers on the two sides of the Atlantic have not been able to agree. The practice differs also in another respect. In Europe rope-belting is largely used, while in this country it is rarely found, and has been condemned in one or two places where it has apparently had a fair trial.

(2) *The Generator.*—The kind of generator used depends upon the method of utilizing the electrical energy produced.

The arc-lighting dynamo is made to generate a current of constant quantity and potential varying with the number of lamps on the machine. The incandescent direct-current dynamo generates a current of constant potential and quantity varying with the number of lights. The railway or ordinary power-generator is similar to the incandescent direct-current machine. The alternating-current dynamo produces a current suitable for incandescent lighting, but so far it has not been made available for power-work as the alternating motor has little torque and therefore cannot start under a load. The pulsating direct-current machine is the ordinary direct incandescent dynamo with a third brush added and is used as before stated. The three-phase-current dynamo has no commutator, runs noiselessly, and can be used for power purposes as the motor has sufficient torque to start with a load.

In the synchronous method of transmitting power by alternating currents, it is necessary to start the motor by some exterior power ; but if proper arrangements are made, the starting is no more difficult or tedious an operation than the starting of a large Corliss steam plant.

The synchronous motor when overloaded "lies down" and declines to do any work at all until the load is reduced to proper limits.

The synchronous alternating motor has an excellent quality in which it is only equalled by the plain shunt-wound motor of the every-day electric-lighting station. It regulates perfectly as to speed, keeping in step, within the limits of its capacity, with the generator which drives it.

The non-synchronous type of motor, in connection with the three-phase current, presents many features of superiority over the synchronous, in that its speed will not vary more than a few per cent. from light to full load, and also from the fact that it will start under full load, and requires no exciting current. A field is set up by three conductors conveying currents of three-phase character, in a laminated iron mass, which field is made to rotate, and drags around a movable iron armature on which is a system of closed coils, or coils which can be closed, these coils having strong currents induced in them by the moving lines of the field. Thus the rotating magnetic lines in cutting the armature conductor push the conductor along by virtue of the reaction of opposing currents set up in the conductors of the armature, or closed circuits. These motors are not capable of being used as generators when revolved by exterior power. The great advantages of this method are that the motors can be started and stopped at will, and have no commutators.

The sizes of the dynamos have greatly increased in the last three years. We have now seventy-light arc dynamos, 2,800-light direct incandescent machines ; Ferranti's 100,000 sixteen candle-power light alternating (10,000 horse-power) dynamos ; and 670 horse-power generators for power use.

The Thomson-Houston Company are now building seventeen of these large-power dynamos for the West End Street Railway of Boston.

In increasing the sizes of dynamos a change from the bi-polar type of the smaller dynamos has been found necessary, and the large machines are made with not less than four poles. Slower speed of the armature is a natural advantage, and many other improvements are to be found in the latest type of power dynamos.

The size of the dynamo should be proportioned to the total work at the station. There should never be less than two generator units, and preferably more. With a total of 250 horse-power, it would be poor practice to have but one 250-horse-power dynamo. Three eighties would be far preferable. With a total of 2,000 horse-power it would be poor practice to have twenty-five eighty-horse-power dynamos. Eight 250's would be preferable.

The switchboard should be provided with every possible safety device to automatically prevent overloading of the dynamos, injury to the machines from lightning, and to automatically throw off the current in case of short circuit on the line resulting from crosses with the line wires or accidents of such nature.

(3) *The Line.*—Having converted the power into the form of electrical energy, we now must transport it to the place where it is to be used. The line wires do this. For lighting, the lamp is the place where the energy is to be utilized, and the wire leading from the dynamo to the lamp may be thoroughly insulated and placed overhead, underground or anywhere so far as fulfilling its duty in this respect. In railway work, we want the current at variable points over many miles of streets, and this can only be obtained by the use of bare conductors and brushing, sliding, or rolling contacts. It is this essential difference between railway and lighting work that prevents us from placing the railway wire underground as we do the lighting wire. The railway wire must be bare in order that we may obtain electrical contact every fraction of inch from one end to the other. To place this bare wire in a hole in the ground and keep it securely insulated from the ground, to keep the width of the slot down to safe dimensions, and yet work the conducting plow which must be absolutely insulated from both sides of the slot, has been found to be no easy task. Every practical trial in this country has failed.

(4) *The Motor.*—The motor is simply the dynamo reversed in its operation, and the various forms are those best suited to the varying conditions of use.

Several different systems have been successfully used for long-distance transmission, but the alternating has proved most successful. The difficulty of handling a potential of over 2,000 volts direct current has hindered progress in this direction. The sparking between the segments of the commutators in these dynamos and the difficulty of insulating for such high pressure have been sources of trouble. In the alternating, where a low potential can be developed in the dynamo, and by the use of step-up transformers raised to any desired height, this difficulty is avoided.

The following are some of the actual examples of electrical transmission which we find abroad and at home.

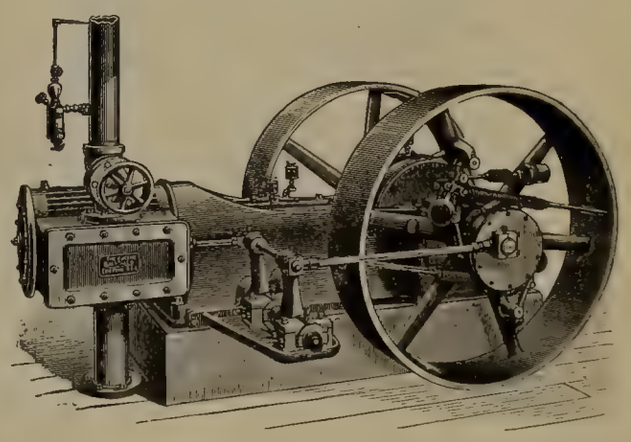
Many of the large water-falls of Europe, notably of Switzerland, are now being utilized, and the neighboring cities and towns lighted by electricity, transmitted distances ranging up to 112 miles.

(*To be continued.*)

SOME NOTABLE ELECTRIC PLANTS.

Mr. C. H. Davis, consulting electrical engineer, 120 Broadway, New York, has several important contracts under way. He designed the plans for the substitution of electric power for the horses on the Union Railway, Chester, Pa., also the plans for the installation of the electric-light plant in the New Netherlands Hotel, corner 5th avenue and 59th street.

The new power-house of the Chester, Pa., road will cost $30,000, and will be 250 feet long by 100 wide. It will be built of brick and will have an iron roof covered with slate. The road is 15 miles long, and the improvements designed by Mr. Davis include the laying of 12



HIGH-SPEED BALL ENGINE FOR PLANT IN EQUITABLE BUILDING, BALTIMORE.

miles of entirely new track. Lewis & Fowler box rail, 65 lbs. to the yard, with their new joint-chair, will be used on 5 miles of the new road, and the rest will be laid with the girder rail made by the Tidewater Steel Works, of Chester, Pa. The steam-plant will consist of Robt. Wetherill & Co.'s Corliss engines, and the same concern will furnish the boilers, pumps, piping and shafting.

There will be two Short generators, one of 300 H. P. and the other of 200 H. P. The car equipment will consist of ten Short motor cars, each with two 20 H. P. motors; 4 Westinghouse 50 H. P. motor cars, and 20 trailers. The cars were built by the J. G. Brill Co., of Philadelphia, and are set on Brill's elliptical spring extension trucks.

All of the wire used for the trolley and ground-return was made by the J. A. Roebling's Sons Co., Trenton, N. J., and the cross-suspension and bracket system of overhead construction has been adopted.

The poles were furnished by the H. M. Loud & Sons

Lumber Co., Oscoda, Mich., and are of their well-known octagonal style, which is so extensively used on electric railways.

The bonding of the rails will be after Mr. Davis' method, which, it is said, is a great improvement over the ordinary way of connecting the rails. On one line bonded in this way there is a resistance of less than $\frac{2}{100}$ of an ohm.

The electric-light plant in the New Netherlands Hotel, designed also by Mr. C. H. Davis, will be one of the most complete in this country, and will contain many new features. There will be in all 5,500 lights in the building. Every closet in the house will have a lamp which will be lighted and extinguished by the opening and closing of the closet door. Every room will have two circuits running to it directly from the dynamos, so that there will never be absence of current for the lights. All the room switches will be flush with the walls, and nothing but ceiling lights will be used. Pendants will be conspicuous by their absence. These switches are of the well-known pattern made by The Cutter Electrical and Manufacturing Company, of Philadelphia. The halls and corridors will be lighted by separate circuits from those of the rooms. There will be 350 lights in the restaurant and 250 in the main rotunda of the hotel.

The power-plant will consist of Watts-Campbell Corliss engines, made in Newark, N. J., and there will be 5 Edison generators of 125 H. P. each.

The wiring will be done on the panel-board system devised by Mr. Davis, and altogether about 40 miles of wire will be required. The wire to be used will be the celebrated Grimshaw white-core brand, made by the New York Insulated Wire Co.

The interior tubing of the Interior Conduit and Insulation Co. will be used throughout, and all the wiring will be concealed.

A feature of the engine-plant will be the absence of driving belts. In their stead the rope system of driving will be used.

The switchboards will be magnificent specimens. They are being constructed by the Edison Company after Mr. Davis' designs.

The cost of this plant will be $100,000, which does not include the light fixtures. These will be of the most elegant design.

Mr. Davis has two other notable plants in hand. One is for the new building of the Equitable Life Assurance Association in Baltimore, and the other is for the Jersey City refinery of the American Sugar Refinery Company.

The former plant will be of 3,000 lights capacity. High Speed Ball Engines, made by the Ball Engine Co., Erie, Pa., will be used, and the Western Electric Co. will furnish the switchboards, wire, apparatus, etc.

The Safety Insulated Company's wire will be used in this installation, as will also be the Interior Conduit and Insulation Company's tubing. The wiring will be done on Mr. Davis' panel-board system.

The switchboard will be about 30 feet long, and will be practically constructed in lattice-work fashion. It will be a very handsome piece of work.

The Jersey City plant will be virtually a good-sized central station. The feature of this installation will be the arrangement of the dynamos, which will be placed on top of the engines. Four 100 H. P. generators will be installed, and for this plant a substantial brick building will be constructed.



STYLE OF CAR TO BE USED ON CHESTER, PA., ELECTRIC RAILROAD. MADE BY THE J. G. BRILL COMPANY, PHILADELPHIA.

ELECTRIC VALVES IN A THEATRE.

The automatic fire-extinguisher at the Fifth Avenue Theatre, New York, is so arranged that directly there is a flow of water through any of the sprinkler-heads an electric alarm is operated.

A cast-iron box is screwed into the pipe leading from the tank to the extinguisher-mains. In this box, should a sprinkler-head be opened, or a leak occur in any portion of the system, a flap is thrown in the direction of an operating lever by which an electrical circuit is closed and an alarm sounded.

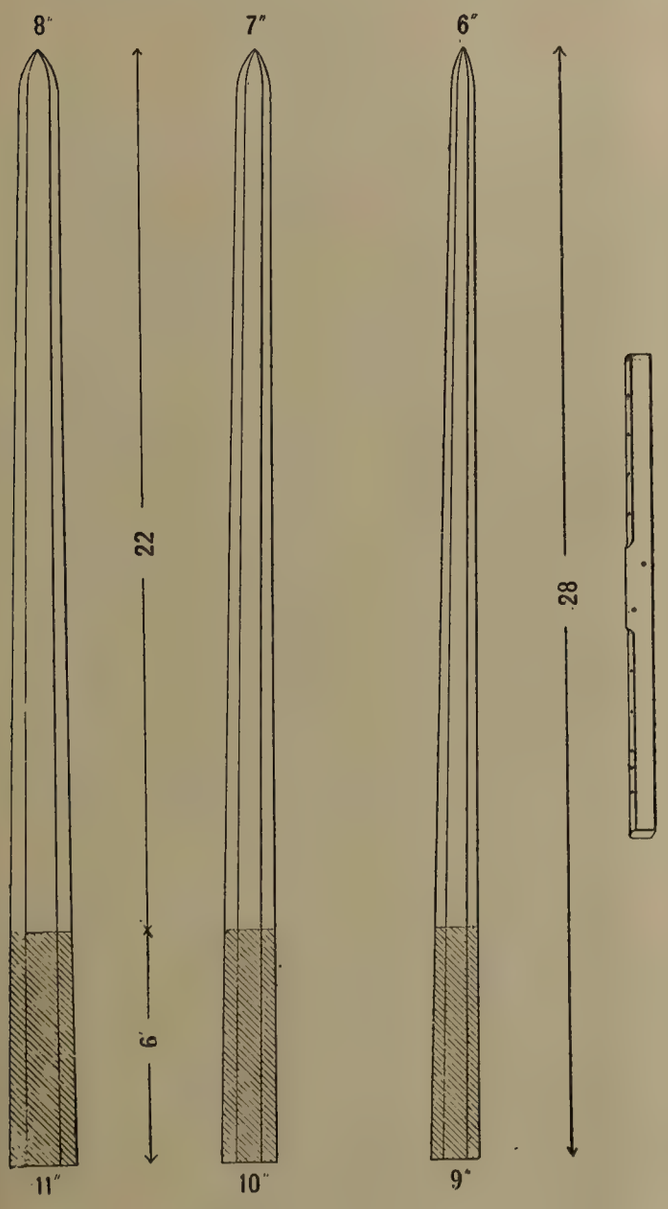
There is also an arrangement for closing an electrical circuit in the water-tank to indicate the quantity of water in it. In the engine-room there is a switchboard for the purpose of determining the condition of the water-level in the fire-tank. This switchboard has four posts, with which contact is made by a revolving lever When in contact with the first post all circuits are broken; with the second, the condition of the battery is indicated; with the third, a wire is thrown into circuit, and a bell rung, if the tank is filled to high-water level; with the fourth, the same wire is thrown into circuit, but in this case the bell rings only if the water is below high-water level.

OF INTEREST TO ARCHITECTS.

Here is something that is worth the very careful consideration of those concerned. In speaking of the tendency of architects to belittle the importance of steam plants an engineer says:

"I wonder why it is that architects, in their plans and specifications for office and other large buildings, pay such little attention to adequate accommodations for the steam plant. I have in mind a building recently completed in this city, of magnificent proportions and splendidly finished, having everything within its walls that modern ingenuity has devised for the convenience of office men, yet when the building was fairly under way and the proprietors began to look around for their steam equipment, they had to entirely change their plans in that particular, for the reason that the space allotted for the engine-room would not permit them to carry out their original designs. The room was too cramped altogether, and instead of putting in one or two large engines with capacity sufficient to furnish the power required, they were compelled to place nearly four times that number of a different type of engine, small enough to fit in the small apartments set aside for that purpose. Now, isn't that all wrong? Why, it looks like as if some of these architects do not regard the steam plant as at all worthy of consideration in making their calculations, yet nothing is more important, for light, heat and transfer facilities are dependent upon it, and if these do not work right and give satisfaction to the occupants, the building will lose its reputation for good management, and untenanted rooms will be the consequence. The sooner this fact is recognized by our architects the better, and the sooner will they become entitled to the good regards of all those who in one way or another are interested in the efficiency and proper arrangement of the steam plant."

The same may be said with reference to electric plants.



OCTAGONAL POLES USED ON CHESTER, PA., ELECTRIC RAILWAY. (SEE PAGE 578.)

EASY LESSONS FOR STUDENTS.

BY THE EDITOR.

Leakage.

Leakage and waste are synonymous terms, and, consequently, the larger the leak the larger the waste. Electric currents have a natural tendency to seek the ground, and under certain conditions it is a difficult matter to keep them away from it. This proposition refers particularly to electric circuits where the wires run along poles, whether they be telegraph, telephone, electric light or electric railway wires.

One of the most important objects to be attained in building aërial electric lines is to provide as perfect insulation as possible, to prevent leakage of the current. Yet it is quite impossible to avoid leakage entirely, however good the insulation of the wires from their supports may be. The atmosphere itself frequently acts as a medium of leakage, and against this it is of course practically impossible to guard.

When the insulation of a line is defective more or less of the current escapes by way of these weak points of insulation to the earth. The wires necessarily come in contact with the insulators, and in a damp atmosphere the latter become coated with a film of moisture which facilitates to a greater or less degree the escape of current to the ground, either through the points of support or through the atmosphere. It is for the purpose of reducing the leakage at the points of support (the insulators) to a minimum that the insulators are made cup shape. They are placed on the poles with the opening downward, so as to prevent the moisture getting inside. This works all right as far as rain is concerned, but in a damp atmosphere it is evident that the moisture cannot be kept from the interior of the insulator, consequently a small leakage necessarily occurs.

Leakage through the atmosphere depends, of course, upon the amount of moisture the air contains, and in all cases it is exceedingly small compared with the leakage at the insulators. It is for this reason that telegraph lines work best when the air through which they run is dry. All of the current is confined to the wires where it is needed, and work is carried on with the greatest degree of efficiency, but on a damp or wet day the leakage may be sufficient to sap all of the current from the line before it reaches its destination. Each insulator, of course, offers an avenue of escape for the current, and when we remember that along a line there are hundreds, and perhaps thousands of insulators with which each individual wire comes into contact it is easy to understand how a large escape of current may occur under unfavorable conditions.

On electric light lines and electric railway lines the amount of current lost by leakage is comparatively small, and as a rule is not considered in practice. That it is small is because such lines are short in comparison

with telegraph lines, and the wires are of higher conductivity.

In all cases the leakage is measurable and is in inverse proportion to the resistance of the points where the leaks occur; consequently as the resistance decreases the leakage increases. In all calculations regarding the determination of leakage of current the resistance, or conductivity of the wire itself is an important factor, and it may be stated as a law that where the difference between the resistance of the wire itself and the points of support is greatest the leakage will be the least. With reversed conditions reverse results will be obtained, of course. It is advantageous, therefore, to keep the ratio between the two factors as large as possible to obtain the best results in practice.

AN ELECTRIC DINNER.

On August 29 last the Windsor Hotel, Ottawa, Canada, gave a dinner all the dishes of which were cooked by electric heat. The following is a copy of the bill of fare :

ELECTRIC DINNER.

Every item on this *menu* has been cooked by the electric heating appliances invented and patented by Mr. T. Ahearn, of Ahearn & Soper of this city, and is the first instance in the history of the world of an entire meal being cooked by electricity.

The bread and meats were cooked in an electric oven, and the liquids in other electric heaters.

Soup.

Consommé Royal.

Fish.

Saginaw Trout with Potato Croquettes, sauce Tartar.

Boiled.

Sugar-cured Ham, Champagne Sauce.
Spring Chickens with Parsley Sauce.
Beef Tongue, Sauce Piquant.

Roast.

Sirloin of Beef and Horse Radish.
Turkey with Cranberry Sauce.
Stuffed Loin of Veal, Lemon Sauce.

Entrées.

Larded Sweetbreads with Mushrooms.
Lamb Cutlets and Green Peas.
Strawberry Puffs.

Vegetables.

Potatoes, Plain and Mashed.
Green Corn.
Escalloped Tomatoes.
Vegetable Marrow.

Pudding and Pastry.

Apple Souffles, Wine Sauce.
Apple Pie. Black Currant Tart. Chocolate Cake.
Cocoanut Drops. Vanilla Ice-Cream.
Maraschino Jelly.

Fruits.

Apples, Raisins, English Walnuts, Almonds,
Watermelon, Grapes.

BLACK TEA, GREEN TEA, COFFEE, CHEESE, BISCUITS.

Mr. Ahearn's heating appliances are giving great satisfaction, it is said. The right to manufacture them in the United States has been purchased by the Railway Equipment Co., of Chicago.

AT the annual meeting of the New Bedford Gas and Edison Light Company, which was held on September 2, the old board of officers was re-elected. The president's report showed a satisfactory condition of the company's affairs, a steady growth in the motor business, the candle-power of the gas light had been raised from 16 to 20 per cent., and the cost to consumers was 20 per cent. less.

HONORS FOR A PHILADELPHIA INVENTOR.

Mr. James F. McLaughlin, a well-known electrical inventor of Philadelphia, Pa., has just received notice that the French Academy of Science and Arts has awarded him the gold medal of the Institute and elected him an honorary member, in recognition of the merits of his electric street-car motor and storage battery inventions. He has brought out a regulating socket for incandescent lights that is said to be a success.

THE MANUFACTURE OF INSULATING COMPOUNDS.*

BY RALPH GRAY.

With the growth of electrical industries there has come a large business in insulating, not only for wire-covering, but for special appliances for insulated fixtures that are parts of an electrical plant. Quite a variety of small moulded insulators are made, and most of them are simply improvements on the old-fashioned glass insulators, types of which are shown in the cups on every telegraph pole. Most of these that are made of compounds are moulded from a variety of substances, such as mica, soapstone, silica, lava and like substances. Where the body of the compound is made from substances which come from the earth, the first necessity is to reduce it to a powder, which is done by running it through a crusher, then through a pulverizer, and then through silk bolting cloth, after which it is deposited in a receptacle which is close to the mixing-tubs.

These mixing-tubs are arranged on various principles, some of them being like a churn in a rubber factory, others being nothing more or less than friction-rolls, such as rubber dough is mixed upon. Indeed, the whole business is quite similar to the mixing of rubber compounds, which in turn has been described as being almost parallel to the bread-mixing business. The compound, when thoroughly mixed, is a plastic dough, very much shorter and more brittle than the rubber dough would be. This is calendered by small pressing-rolls, and then the sheets are cut up into various forms most convenient for filling the moulds.

In some works the moulds are filled by hand and the pressing and vulcanization done as it is in rubber works; in others the sheets from the calender feed directly into a hydraulic machine which presses the compound into shape and sets it at once. Where a compound of this kind is used a great quantity can be turned out in a day, and the work is almost as simple as making school-crayons. For tube-work these compounds are run through an ordinary tube-machine, and if the compound is tenacious enough, may be manufactured into tubes of almost any length or any thickness of wall and size of diameter.

The manufacture of insulated-wire coverings is conducted in a variety of fashions, much of the machinery as well as processes having originated in the factories that produce the goods. Processes and machines are usually jealously guarded from the public eye. The simplest form of insulation known, for ordinary work, is a cotton braid which is put around the wire in much the same manner that the covering for a whip is braided, although these braiders run at a higher speed and are built especially for this work. The cotton thread is treated with a variety of insulating materials, the idea being to get something that is water-proof and weather-proof. In some of this wire-work the wires themselves are so

* From *India-Rubber World.*

small that they are less in diameter than a single hair on the human head.

What are known as tape-covered wires are covered with one, two or three tapes which are wound by an automatic machine outside of the braid covering, the tapes being treated before and after winding with a water-proof compound. This tape is cut by a tape-cutter from various fabrics, linen perhaps being the best, and is often soaked with asphaltum. Ozokerite has been used for this purpose and paraffine is also recommended. Rubber manufacturers are making a rubber compound, using a fair grade of gum and quite a quantity of ozokerite, which makes an extremely good filling for braids. This filling, by the way, can be either put on by the knife process in solution, or it may be frictioned in the cloth and covered later with a good varnish.

Some manufacturers make two and three-ply coverings in a braiding-machine that is similar to the hose-braider, treating this for insulating purposes with their own compounds. When it comes down to the manufacture of rubber compounds for insulating wire, there are a variety of processes and ingredients employed. Some use a small amount of pure Para rubber with just enough sulphur to vulcanize; others have used Para rubber with sulphides of certain of the heavier metals as a vulcanizing agent. Other wires that have good reputations are made of a rubber compound with infusorial earth, zinc-white, devulcanized rubber and certain of the more tenacious rubber substitutes.

It might be well to note just here that ordinary rubber substitute is not applicable for this sort of work. A rubber substitute for moulded work should have a light velvety feeling after vulcanization, for insulated wire; however, it needs to be more in the line of a sulphur substitute which is not as lively but has very great lasting qualities. Whenever these substitutes are used, they should be thoroughly washed from acid, and there should be no chloride of sulphur present. As a rule the vulcanizing is carried on in upright vulcanizers where live steam is admitted to the coils of rubber-covered wire wound on great spools to keep in shape.

The color of insulated wire compound is not necessarily any test as to its quality. A white, black or red compound may be an exceedingly good one, or it might be an equally poor one. The red is apt to be unsatisfactory if the ordinary oxide of iron is used in the coloring matter. An antimony color, however, gives excellent results, particularly if the compound has not been overcured. Indeed, in speaking again of vulcanizing, the manufacturers are careful not to vulcanize their covering any more than is absolutely necessary, as time will produce a certain oxidization in the best of compounds, and the less they are vulcanized the longer they will stand.

It is hardly necessary to describe the process of washing, mixing or calendering in insulated-wire factories, as it is identical with that used in usual rubber work. The process of covering the wire, however, is original to this line of manufacture. The wire, after being straightened by a patent straightening-machine, is usually coated with tin that any possible sulphur in the rubber compound may not affect the copper. It is then run through a tubing-machine made particularly for this kind of covering, and the gum is forced upon it, making a continuous solid cord with the wire in the centre. Some kinds of insulation put an unvulcanized compound next to the wire, as in this they are obliged to use sulphur.

The compound contains, however, such dryers as litharge, magnesia, as much silica, or infusorial earth, which is an excellent insulator, as the rubber will stand. The amount of sulphur used in the covering that is vulcanized runs all the way from 6 to 20 per cent. of the weight of the gum. The latter amount is, however, very rare, and is to be deprecated, as it is simply put in to make a quick cure and the result is apt to be unsatisfactory. Taking the average rubber-covered wires manufactured through the United States the average proportion of Para rubber to the compound may be stated as about 30 per cent., which, considering the fact that rubber is able to absorb such quantities of compound, is a fine showing.

PERSONAL.

Mr. Geo. B. Shaw, of Eau Claire, Wis., formerly general manager of the National Electric and Manufacturing Co., Eau Claire, Wis., is a candidate for Congress. His many friends in the electrical fraternity, irrespective of party affiliations, wish him success in the contest.

Mr. Geo. H. Guy, secretary of the New York Electrical Society, is on his way to England. He will be absent from the city several weeks.

TO BE PLACED UNDERGROUND.

In the very near future all of the overhead wires on certain streets in the city of Rochester are to be placed beneath the ground. Preparations will soon be commenced for the construction of an underground conduit on practically the same conditions stated in the proposal made by the electrical committee to the Consolidated Company. The change will involve an expenditure of about $100,000.

IDE AND IDEAL ENGINES.

W. R. Fleming & Co., Mail and Express Building, New York, report the following recent sales of Ide and Ideal engines manufactured by the Harrisburg Foundry and Machine Works, Harrisburg, Pa.: Central Park Apartments, New York city, two 175 H. P. Ideal engines. Raritan and Perth Amboy Electric Light Co., Perth Amboy, N. J., one 150 H. P. Ide engine. Racket and Tennis Club, New York city, one 35 H. P. and one 70 H. P. Ideal engines. San Francisco Laundry Association, San Francisco, Cal., one 100 H. P. Tandem-Compound Ideal engine. Edison Spanish Colonial Co., New York city, two 25 H. P. Ideal engines for steamships "Mexico" and "Panama." Rubber Reclaiming Co., New York city, one 15 H. P. Ideal engine. Canfield Rubber Co., Bridgeport, Conn., one 30 H. P. Ide engine. Hotel Beresford, New York city, two 45 H. P. Ideal engines. They have just completed a plant for the Hotel St. Lorenz, New York city, that consists of two 60 H. P. Ideal engines, and are also installing in the Century Club, New York city, one 50 and one 60 H. P. Ideal engines. They have also recently taken several contracts for complete steam plants and are now erecting the following: Hotchkiss School Association, Lakeville, Conn., one complete plant of 70 H. P. Ideal engine and 90 H. P. horizontal tubular boilers. Mount Vernon Construction Co., Alexandria, Va., complete boiler plant of 300 H. P. Municipal Electric Light Station, South Norwalk, Conn., complete plant of 100 H. P. Ideal engine and 125 H. P. horizontal tubular boiler.

A GOVERNOR to regulate the speed of the generator where water-power is used to furnish the current for electric roads, has been successfully operated by N. D. Alexander, of the Waterville & Fairfield Railway and Light Company, of Waterville, Me. It is claimed that by its use the services of two men are dispensed with.

WORK has been resumed in the mine at North Groton, N. H., by the Belden Mica Company. An exceedingly fine vein has been struck, and on some days over 40 basketfuls have been secured with but 10 men at work.

WORK is being vigorously conducted on the addition to the electric-light plant in New Bedford, Mass.

NEW BOOKS.

THE PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS, by Francis B. Crocker and Schuyler S. Wheeler. D. Van Nostrand Company, New York. Price, $1.00.

This book, which has 98 pages and 35 illustrations, belongs to that class of publications which is regarded as of real practical value. Its title indicates its character, and the information it contains is of the most valuable kind for those who have the handling of dynamos and motors. These machines, like human beings, are subject to disorders, and to locate the seat of such irregularities requires a considerable knowledge of the organized system.

This little book is a sort of an electrical *materia medica*, and enables the attendant to diagnose a symptom and apply the remedy without burdening the facilities of the hospital or calling on the services of a specialist.

The book is not devoted entirely to diagnoses and remedial work, however, these subjects constitute the second portion of the work, which is divided into two portions.

The first part is subdivided into seven chapters under the following heads:

I. General Principles of Dynamos and Motors; II. Selecting Dynamos and Motors; III. Installing Dynamos and Motors; IV. Starting Dynamos and Motors; V. Running Dynamos and Motors; VI. Stopping Dynamos and Motors; VII. Testing Dynamos and Motors.

Part II., under the head of "The Localization and Remedy of Troubles in Dynamos and Motors," contains the following chapters:

I. Sparking at the Commutator; II. Heating in Dynamo or Motor; General Instructions; III. Heating of Armature; IV. Heating of Field-Magnets; V. Heating of Bearings; VI. Noise; VII. Speed too High or Low; VIII. Motor Stops or Fails to Start; IX. Dynamo Fails to Generate.

We need more books of this kind. It is all right enough to instruct on theories, but there is a great need for books of the class under consideration for the use of practical men, and there is no doubt that this work will find a large sale. Something of the kind is greatly needed.

ECONOMIC LEGISLATION.

WE have received from Mr. Allen R. Foote a bound copy of the advance sheets of his book on "Economic Legislation." The completed work will consist of two volumes of about 1,400 pages each, and will be ready for delivery about October 1.

WE have received from the Endolithic Ivory Company, Ltd., 61½ Fare street, London, a sample ivory tablet lettered on the company's process. The letters have a silvery surface, which, on the ivory ground, have a very pleasing effect. These tablets are very neat for attaching to electrical apparatus, the name of the maker being placed thereon. The lettering is said to be permanent.

F. W. LANDON & Co., of Concord, N. H., contractors and dealers in electric bells, fire-alarms, hotel and house annunciators, speaking-tubes, electric light, telephone and telegraph supplies, have disposed of their stock and good-will to the Northern Electrical Supply Company, of the same place. The members of the firm have become interested with that company, and Mr. F. W. Landon will hereafter be found at the office of the Supply Company, Depot street, Concord, N. H., where he will be pleased to welcome his old patrons.

LEASES ITS PLANT.

The Jenny Star Electric Company has leased its New Bedford factory to the Suffolk Electric Company, of Boston, where the latter concern will manufacture arc lamps under the Dewar patents. The Jenny Company will, however, still have its motors and dynamos made there under the supervision of the Suffolk company. A small force is at present engaged in making lamps and getting tools in readiness for their manufacture on a large scale. In the fall the company intends to commence making electric fans for the following summer's trade.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Sept. 10, 1892.

MR. P. H. ALEXANDER, of Baltimore, Md., is in town, looking happy and contented as ever.

MR J. C. O'NEIL, of Cleveland, Ohio, dealer in electrical supplies, was in town during the week.

THE ELEKTRON MANUFACTURING COMPANY. 89 Liberty street, of which Mr. Watson is manager, is making extensive improvements in its office.

P. CLAUS & Co., electrical engineers and contractors, have equipped a factory for building their dynamos, motors and generators at 357 West 40th street. They also have their office at the same address.

HUEBEL & MANGER, 286–290 Graham street, Brooklyn, N. Y., have issued a catalogue, the title of which is "A Ringing Bell Every Time." It is advisable for purchasers of electric bells to write for one of these circulars.

THE ELECTRIC LAUNCH AND NAVIGATION CO., 120 Broadway, is building a handsome electric launch for John Jacob Astor. It is to be ready October 5, and Mr. Astor will hire it for the balance of the season, with the privilege of buying it. The hull will be constructed of mahogany. This is the company which has secured the privilege of operating electric launches on the lagoons at the World's Fair.

MR. J. P. HALL, 143 Liberty street, electrical engineer and contractor, is installing a very extensive plant in the United Charities and Correction Building, 22d street and 4th avenue. This plant will consist of United States dynamos and systems. The wires will be those of the New York Insulated Wire Company, 15 Cortlandt street, consisting of Grimshaw white-core wires, placed in the celebrated Vulca ducts or tubes, which are set in the plaster so that in case of any possible trouble the conductors can be easily drawn out or readily reached in any part of the building.

CHARLES H. HINDS, Trio Building, 13th and Hudson streets, manufacturer of electric gas-lighting appliances, static-electric machines and burners for the multiple system, has moved one story higher in the same building, where he has more room and will soon be prepared to furnish the trade with every requirement in his particular line. He will also have greater facilities to carry on special work and model-building.

FEW firms achieve in such a short space of time the success with which Mr. George A. Hill, the manager of the Typewriter Exchange, 10 Barclay street, has met during the past fifteen months. Commencing in a small way, the Typewriter Exchange is to-day said to be the largest concern of its kind in the world. They constantly carry over 500 machines of different makes;

have over 100 machines distributed upon rental, and their average monthly sales exceed 60 machines. Here one can purchase a typewriter of any known make at a discount of from 40 to 60 per cent. on the list prices.

Mr. J. B. Olsen, the representative of the New York Insulated Wire Company, is meeting with big success in this city selling Grimshaw wires and Vulca ducts, having secured the above order, which calls for several thousand feet of wires and ducts. Mr. Olsen also filled a big order from the New York Electrical Equipment Company, Elm and Duane streets, for Grimshaw wire and Vulca ducts, to be used in the installation of an isolated plant in the Gerry Building, 23d street and 4th avenue. Another order secured was from Mr. W. H. Tucker, the electrical engineer and contractor, who is installing one of the finest electrical plants ever placed in this city, in the elegant new Metropolitan Building, Madison square and 23d street. This plant will consist of the United States Electric Lighting Company's system, Ball & Wood engines, Grimshaw wire and Vulca ducts.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age.

Names of Companies.	Capital.	Par.	Price.
American Dist. Tel., N. Y.	3,825,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	205 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N. B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	117 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*105
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	103 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	113 50
General Electric Co., 5s	4,000,000		*104
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	23 00
Laclede Gas pref.	2,500,000	100 00	66 50
Laclede Gas 5s	10,000,000		*83
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	57 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
North American Railway Co.	39,767,200	100 00	13 00
Postal Telegraph	10,000,000	100 00	78 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	97 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	37 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	51 25
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The bears have the market for the moment and are making the most of their opportunity. It is the fag end of a long, dull summer season and the revival will be strong, sharp and permanent. Of course one must take into account the cholera scare, for such a fear not only clogs the ordinary wheels but tends to stop all speculation for the time being. Our imports will diminish rapidly, which will reduce the volume of circulation and turns the thoughts of holders of goods towards a greater profit in those on hand, leaving outside ventures to those who make a business of speculating. Investors do not, as a rule, change but simply stiffen prices by taking securities off the street. The sugar people have the best argument, which is that the quarantine delays necessary imports and consequently up go the rates for all stock in hand. They also become a ten per cent. security, which gives them another boom. The industrials are substantially in possession of the market, there being a disposition to trade in them instead of rails, and the electrics, although falling back with the others, are held very strong. Western Union will, before another year has passed, always barring the ever-present contingency that the Government may purchase it, raise its capital to a round hundred millions. When the stock struck par the other day the whole investing public drew a long breath of relief, as it was accepted as proof positive of absolute value denuded of all speculative covering. The fluctuations have carried it down several points, but no stock will be sacrificed. The winter market should see it at least five points above par and on its merits. General Electric is back about eight points and is a purchase at the highest point it has ever touched.

The company's business is becoming systematized and extending rapidly under the consolidation. The bonds have not fallen; Westinghouse oscillates a point over and under par for its seven per cents. There can be no doubt of its ultimate value once the intentions of those in control become positively known. It either means a prodigious corporation owned or backed by the Rothschilds with all their capital and ability of staying, or an amalgamation with the General Electric. I consider the latter the most probable result; still, until the public are satisfied they will not venture any large amounts in the stock even at seven per cent. Edison Illuminating stands out bold and strong and the majority of the holders are permanent investors. They have

quietly captured the incandescent business of New York and are in possession for keeps. The service is satisfactory, prices charged acceptable, and the profits agreeable to the shareholders. Their five per cent. bonds rank among the highest in the Stock Exchange list. Laclede gas securities are also a purchase. The company reports cash receipts for August of over $60,000, an increase of full $5,000 over the same month last year. The total net receipts, including the Electric Light and Pintsch Gas plant, were $40,248, an increase of $8,709. For the eight months ending August 31 the net earnings were $391,599, an increase of $69,000 over the corresponding period of last year. These showings of constant increase in the net amounts is what is giving stability to the electric securities all over the country and will continue to as long as cautious investors have money left. The Presidential campaign will distract attention and disrupt business for the next six weeks, but a lively fall is assured. The market is fairly full of new enterprises, offering on terms to suit the most fastidious. The fact is, the local public-spirited men are willing to improve their homes and help the capital to secure extraordinary returns, coming in on the home-stretch themselves as permanent holders. They come from all parts of the country and court every inquiry. There is twelve months very active work ahead in the electric-railway business and many millions of money to be made, and the work is legitimate from every standpoint. Those who are able and willing to invest need look no further. Another security offering this week is the Guaranty Identification Card Co. Prominence is given to this company just now as it received its patent in November, 1891, and on May 5, 1892, the Government practically adopted it for the Chinese identification. The question of infringement will be settled in due course, meantime "The Identification Card" is recognized by all the leading banks and business houses, the post-office department, and, in fact, every place where identification is required. The cards, the price of which is $5, are good for life all over the world, and being the only patented thing of the kind, finds plenty of customers and there is money in the stock.

TRADE NOTES.

J. J. PAINTER'S SONS,
PITTSBURG, PA., June 24, 1892.

SILVER BRONZE PACKING CO.,
115 Liberty st., New York city.

GENTLEMEN: We have used your Silver Bronze Packing on our launch engine for some months and it has given perfect satisfaction in all respects. We sometimes carry 200 pounds steam-pressure and consequent high temperature any length of time.

As you are aware our stuffing-box is very small and it therefore did not give you a good opportunity to make as good a job as you could with more room. Still the packing works beautifully, and we cheerfully recommend it as just the thing for high pressures and rapid piston speeds.

The packing works free but tight, and keeps piston-rod smooth and in good condition. We believe that after engineers or owners of engines have once used your packing they will use nothing else.

Believe us, very truly yours,
(Signed,) GEO. E. & C. A. PAINTER.

P. S.—Engine in our launch "Gwendoline" is a Willard high-speed with piston valve 8″ x 8″ running at 325 revolutions per minute.

SOUTHWESTERN ELECTRIC LIGHT AND WATER POWER CO.
KANSAS CITY, MO., March 30, 1891.

JAMES LEFFEL & CO.,
Springfield, Ohio.

GENTLEMEN: We have in use at our electric light and electric power plant at Joplin, Missouri, one of your 66″ turbine wheels, which has now been in operation some time, and in view of the fact that we have recently placed an order with you for another wheel of exactly the same pattern, is in itself sufficient evidence that we are well pleased with the first wheel furnished us. This wheel drives 100 arc and 2,000 incandescent lights, all on the end of a circuit of 5.4 miles long, with a head of about 12 feet.

In this connection we desire to say that the writer has had considerable experience in electrical matters, in one way and another, and confesses considerable surprise at the steadiness with which we are able to operate our electrical generators. We are using the present wheel exclusively on arc and incandescent lights, and it is our opinion that no one in the country is making any steadier incandescent lights than we are from the wheel in question.

You are at liberty to refer any one to us for any information regarding our wheel. Yours very truly,
(Signed,) IRA C. HUBBELL, *General Manager.*

EDISON ELECTRIC ILLUMINATING CO.,
WILLIAMSPORT, PA., June 29, 1892.

THE ELECTRIC CONSTRUCTION AND SUPPLY CO.,
18 Cortlandt st., New York.

GENTLEMEN: We have had quite a number of "Ward" arc lamps in use for the past year or more, and find them economical in current and entirely satisfactory to the customers.

We like them very much, and our order of yesterday will be evidence that we are pushing this branch of the business.

Wishing you the success that your lamp merits over all others with which we are acquainted, we remain, very truly yours,

THE EDISON ELECTRIC ILLUMINATING CO.,
by SHAW & HESS, *General Managers.*

THE EDWARD P. ALLIS COMPANY, of Milwaukee, Wis., is building for the Brooklyn City Railroad Company eight 1,000 H. P. engines and six 2,000 H. P. engines. The electric generators operated by the latter will be mounted on the main shaft, the other engines will be arranged with the usual fly-wheel and be belted direct to the generators. These engines will cost the railroad company about $400,000. Some new features will be embodied in these engines that are somewhat different from the usual practice.

The Electrical Age's Illustrated Patent Record.

Issued September 6, 1892.

481,975. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric Manufacturing Company, Pittsburg, Pa. Original application filed Oct. 31, 1888. Divided and this application filed Sept. 27, 1889.

481,979. Apparatus for Electrically Purifying Water. Louis T. Stanley, Brooklyn, N. Y., assignor, by mesne assignments, to the Cutter Electrical and Manufacturing Company, Philadelphia, Pa. Filed Feb. 11, 1890.

481,989. Electric Fire and Burglar Alarm Connection

PATENTS.—Continued.

Homer T. Wilson, Louisville, Ky. Filed June 9, 1892.

481,999. Electric Furnace Generator. Emile Berliner, Washington, D. C. Original application filed Aug. 31, 1887. Divided and this application filed May 18, 1891.

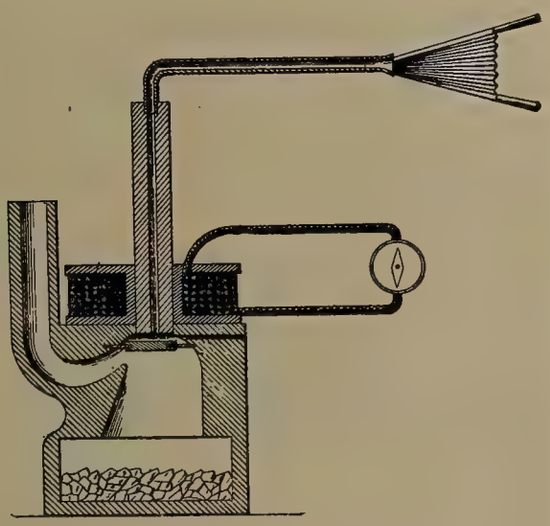
482,012. Battery-Connector. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

482,015. Printing or Recording Telegraph. Zacharay T. Lillard and Ursinus Erhard, Kansas City, Mo. Filed Jan. 23, 1892.

482,031. Trolley for Electric Railways. Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb. Filed March 25, 1892.

482,032. Electrostatic Switch and Phase-Indicator. Alfred U. Alcock, Melbourne, Victoria. Filed May 26, 1891. Patented in Victoria.

482,043. Storage-Battery. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y., assignors to the Acme Storage Battery Company, of West Virginia. Filed Sept. 25, 1891.



481,999.—ELECTRIC FURNACE GENERATOR.

482,044. Storage-Battery. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y., assignors to the Acme Storage Battery Company, of West Virginia. Filed Sept. 25, 1891.

482,074. Electrical Heater. John V. Capek, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed March 5, 1891.

482,093. Rheostat. Harry W. Lawrence, Denver, Col., assignor of one-half to Henry H. Metcalf, same place. Filed April 25, 1891. Renewed Jan. 23, 1892.

482,104. Ceiling-Block for Incandescent Lamps. Luther Stieringer, New York, N. Y., assignor to himself and William J. Jenks, same place. Filed July 3, 1886.

482,112. Support for Electric Lamps. Augustus Wright, Providence, R. I., assignor to the Hope Electric Appliance Company, same place. Filed March 23, 1892.

482,129. Combined Telegraph Key and Sounder. Dan J. Ludwig, N. Y. Filed May 2, 1892.

482,133. Electric Alarm-Clock. John McMillan and George H. Taylor, Philadelphia, Pa.; said Taylor assignor to said McMillan. Filed March 26, 1891. Renewed Feb. 15, 1892.

482,136. Automatic Battery Cut-Off. Walter S. Richards, Natick, assignor of one-half to George B. James, Boston, Mass. Filed Jan. 3, 1891.

482,137. Electrically-Adjusting Relay. Walter S. Richards, Natick, assignor of one-half to George B. James, Boston, Mass. Filed Sept. 14, 1891.

482,139. Electric Valve-Controller. Edward F. Roberts, Columbus, Ohio. Filed Aug. 26, 1890. Renewed Feb. 11, 1892.

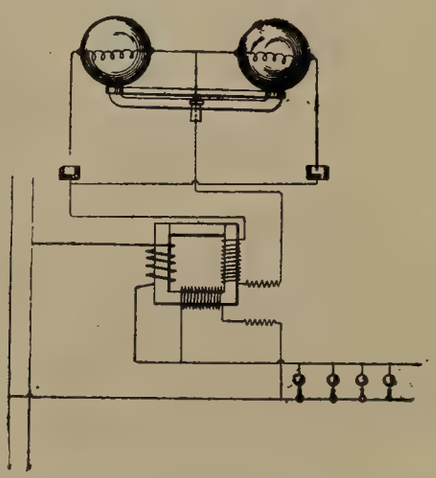
482,148. Telltale for Electrolytic Refineries. Francis B. Badt, Chicago, Ill., assignor of two-thirds to Lester S. Hills and A. M. Searles, same place. Filed May 16, 1892.

482,150. Electric Conductor. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Jan. 8, 1891.

482,151. Electric Conductor. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed July 17, 1891.

482,152. Electric Circuit and Cable. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Aug. 28, 1891.

482,153. Machine for Folding Tape. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed April 30, 1892.



482,209.—INDUCTION-COIL FOR ELECTRIC METERS.

482,157. Electric-Arc Lamp. John T. Birch, Pittsburg, Pa., assignor of one-half to William B. Henderson, Ingram, Pa. Filed April 4, 1892.

482,172. Electrical Gas-Lighter. James E. Hamilton, Chicago, Ill. Filed March 11, 1892.

482,174. Telephone-Exchange Apparatus. Angus S. Hibbard, New York, N. Y., assignor to the American Telephone and Telegraph Company, of New York. Filed June 2, 1892.

482,177. Electrical Conductor. Philip H. Holmes, Gardiner, Me., assignor to the Holmes Fibre-Graphite Manufacturing Company, Chicago, Ill. Filed Jan. 2, 1892.

482,181. Electric Connector for Hose. Charles F. Kellom, Delair, N. J. Filed Dec. 31, 1891.

482,209. Induction-Coil for Electric Meters. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 5, 1889.

482,240. Electric-Arc Lamp. James E. Gaston, Sparta, Ill., assignor to the Gaston Electrical Manufacturing Company, same place. Filed May 31, 1892.

482,251. Watchman's Electric Time-Recorder. Emanuel R. Heyser, Leon, Mex. Filed March 2, 1892.

PATENTS.—Continued.

482,253. Electric-Arc Lamp. Jesse F. Kester, Terre Haute, Ind., assignor to the Kester Arc Lamp and Manufacturing Company, Chicago, Ill. Filed May 11, 1892.

482,263. Electric Annunciator. Erastus D. Moore, New York, N. Y. Filed Feb. 18, 1892.

482,265. Armature for Dynamo-Electric Machines. John Nebel, Charlton, assignor to the Siemens Brothers & Co., Limited, Westminster England. Filed Nov. 11, 1891. Patented in Germany; in England; in France, and in Belgium.

482,270. Means for Drawing Cables into Conduits. Thomas F. O'Connor, New York, N. Y., and Joseph W. Marsh, Pittsburg, Pa., assignors to the Standard Underground Cable Company, Pittsburg, Pa. Filed Jan. 8, 1892.

482,297. Electric Insulator. William H. Clark, Brooklyn, N. Y. Filed May 21, 1891.

482,306. Electric Railway Signal. Charles K. Hall. New Orleans, La., assignor for forty-nine one hundredths to William B. Lillard, same place. Filed April 4, 1892.

482,323. Magnetic Separator for Ore-Concentrators Charles E. Seymour, Lake Geneva, Wis., assignor to the Seymour Concentrator Company, Chicago, Ill. Filed Oct. 2, 1891.

482,324. Electric Meter. Francis Teague, London, England, assignor to John Abbott Iliffe, same place. Filed Nov. 17, 1891. Patented in England, in France, in Germany and in Italy.

482,325. Trolley for Electric Railways. James M. C. Tyner and Samuel S. Irving, Minneapolis, Minn. Filed Nov. 30, 1891.

482,328. Electric Cable. John A. Barrett, Brooklyn, N. Y., assignor to The Standard Underground Cable Company, Pittsburg, Pa. Filed Aug. 28, 1891.

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NEW YORK STREET RAILWAY ASSOCIATION.

As this issue is on the press the convention of the New York Street Railway Association is being held in Saratoga. A full report of the proceedings will be published in our issue of next week.

WESTERN UNION'S PROSPERITY.

The directors of the Western Union Telegraph Company, last week, after declaring the usual quarterly dividend of 1¼ per cent., resolved to increase the capital stock of the company $13,800,000, making it $100,000,000. It is stated that this increase is to represent the surplus earned over and above dividends since October, 1881, which is reported to be $14,455,757.16. The present stockholders will receive as a dividend 10 per cent. of their present holdings in new stock. This will require $8,620,000 of the new stock, leaving a balance of $5,180,000 in the treasury.

The company is making money so rapidly why would it not be a good idea to give some of it to its employés in the shape of increased salaries, and to the public in the shape of lower rates on telegrams.

CANADIAN ELECTRICIANS.

According to a Canadian contemporary, there is a feeling of apathy in Canada with reference to active participation in the World's Fair by Canadians. Indeed the feeling prevails that Canadian concerns should refrain altogether from taking part in the fair because of the "unfriendly spirit" shown lately towards Canada by the United States government. This "unfriendly spirit" probably refers to the recent action of the United States government regarding canal tolls and foreign vessels passing through the Sault Ste. Marie canal, but why this should engender any unfriendliness among Canadian electricians towards the American people and their fair is hard to discern. The executive committee of the Canadian Electrical Society is the august body responsible for this teaching, and recommends, furthermore, that it would be wiser for Canadian electrical interests to hold a creditable exhibit of their own in connection with the Toronto Industrial Exhibition of 1893. If Canadians act on this advice they should take the precaution to build a fence around their exposition building and securely guard their electrical exhibit. Some American might gain admittance thereto and walk away with their ideas.

If this is the reason why Canadians are disposed to ignore the World's Fair they should be ashamed of themselves. The United States can stand it if they can.

THE TROLLEY IN BROOKLYN.

The Coney Island and Brooklyn Railroad Company deserves credit for the enterprise it has shown in connection with the change from horse to electric power on its lines. Last week the line to Fulton Ferry was given over to electricity, and it may surprise our fearful and sensational daily contemporaries and those individuals of like kin to know that Brooklyn's population was not diminished any by the running of the electric cars through the city. The Brooklynites still live and are happy because they can get from one part of their big city to another in less time than before the advent of electric cars, and they also have a well-grounded belief that the howls of sensational dailies on the so-called dangers of the trolley system have no basis whatever in fact. Those papers which have been giving up so much of their space and powder in an endeavor to annihilate the trolley have been so blind in their passion that they did not realize that they were administering an overdose of their transparent silliness. The trolley, however, has overcome all of these obstacles simply on its merits, and the sensation-mongers are rapidly withdrawing from the fray, completely beaten at every point. Brooklyn is to be congratulated on her good fortune in having more rapid transit in her streets, and there is hardly any doubt that her big sister city, on this side of the East river, will before long be enjoying the same luxury, in the uptown districts at least.

A THREE AND ONE-HALF MILE OKONITE CABLE.

The submarine cables manufactured by the Okonite Company (Limited), 13 Park Row, New York, and so extensively used in the exacting applications of the leading telephone and telegraph corporations in the United States, are recognized as possessing exceptional merit for pliability, durability and the very highest efficiency.

These results, so satisfactory to both the manufacturer and the purchaser, are due in part to the superlative insulating properties of okonite, and in part to the extreme care exercised in the selection of all material, together with the close attention given during every stage of the manufacture of an okonite cable from the time it enters the factory at Passaic, N. J., as raw material, to the time it is shipped to its final destination as a finished production.



THREE AND ONE-HALF MILES OF OKONITE CABLE.

To a person unfamiliar with the magnitude of the business the complex specifications for a submarine armored cable are altogether bewildering, but not in a single instance, it is said, has the okonite cable failed to "test out" to the severest exactions, and it is to-day claimed to be without an equal for work of this class.

The Southern New England Telephone and Telegraph Company recently accomplished the laying of an okonite submarine cable from a point on Pine Island near New London, Conn., across Long Island Sound to Fisher's Island. This cable was three and one-half miles long, contained six copper conductors, weighed fifty thousand pounds and was in one length, without splice. It was transported from the factory at Passaic, N. J., on a "flat" car, on which was constructed a special reel, and laid from point to point without delay, accident or call for special help.

The entire management of transferring from the car, laying, etc., from start to finish was under the direction of Mr. E. B. Baker, sup't Southern New England Telephone and Telegraph Company, ably assisted by Mr. R. D. Blish, the cable expert of the telephone company.

Our illustration, taken from a photograph, shows the cable after it arrived at New London as it is being transferred from the reel on the "flat" car to the reel on the float from which it was laid.

PROTECTION AGAINST FIRE AT THE WORLD'S FAIR.

The Chicago Fire Underwriters' Association has issued to its members a statement of the means provided for the protection of the World's Fair buildings against fire, Fire-stops in walls and columns of all exposition buildings are required to be of plank covered with cement mortar, composed of Portland cement and three parts of clean, sharp sand. Large stops require the addition of expanded metal or wire lath, plastered on both sides with cement mortar. The roofs of the various buildings are being cared for by means of ladders, with necessary scuttles, runways and cleated walks on roofs, so as to permit a complete fire patrol of the entire roof system, and to facilitate operations in fighting fire. The basement area of eight exposition buildings are being divided into compartments 150 x 250 feet, by two-inch plank fitted up tight, having connecting trap doors from aisles to each compartment.

Water for the grounds and buildings will be furnished by the city from Hyde Park pumping works, where the exposition company is placing pumps of 24,000,000 gallons capacity per day. In addition there will be a plant of four Worthington pumps on the exposition grounds, with a capacity of 40,000,000 gallons per day, which will take water from the lagoons for steam machinery and for the fountains. In case of fire or break-down of the city pumping works these pumps are expected to furnish a full supply.

The temporary fire protective service consists of one steam fire engine with four city fire companies always on call, three chemical engines, twenty-eight hose carts, 14,500 feet of hose, 570 hand extinguishers and 2,575 brine pails. There are seventy-one barrels of water, of which fifty-five are on the roofs of such buildings as are finished to such a point. Of the 150 fire-alarm boxes to be located, sixty-four are in service, connecting all buildings with central station on the grounds, connecting with other fire stations, with pump-house, police and headquarters. There will a day and night patrol on the floors and roof of each building.

Ten stations have been located for the permanent fire

service, to contain six steamers, nine double-tank chemical engines, three hook and ladder trucks, one water-tower and five patrol ambulance wagons.

ACOUSTIC TELEPHONE.

In large manufacturing concerns, warehouses, public buildings, hospitals, asylums, etc., where speaking tubes are used for communicating from one department or floor to another, there has been a long-felt want for some cheap and more satisfactory service.

From time to time various styles of apparatus have made their appearance, but many of them have been pro-

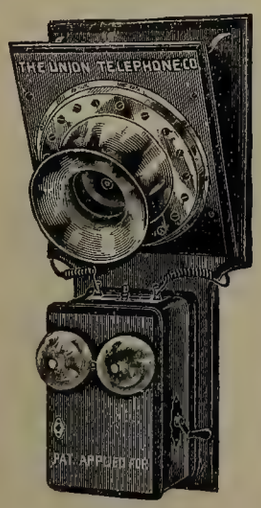


FIG. 1.

nounced decided failures after repeated trials. An apparatus has, however, been placed on the market that is claimed to have proven a success.

It is known as the Simpson Acoustic Telephone, and is manufactured by the Union Telephone Company, of 64–66 Broadway, New York, under patents granted to A. L. Simpson, the inventor.

By this system communication may be had from different parts of buildings and between distances not exceed-

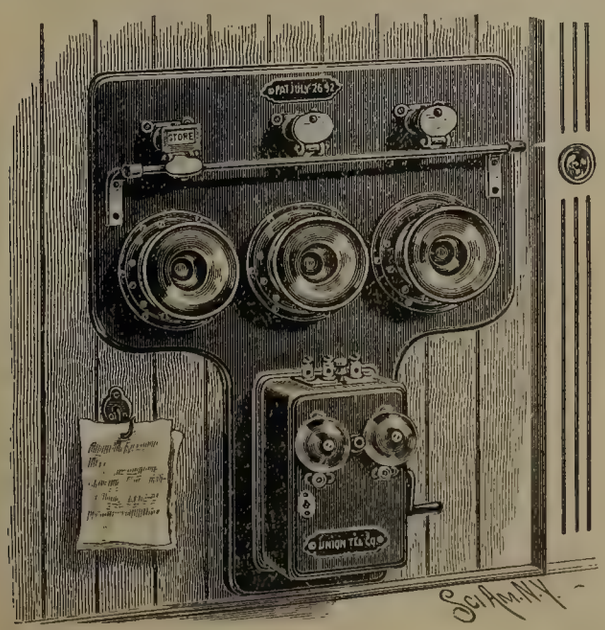


FIG. 3.

ing two miles in length. The prominent features are perfect articulation and the entire absence of electric batteries, and as the apparatus is sold outright, purchasers are saved the expenses of large telephone bills.

This telephone is specially adapted for all those wishing rapid, cheap and direct private communication with stables, depots, offices, banks, stores, mines, warehouses, hospitals, railroads, hotels and private dwellings.

In the accompanying illustrations, Fig. 1 shows the telephone which is placed on brackets in the window, the wires running out through the window casing.

Fig. 2 is the same telephone horizontal arrangement, with upright mouthpiece, designed to meet the wants of those desiring to have their instrument away from the window or in any part of an office or hallway. This is an entirely new style of acoustic telephone.

In Fig. 3 will be seen the main board of the multiple-duplex system and is used where a number of lines are brought together from different points. There is a horizontal bar with annunciator drops over each mouthpiece indicating from whence the call comes. When any one at the other end of the line wishes to call up, the call bell is simply rung and the corresponding drop over the mouthpiece on the main board falls; but on the other hand, when calling up from the main board the drop is thrown down by hand which causes the bell to be rung at the opposite end of the line without disturbing any of the other wires.

Only the very best quality of materials is used in the construction of the various parts of this telephone, with a

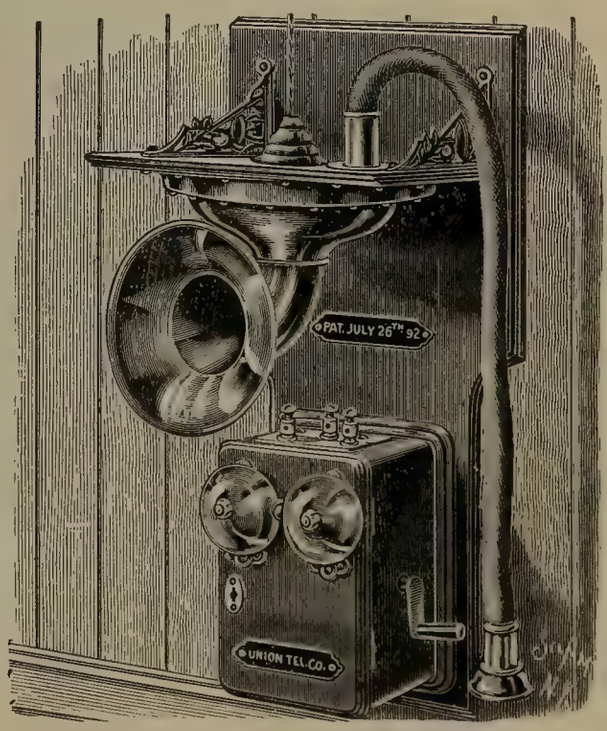


FIG. 2.

view to having them as durable as possible. The following are the essential features:

The frame of the mouthpiece and the diaphragm are constructed in two pieces only, the metal mouthpiece, condensing chamber and support for the diaphragm being spun of one piece of metal, the diaphragm being bolted to this by means of small screws and bolts. The advantages so derived are essentially a collection and distribution of about 95 per cent. of all the sound waves received on the diaphragm, and the avoidance of reverberation, so frequent in many acoustic telephones.

The method of connection is extremely simple, the only care being required is to see that the line is free from pressure against solid substances. To guard against this hangers are provided.

The cost of putting up a telephone line of 1,000 feet including two telephones is very moderate, and if the work is done by the employés of the company a guarantee is given to put it in proper working order. For parties desiring to put up their own lines, full printed in-

structions are furnished that will enable a skilled mechanic or lineman to do the work properly.

The telephones are furnished in highly polished metal and wood (cherry, walnut or ash).

So great has been the demand for these telephones that the company is pushed to its full capacity to keep up with orders and is already contemplating the enlarging of its establishment.

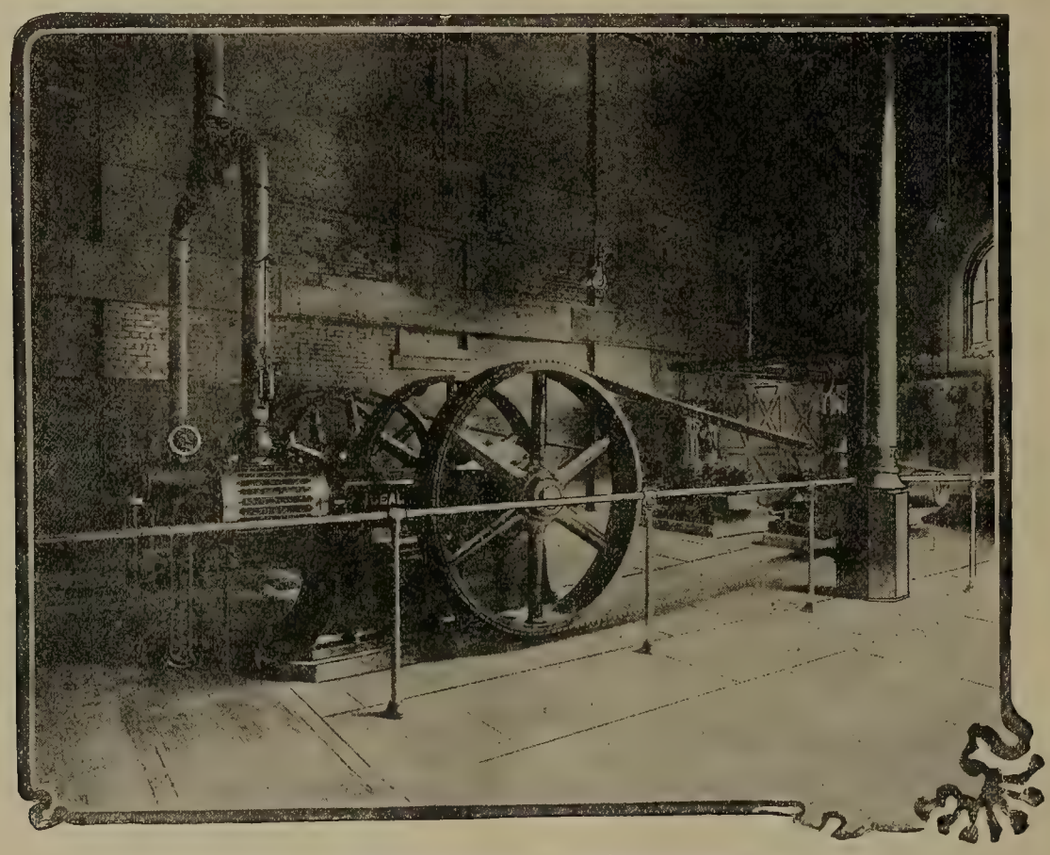
POPULAR ENGINES.

Of all the many types of engines manufactured, perhaps none have attained a wider popularity or given more satisfaction than the well-known "Ide" and "Ideal" engines manufactured by the Harrisburg Foundry and Machine Works, of Harrisburg, Pa., of which company W. R. Fleming & Co., Mail and Express Building, are the New York representatives.

These engines are in use throughout the country, and engines are double-acting, with balanced valves, and in which the highest economy is combined with compactness of form to insure minimum expenses for attendance and repairs. They are said to be the only self-lubricating, double-acting engines in use, and the only self-lubricating engines that do not mix water with oil.

Besides running electric-light plants these engines will be found of great value in the bottling departments of breweries, also in the running of elevators. They are specially adapted for making long runs without shutting down, and do not require the same unceasing attention to keep the oil-cups filled as do other makes of engines. The governors are automatic and of the simplest design, giving, however, a most perfect regulation. "Ideal" safety caps specially designed to preclude the possibility of injury to or breakage of the engine in case of foaming or flooding in the boilers and water running over in large quantities are provided.

The manufacturers guarantee the engines to run



ENGINE AND DYNAMO PLANT IN LEMP'S BREWERY, ST. LOUIS.

the accompanying illustration shows an electric-light plant in the brewing establishment of W. J. Lemp, St. Louis, Mo., in which two "Ideal" engines have been installed to operate the Edison system which is used to light the building.

These engines are automatic-cut-off, 11 x 12 inch, and of 70 H. P. each. They are self-lubricating throughout, a special feature being that but one oil receptacle is employed to distribute the oil in streams to all parts of the engines which need to be lubricated. The advantage of this method over those which necessitate the employment of ten or twelve small oil-cups will be thoroughly appreciated, Again, the unused oil is returned to the oil-chamber to be used over again, and hence a large saving in the oil bill. It is claimed by the manufacturers, that there has never been placed on record a single instance of one of their engines ever having stopped running from a hot bearing, and that owing to perfect lubrication and large bearing surfaces, they can be run for weeks at a time without adjustment. These noiselessly and smoothly, without vibration, and that, while running at full speed, with all anchor bolts out, they will not shake or move on the foundation in the slightest degree; furthermore, that when working under extreme changes of load, there will not be a variation in the speed of over one per cent. All engines are subjected to tests under the above conditions before allowed to leave the shops. That the manufacturers are warranted in offering such a cast-iron guarantee is amply proven by the immense number of voluntary testimonials of the meritorious value of these engines received from all over the land wherever they have been used. To print a list of the "Ide" and "Ideal" engines at present in service would constitute a volume in itself.

The Harrisburg "Ideal," as well as the "Ide" engines are built cross and tandem compound, giving fully equal satisfaction to the simple engines and consequent advantage in fuel economy from compounding. Lack of space prevents our giving at present a description of this type of engine, which will, however, appear later.

IMPROVED ANNUNCIATOR.

An improvement in electric annunciators, designed to overcome the ills that such devices are heir to, is illustrated herewith. It is the invention of Mr. E. D. Moore, Secretary and Treasurer of the Moore Electrical Works, 652 and 654 Hudson street, New York, and, it will be seen, is very simple.

The magnet is of the ordinary type and is set on a frame *a*, which acts as a common support for every part of the apparatus. The armature *d* is made with a notch in it to hold the indicator plate *e* when the letter is in a position to be operated by the electromagnet. When the magnetism draws the armature down, the hold on the indicator plate by the armature is released and the plate, by virtue of a spiral spring around the pivot *g*, flies to the position indicated by *e'* (fig. 2), thus showing the location whence the signal came.

The armature lever is made with a 90° angle, so that the perpendicular portion acts as a counterpoise to the arm acted upon by the magnet. The lever is pivoted to the frame *a* at *i*, passing through an aperture made in the frame. When the armature is acted upon by the magnet the hanging portion of the armature lever is moved from the perpendicular line, but it returns by gravity to its normal position the moment the current ceases.

The simplicity of this device commends it for general

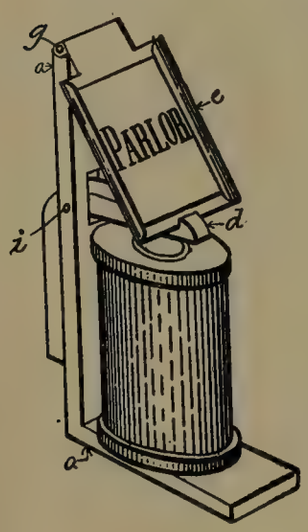


FIG. 1.

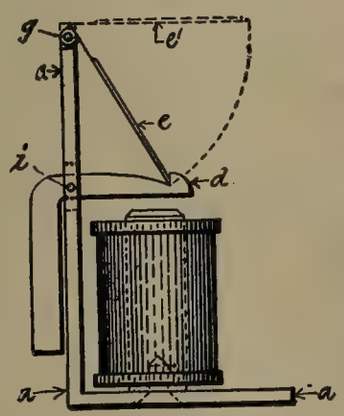


FIG. 2.

use for burglar alarms, annunciators, and like purposes, where it is desired to indicate at a distant point whence an electric signal comes.

It is a compact arrangement of parts, and apparatus constructed with this device will take up a minimum amount of space, besides being reliable in its action, as there is nothing to get out of order.

OUR ACKNOWLEDGMENTS.

We have received from the Okonite Company, 13 Park Row, one of the wire computers gotten up by that company, which was described in the ELECTRICAL AGE of August 13 last. This computer was compiled by Mr. Wm. Cox, and by its use much of the labor and time spent in making wire calculations in electrical construction are saved.

A copy of a beautifully colored lithograph, giving a bird's-eye view of the World's Fair, gotten up by the New York Insulated Wire Company, 13-17 Cortlandt street, New York, has reached us. Grimshaw white-core wire is to be used exclusively for the entire incandescent lighting of the buildings and grounds.

THE ELIHU THOMSON PRIZE.

We have received from Mr. Ernst Thurnauer, Paris, General Manager for Europe of the Thomson-Houston International Electric Company, under date of September 1, last, a circular concerning a prize offered by Prof. Elihu Thomson for the best work on a theoretical question in electricity. The following is the full text of the circular :

"At the last prize contest instituted by the City of Paris for the best electric meter the prize of 5,000 francs was awarded to Prof. Elihu Thomson.

With the desire that this sum should serve for the development of the theoretical knowledge of electricity, he has requested the undersigned, General Manager for Europe of the Thomson-Houston International Electric Co., to offer a prize for the best work on a theoretical question in electricity, and to organize a committee who should propose the subjects, examine the productions and decide the prize.

The following gentlemen have been chosen, and have kindly consented to act as members of the Committee : J. Carpentier, President of the Société Internationale des Electriciens ; Hippolyte Fontaine ; E. Hospitalier, Professor in the School of Physics and Chemistry of the City of Paris ; E. Mascart, Member of the Institute ; A. Potier, Member of the Institute, *Examiner ;* B. Abdank-Abakanowicz, Consulting Engineer, *Secretary of the Committee.*

The Committee has decided that the prize should be given for an investigation on one of the following subjects :

1. The heat developed by successive charges and discharges of condensers under different conditions of frequency, nature of dielectric and quantity of charge.

2. It has been shown theoretically that when the two surfaces of a condenser are connected by a conducting body, the condenser becomes the source of alternating currents as soon as the resistance of the conducting body decreases below a certain limit. The formula that permits calculating the period of this oscillation has not yet been completely verified. This period of oscillation should be investigated experimentally under conditions such that the exact measure of resistance, capacity and coefficients of self-induction may be possible, in order to arrive at a complete and precise verification of this formula.

3. When a condenser made with an imperfect insulating material has been charged and then left to itself, the charge is gradually dissipated. The time necessary for the charge to be reduced to a given fraction of its initial value depends only on the nature of the insulating material. It is proposed to investigate whether, as certain recent theories would seem to indicate, analogous phenomena do not present themselves in metallic conductors, and whether these can be shown experimentally.

4. It is proposed to arrange and systematize our present knowledge of the graphical solutions of electrical problems, and deduce from them some general methods as in graphical statics.

The theses presented may be written in any one of the following languages : English, French, German, Italian, Spanish or Latin. They may be in manuscript, or printed.

Each thesis presented must be signed by a pseudonym and accompanied by a sealed envelope bearing the same pseudonym on the outside, and with the name and address of the author inside.

The papers must be sent before the 15th of September, 1893, to B. Abdank-Abakanowicz, Consulting Engineer, the Secretary of the Committee, at 7 Rue du Louvre, Paris, who will furnish any further information required."

POWER HACK-SAW.

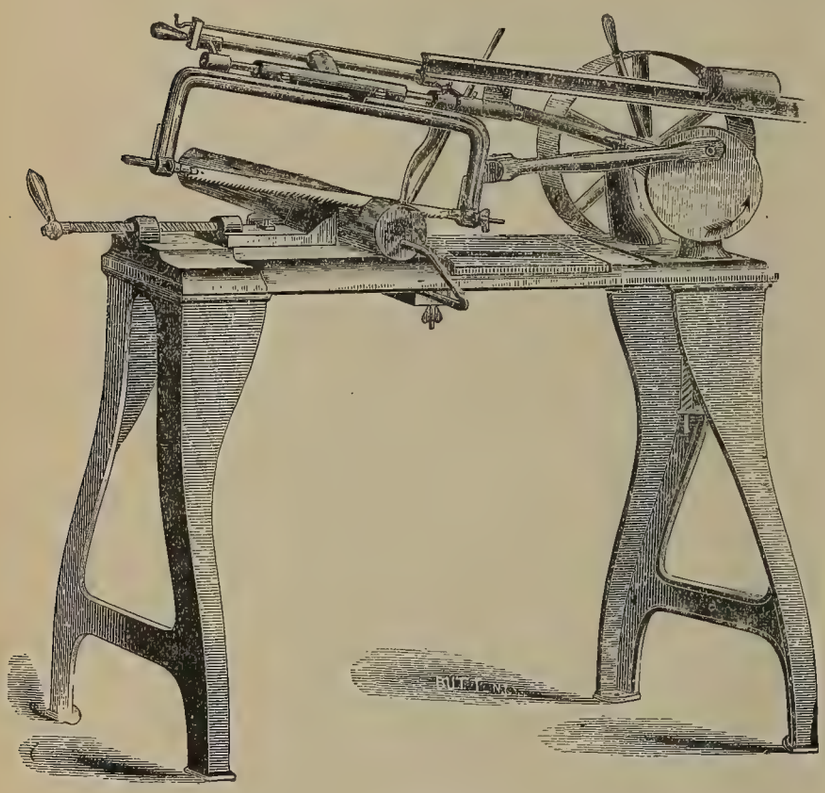
The accompanying illustration shows a power hack-saw manufactured by the Miller's Falls Company, of 93 Reade street, New York, that, although having been on the market only about eight months, has won for itself an enviable reputation and is being rapidly adopted by those who have use for such a machine.

It is claimed that the blades made by this company, when used in their power frame, will cut about ten times as much as is usually done with it by hand.

Many electrical manufacturers are using the power hack-saw in their works, and it will be found of great value by street-railway people for cutting rails, etc.

It is simply constructed and easy manipulated. In connection with the machine a rest is manufactured, adjustable to various heights, for use where long pieces are to be cut.

The manufacturers have received a great number of testimonials attesting the satisfactory performance of



HACK-SAW.

these saws, many of which are from well-known electrical concerns in various parts of the country.

In many instances, where one machine has been purchased as an experiment, the order has been duplicated. They are sold at a reasonable price and are within the reach of all.

FIRE HAZARDS FROM ELECTRIC WIRES.

During the latter part of July last we sent out a circular to prominent electrical engineers and electric-light specialists asking for their views on the subject of certain questions propounded by an official of a prominent insurance company in New York City, regarding the safety of old electric wiring and the possibility of rendering new wiring safe, from the underwriters' standpoint.

The questions referred to were as follows:

"1. Is all, or nearly all, of the old wiring unsafe and likely to cause fires?

"2. Can buildings be so wired as to be perfectly safe, from the standpoint of the fire underwriter? and if so, how?

"3. Assuming that to be safe wires must be inserted in some kind of tubing, what shall it be, considering the question first from the standpoint of absolute safety, and next from the standpoint of economy?"

In the issue of the ELECTRICAL AGE of August 6 we gave the views of Mr. H. Ward Leonard of this city, on these points, and have just received the reply of Captain Wm. Brophy, of Boston, the eminent authority on such matters, to whom a copy of the circular was sent at a later date.

The following is Capt. Brophy's communication in full:

BOSTON, Sept. 12, 1892.

ELECTRICAL AGE PUBLISHING COMPANY,
WORLD BUILDING, NEW YORK, N. Y.

Gentlemen: I have your circular letter of August 13, propounding certain questions about fire hazard in connection with electric lighting. Permit me to reply to your questions as follows:

First. I think much the larger portion of the old wiring—that is, wiring done within six years, and done according to the then existing requirements and best practice—is safe and is not likely to cause fire and consequent loss to the underwriters and owners of property, unless under extraordinary circumstances.

The character and occupancy of a large majority of the buildings that have been wired, even with the low grade of insulating covering in use five or six years ago, is such that if ordinary care has been used in doing the work there is very little if any danger from their continued use. They are mostly frame, or brick and stone, with frame or wood construction inside. The woodwork on which the wires have been run being perfectly dry and not subject to an excessive amount of moisture is in itself a very good insulator, and will continue to be so much longer than any of the existing insulating compounds at present in use for covering wire.

The bursting of a water-pipe, or overflowing of a sink or bath-tub, may cause the wood and insulation to become water-soaked at that point, when of course there might be danger of fire. Such incidents are less frequent, however, than the explosion and overturning of kerosene and naphtha lamps and stoves, and thus far have not proved to be such a fruitful cause of conflagrations great and small; neither can they be so prolific of disaster to the underwriters as the swinging gas-jet, lighted cigar-stub, or that venerable combination that has done duty so long, "rats and matches."

Yet none of the above can be prohibited or suppressed by insurance rules, or state or local laws.

Other buildings not included in this class are of so-called fire-proof construction, in which the wires have been imbedded in plaster, cement, channels cut in brick or stone walls, and under brick, tile, marble or stone floors. In this class of work the insulation soon breaks down and renders the wires worthless for the purpose for which they were intended, unless the insulation is mechanically protected from the action of the material surrounding it; yet owing to the construction and material of these buildings fire seldom results from this cause.

Second. Yes, buildings can be so wired as to render electric lighting safer than any other form of artificial illumination from the standpoint of the underwriters, by using the best known grade of insulating covering, and by so placing them that when not suspended in, and surrounded by air, they will rest on indestructible insulating supports, so that when the unrelenting hand of time has destroyed the insulating properties of the covering they will still be safe.

One of the most potent factors in the attainment of this most desirable end is the underwriters themselves. If, instead of wringing their hands in despair in the contemplation of the possibilities for evil some of them seem to think the past and future of the electric light has in in store for them, they will co-operate with those who next to themselves have as deep an interest in rendering the electric light perfectly safe as any other class in the community, viz., those engaged in the business of electric lighting, and aid them by placing the stamp of their disapproval on all unsafe wiring and the men or firms found doing the same, they will have done their share in rendering electric lighting safe and harmless. A very few lessons of this kind will soon improve matters by driving out of the business the discharged wireman and snide contractor, whose absence will surely tend to insure safe wiring and will also teach the public that cheapness alone does not secure reliability or safety, and that the money paid for a poor job may prove only the first instalment of a very costly undertaking.

On the other hand, let those engaged in the electric lighting business refuse to furnish current to any building unsafely wired. Make a rigid inspection of all the electric light wiring done in the territory covered by their plant, regardless of the insurance or other inspection made by the State or local authorities, for with all due respect to those bureaus, I feel sure that those engaged in the electric lighting business can now be trusted to do their share to make electric lighting perfectly safe. Better by far for them to suffer a loss of revenue by a refusal to connect to unsafe wiring than the loss of reputation for safety that might result to their system of lighting did they do otherwise.

I cannot let this opportunity pass without condemning the practice in vogue where a system of insurance inspection is maintained by the assessments levied on electric lighting, construction companies and individuals engaged in electric light wiring, of giving the endorsement of the insurance organization to *all* who apply for it, often without any regard to the character, ability or responsibility of such applicants, so long as they pay their yearly stipend for the support of a system of inspection that too often does not inspect. Where this state of affairs exists a fair price cannot be procured for safe wiring and the "fakirs" have the field all to themselves, the only one who stands in their way being the electric light manager who will not connect to unsafe work.

The insurance companies doing business in such localities may well look forward to what the future has in store for them with some degree of anxiety.

Third. I do not assume, or agree with those that do so, that "to be safe, wires must be inserted in some kind of tubing." A tube for electric wires that would possess the strength of iron gas-pipe and at the same time possess a high grade of insulation, would prove of great value in the installation of any electric wires. In the absence of such tubing we can only provide a suitable wire-way for convenience in withdrawing the wire and replacing the same should it become necessary from any cause to do so, to avoid the necessity of tearing up and disfiguring portions of the floors, walls and ceilings. This shoud be ample in size, should present a smooth and unbroken interior surface, should possess sufficient mechanical strength to resist the action of the carpenter's saw, axe, chisel, spikes and nails, and the cross-purposes of the plumber, steam and gas fitter. Iron pipe seems to be the only thing now available for this purpose. Of course a high grade of insulation would have to be used, and the use of twin wires as at present practised in interior conduits abandoned. I am not advising this method of wiring, but where tubing is absolutely necessary the pipe will be ample for all purposes except that of insulation; the covering on the wire must suffice for that.

To my insurance friends let me say, let them not lull themselves into the belief that one man, be he ever so competent, can properly inspect *all* the wiring done in four or five, or one State, or even one of our large cities, and truthfully say it is well or safely done—such a feat is impossible. The inspector may see that that is exposed to view, and have existing faults corrected, but what, pray, does he know about much of the greater portion of that which is hidden from view?

For prudential reasons a gas-lighting company will not turn gas into a building containing leaky pipes, and for similar reasons electric lighting companies should not turn current into a building containing leaky electric wires. For business reasons alone it is for their interest to have all wiring done in the best possible manner, in order to prevent all unnecessary waste of the electrical energy which they are engaged in furnishing to their customers. Yours very truly,

WM. BROPHY.

THE ELECTRIC TRANSMISSION OF POWER.*

BY EUGENE GRIFFIN.

(*Continued from page* 577.)

Probably the most notable plant ever constructed is that of the Frankfort Exhibition, where over 300 horse-power was transmitted 112 miles by means of three slender bare wires No. 4 B and S gauge.

Lauffen, where the generating station was located, is situated on the Neckar, a branch of the Rhine, and the enormous water-power was utilized to generate 300 horse-power of electrical energy at a tension of from 16,000 to 30,000 volts.

At Lauffen step-up transformers were used to increase the potential from the fifty volts of the dynamos to these very high pressures used, and at the other end of the line, namely, in the grounds of the electrical exhibit, step-down transformers re-converted the pressure to a point where it could be utilized for both light and power uses.

An immense bank of lamps, wired up in series, gave evidence of the high voltage of the line. In only one case did the insulation break down, and that was at a strain of 30,000 volts.

An interesting feature of the installation was the supplying of an artificial cascade, thirty feet high, with water pumped by means of the electrical current, thus completing the cycle of changes. The experiment was undertaken more as a matter of scientific investigation than an attempt at commercial success. An efficiency of seventy-four per cent., however, was obtained.

The cost of the installation per effective horse-power, based on the assumption of 300 horse-power delivered at Frankfort, was a little over $300, of which the cost of the line involved $210.

During the progress of the exhibition, the plant was run at a potential of 16,000 volts. At the close, however, experiments were made at a very much higher pressure. The insulators were made in three sections. The porcelain top was flat with a deep groove to hold the wire, and underneath a saucer-shaped receptacle. Beneath this was another receptacle of larger breadth and depth, and under this still another. All were filled with oil. On final experiments the pressure was increased to 20,000 and finally 30,000 volts. Though

* A lecture delivered before the Franklin Institute, Philadelphia, February 29, 1892.

none of the insulators gave way a plate of glass was easily punctured. It is believed that these insulators, somewhat modified in form, can readily be made to stand a pressure of 50,000 volts.

During the experiments regular readings were taken at both ends of the line, and voltmeter readings were taken between one conductor and the neutral point in each of the three circuits, which averaged fifty-four volts, the current readings being 500, 490 and 500 ampères, respectively, in the primary circuits. The mean electric power delivered to the line was 80,500 watts. At the same time the Frankfort end of the line delivered current for 1,060 incandescent lamps of sixteen candle-power which absorbed about 58,000 watts. These figures give the seventy-four per cent. efficiency which it is claimed is low owing to the lag. Wet weather was not found to appreciably affect the working of the line. The losses due to condenser action of the conductors was also found to be very small.

A description of the Lauffen-Frankfort transmission plant is not complete without brief reference to the permanent transmission of power from this point, to-wit: Lauffen to Heilbronn, a distance of seven and one-half miles. The plant is owned by the Lauffen-Portland Cement Company, and the power, besides running their work, also supplies the city of Heilbronn with light. The power plant is of 1,500 horse-power capacity, of which 600 horse-power is used for the cement works, leaving 900 horse-power for the supply of light and power. The alternating-current system is used on account of the great distance the current is transmitted. A 300 horse-power rotary-current dynamo with a capacity of 4,000 ampères at fifty volts is used. This current is transformed to 5,000 volts. The transmission is by three sets of bare wires, .24 inch in diameter carried on overhead poles with oil insulators. An ingenious device for protection against lightning is the placing of an ordinary barb wire above the wires on the pole, and connecting with earth at frequent intervals. At the outskirts of the town of Heilbronn the current passes through a large transformer similar in type to that at the Lauffen end, which transforms the current down from 5,000 to 1,500 volts. From here it is conveyed by concentric cables underground. At more central points other transformers are located which reduce the potential down to its final pressure of 100 volts, at which it is supplied to customers.

The total loss in the seven and one-half miles of leads and in the double transformation is said to be only twenty per cent., 160,000 watts of the 200,000 generated at Lauffen being available to customers. This is sufficient for 3,200 incandescent lamps of sixteen-candle power.

Another interesting plant is the generating station located at the villa town of Tivoli, Italy, which is situated in the Sabine Hills, eighteen and one-half miles from Rome. The practically unlimited water-power of the river Amene is used at this point to drive water-wheels. The current generated is utilized for light and power in Rome.

The motive-power is derived from a water-flow of about 132 cubic feet under a head of 157 feet.

Six turbines of 300 horse-power each are coupled direct to alternating dynamos, 230,000 watts capacity, at 170 revolutions a minute.

In addition there are three direct-current machines, each coupled to a turbine making 375 revolutions, which are used as exciters for the alternators.

At full load a potential of 5,100 volts is used. The current is conducted by means of four bare copper wires (between Nos. 7 and 8 B and S gauge), carried on iron poles with oil insulators.

The drop in potential amounts to twenty per cent. on a line of 18.4 miles (circuit 36.8 miles). At the outskirt of Rome near Porta Pia is located the distributing tower in which the current is transformed from the pressure of 5,000 to one of 2,000 volts. This is again reduced at centrally located points to 100 volts, at which it is furnished to customers.

When fully completed the central station of Rome with its 5,000 horse-power capacity will be the second largest lighting plant of Europe, Berlin having the largest.

The town of Pontresina is situated in the Engadin Valley, at an elevation of some 6,000 feet above the sea.

The lighting plant was designed and constructed by the firm of R. Alioth et Cie., of Basle, and is one of the somewhat uncommon direct-current transformer systems.

About four miles south of Pontresina, at the base of the famous Monteratsch glacier, are the falls of the Bernina.

A portion of the stream above the falls is diverted to a small reservoir, from which it is conveyed by a cast-iron pipe to the power station at the foot of the mountain. It is used to drive the turbines to which the dynamos are coupled.

The maximum rate of water discharge is over seventy gallons a second with a head of 420 feet.

Seventy-five horse-power high-pressure turbines, built by Escher, Neyss et Cie., of Zurich, are used, each connected independently to a primary dynamo by flexible couplings. The generators have each a capacity of thirty-four ampères (1,500 volts), or 51,000 watts at 500 revolutions, and are of the four-pole type, series wound.

The turbines are equipped with automatic regulators which maintain a constant speed, this insuring a constant potential at the transforming station under all loads. Three machines are run in series, giving a combined capacity of thirty-four ampères, 4,500 volts, 153,000 watts, a fourth being held in reserve in case of breakage, The primary current is conducted by a No. 4 copper wire. Oil insulators are used.

In the transforming station, situated in the centre of Pontresina, the current passes first through meters and safety devices placed on the switchboard, then to the four motor dynamos which are connected in series, the secondary lines being connected in multiple with the service lines.

The number of transformers at work is controlled by a multipole switch, the number running corresponding to the number of generators in operation.

The difference in the construction of the "direct-current transformer" or "motor dynamo" from the ordinary dynamo consists in the presence of two distinct windings on the armature, each connected to a separate commutator located at the two extremes. Through one set of windings the primary current is passed, causing the armature to revolve, producing the motor action, while in the other a current is generated and conveyed to the service line—the voltage of this latter depending on the same conditions that govern any dynamo.

The current of the secondary, which delivers 280 ampères at 130 volts, is distributed by a second switchboard, fully equipped with all the necessary regulating apparatus, meters and safety devices.

One hundred and twenty arc lamps are used, and the greatest load is 840 ampères at 130 volts. Over 1,700 incandescent lamps of different candle-power are on the circuit beside the arc lamps used for street lighting.

Streets, hotels and private houses are lighted. The plant was erected by the consumers, and is run on the co-operative plan. Every citizen can join by paying his actual part of the expense. The company is in touch with the township from which it derives its water-power rights, and in return it furnishes the street lighting free.

In spite of the distance between the power station and the point of consumption—four miles—the direct-current system was adopted on account of its safety, and the

many advantages it afforded in making it possible to add accumulators to the system, thus increasing the capacity at the heavy period of consumption, and also its greater adaptability for motor service.

A rather novel plant is being constructed at Kioto, Japan. In this case, the water of a lake some nine or ten miles distant from the city will be brought through pipes to a distance of about two miles from the city limits. Here it will be used to drive electric generators. The power will be used throughout the city for factories and for general lighting and power work. The motors farthest from the generating station will be some four miles distant. Pelton water-wheels of 120 horse-power are to be utilized.

It is estimated that there are fully 200 power stations operated by water-power in Switzerland alone. Even in the "Dark Continent" of Africa they have long distance electric power transmission plants. The Forbes Cliff Mining Company, of Transvaal, operate Pelton water-wheels coupled direct to Edison dynamos aggregating over 200 horse-power, which is transmitted four miles. The efficiency of the entire system is over seventy per cent.

At St. Brieux, Côtes de Nord, France, two 1,300-light Thomson-Houston alternators are driven by two Hercules turbines of the vertical type, one a 125 horse-power, and the other 150 horse-power. An interesting characteristic of this plant is that the alternators are run in multiple upon the same circuit. The distance from the central station to the centre of distribution is some eight and one-half miles, and the pressure employed 2,000 volts. It is interesting to note that the wires used to convey the current for 2,600 sixteen candle-power incandescent lamps over the distance of eight and one-half miles are .31 of an inch in diameter.

A power transmission plant at Ayonnax, eastern France, has been in operation since March, 1890. Power is obtained from a 1,750 horse-power fall, five miles from town, where two 105 kilowatt machines are coupled direct to two horizontal turbines. Current is transmitted on the three-wire system to two 120 horse-power motors, driving directly two 125-volt 600-ampère dynamos. The commercial efficiency is said to be 76.2 per cent.

The power of the 180-foot fall at St. Lorenzen, Austria, will be utilized for running the works of Franz Company, of Marburg, eighteen miles distant. Of the 600 horse-power available, it is expected to utilize about 450 at the works. Total cost of plant estimated at about $110,000.

An Anglo-Swiss syndicate has been formed to utilize the power of the Rhine at Laufenberg for the electrical transmission of power. It is intended to make a canal one mile long, and it is estimated that some 7,000 horse-power will be available.

The 45,000-light station at Paris, supplying the Place Clichy sector, has three floors with superficial area of 19,800 square feet. Three 150 horse-power Armington & Sims engines belted to two shunt-wound dynamos, and three 500 horse-power Corliss engines running at sixty-four revolutions, and coupled direct to 350 kilowatt (700 ampère, 500 volts) eight-pole machines, armatures eleven feet in diameter, run during the day; a 250-cell battery of Laurent-Cely accumulators supplies current during the night. The district has an area of nearly two square miles.

In Guatemala, Central America, a combined arc and incandescent plant has been operated by water-power since the year 1887. Part of the plant consists of two Thomson-Houston 1,500-light alternators. The station is three and three-fourths miles distant from the city. Twenty-one inch Rodney-Hunt turbines of 250 horse-power are used, driving the dynamos by a counter-shafting. The remainder of the plant comprises seven forty-five-light 2,000 candle-power arc dynamos, and three eighteen-light machines. This part of the plant is seven and one-half miles away, and receives its power from a fifteen-inch double Rodney-Hunt turbine of 260 horse-power.

The city of Pueblo possesses an electric-lighting plant which is in many ways remarkable. Two hundred arc lights of 1,200 candle-power are run by four fifty-light arc machines in a station some thirteen miles away from the centre of the town. The power is furnished by the river Atoyac, operating a 200 horse-power Leffel double turbine. Each of the four existing circuits is about twenty-six miles in length, and consists of a No. 4 insulated wire. The dam and the masonry of the station itself has been built of fine cut stones, and forms probably one of the most substantial and well-built structures in Mexico.

A contract recently entered into by the Thomson-Houston International Electric Company provides for a plant to be worked by water-power near the town of Pireacicaba, Sao Paulo, Brazil. The system will probably comprise fifty arc lamps of 1,200 candle-power each, and about 2,000 incandescent lamps of the alternating system. In this case the power station will be only about a mile away from the town.

Turning now to the plants in this country, we find that in the celebrated Comstock Mine, in Nevada, water from the mountain lake has been turned down one of the shafts of the mine for 1,200 feet, and at this depth in the earth a series of specially constructed wheels are located coupled direct to the dynamo machines. This novel plant is still in successful operation. It consists of six generators, ranging from 100 to 120 horse-power capacity each, and six motors of sixty horse-power each.

As so much has been said in the papers recently about the Niagara power plant, the forces exerted by this immense volume of water may be of interest.

Some 21,000,000 cubic feet of water pass over the head of Niagara every minute.

The idea of the great Niagara tunnel is said to have originated with the late Thomas Evershed. The tunnel or tail race is to extend from the surface of the water level below the falls to a point on Niagara River above the falls. It is to be connected with the river by means of short surface canals, wheel pits and cross channels.

The power expected to be produced by the capacity of the tunnel will be equal to the water-power of Lawrence, Lowell, Holyoke, Turner Falls, Manchester, Bellows Falls, Lewiston, Me., Oswego, Paterson, Augusta, Ga., Minneapolis, Rochester and Lockport combined.

The method of using the power is to be the same as that in operation upon the hydraulic canal.

The tunnel is to be of a horse-shoe section, having a capacity equal to a circle of twenty-five feet in diameter, extending through the solid rock from the water level below the falls to the river above the cataract, a distance of one mile. From this point the tunnel is to continue parallel to the shore of the river one and one-half miles more at an average depth of 160 feet below the surface, and at about 400 feet from the river, with which it will be connected by surface conduits. The tunnel is used as a tail race, and the great length is necessary to avoid marring the scenery. Plans have been made for a 120,000 horse-power plant.

Crossing over into Ontario, we find that a scheme is contemplated to utilize the Canadian Falls. The plan is wholly different from that on the American side, and no long tunnel is necessary. Mr. Ferranti has this work in hand.

The papers have discussed a scheme for transmitting power from Niagara to the World's Fair, which involves a distance of 475 miles, which is more than four times that separating Lauffen and Frankfort. Eighty thousand volts is the suggested voltage.

California capitalists were among the first to recognize

the value of electrical transmission for mining purposes. A power plant was built by the American River syndicate of El Dorado County, more than two years ago, which utilized the water-power of Rock Creek. The plant consists of an eight-foot Pelton wheel, running under a head of 110 feet with a five and one-half inch nozzle. It has a maximum capacity of 130 horse-power. The current generated is used at the mills, situated some two miles distant; three centrifugal rolling mills and a ten-stamp battery and rock breaker being operated. The potential used is 100 volts, and seventy-five per cent. of the power generated is available for duty at the mill. The entire works are further lighted by incandescent lamps. The mills are handling an average of 4,000 pounds of ore per month, and a saving of some sixty per cent. over the former method has been effected.

Other plants are located at Grove Mine in Amador County, Cal., and at the Cœur d'Alene Company's works of Idaho.

Probably in the before-mentioned Lauffen-Frankfort installation, the highest potential yet attempted on a large scale was utilized. There a voltage up to 30,000 volts was obtained, and the insulators were found able to stand the pressure.

It is figured that if an insulation can be made capable of standing 1,000,000 volts, over 30,000 horse-power can be transmitted 500 miles with a 0000 wire with a loss of less than one-half per cent. One ampère at this pressure would transmit 1,250 horse-power.

The application of electricity to steam railroad propulsion is a problem that is now upon us. Since the first of this year the engineers of five of our largest railroad systems have been in consultation with the electric companies in reference to this matter.

We have in course of construction a thirty-two-ton locomotive that can easily run seventy-miles an hour, and before the end of the year the power and speed of the electric locomotive will be a demonstrated fact and no longer a theory. It will be easy to demonstrate its economy in many places where it can advantageously replace the steam locomotive; but for long distance runs it cannot at present compete with steam except under unusually favorable conditions; as for example, where there are a succession of water-powers that can be utilized as sources of energy. At present we can only speak of what is to be done. Next year I trust we can point to what has been done.

The application of electric-power to street-car propulsion comes nearer to the masses and is of more direct benefit to mankind than any other application at the present time. It is almost universally acknowledged that the vexed question of "rapid transit" can only be solved by the use of the electric motor. The development in this respect has been enormous.

There are in the United States, according to the census of 1890, sixteen cities of over 200,000 population. There are electric railways in fourteen of these, or in over eighty-seven per cent. There are forty-two cities of from 50,000 to 200,000 population and of these forty-one, or over ninety-seven and one-half per cent. are supplied with electric railways. There are 450 electric railways in the United States at the present time and over 6,400 cars operated by electric power, and sixty-two more roads are being constructed.

Notwithstanding the constant newspaper statements as to the dangers of the trolley system, we have yet to find a single authenticated instance of death caused by the 500-volt railway current carried in the trolley wires. We have at our office many newspaper clippings alleging such cases, but upon investigation every one is found to be incorrect, the death, where there is any fatal result, arising from other causes. For example, a workman in Bangor, Me., was painting a building and short circuited an alternating incandescent current through his body, falling from the building and being picked up dead. In the newspapers his death was caused by the trolley, though as a matter of fact he was never near the trolley wire; never came in contact with it. These facts were certified to by the coroner. I was told of a man who fell from a building forty feet to the ground. He struck the trolley wire in such a way as to produce a short circuit which slightly burned his leg. He stated that the trolley wire in all probability saved his life, as it broke his fall.

On the 16th of this month, the Cambridge line of the West End Company in Boston had been in operation just three years. Since February 16, 1889, there have been many additions made to the electrical equipment of the West End road; until now they have 120 miles equipped electrically and over 300 electric cars in operation.

Last year 119,264,401 passengers were carried on these West End cars, and not one single individual has ever been killed or seriously injured by the trolley current. There have been accidents—very sad accidents. Men, women and children have been run over and killed, but such accidents happen on every road whatever the motive-power, and it is a striking and most significant fact that the insurance companies which insure street railways against loss by accidents find relatively more accidents on horse-car lines than on cable roads, and more accidents on cable roads than on electric roads.

ELECTRIC-LIGHT NOTES.

Newark, Ohio, will soon have a new electric light plant.

It is quite possible that Gallitzin, Pa., may blossom out with an electric-light plant.

The city council of Laurel, Md., is considering the advisability of installing an electric-light plant.

The Ball system will be adopted by the People's Electric Light Company in lighting the streets of River Point, R. I.

The streets of East Greenwich, R. I., will be lighted by electricity for the next five years, a contract having been signed for that purpose.

The city trustees of San Bernardino, Cal., have awarded the contract for lighting the city with arc lights for a period of three years at $11 per lamp to the San Bernardino Lighting Company. Formerly the city had been paying $13 per light.

The Tacoma Light and Water Company has offered to sell its property, franchises rights, etc., to the city for $2,100,000, taking fifty-year five per cent. bonds of the city in payment, or for $2,000,000 in consideration of fifty-year six per cent. bonds.

The stock of the Seattle Gas, Electric Light and Motor Company has been purchased by Eastern capitalists for $630,000, and the following new trustees elected: Hon. H. G. Struve, Colonel G. M. Nelson, John Mather, R. C. Elliott, L. Turner. These trustees then elected the following officers: President, Hon. H. G. Struve; vice-president and general manager, John Mather; secretary and treasurer, L. Turner. At present the company has only an arc-light plant, but extensive additions will be made and incandescent lighting introduced. The company has been re-incorporated under the name of The Seattle Gas and Electric Light Company, and the capital increased from $1,000,000 to $1,500,000.

"Long Stories Boiled Down for Busy Men" is a good way to present the opinions of users of goods to the consideration of business men. The Eureka Tempered Copper Co., of North East, Pa., accomplishes this very thing in a neat little pamphlet which speaks volumes in a nutshell for that company's excellent goods.

TRIAL TRIP OF AN ELECTRIC LAUNCH.

At the invitation of the Union Electric Company, of 45 Broadway, New York, a dozen gentlemen, representatives of the electrical and daily press, assembled at the Erie Railroad ferry, foot of Chambers street, at 10 A.M. on Thursday the 15th inst., where they were met by Mr. Willis S. Mullin, the genial representative of the company, and under his guidance after crossing the river proceeded by rail to Nyack, N. Y., to participate in a trial trip of an electric launch operated by the storage-battery system manufactured by this company. The party were met at the Nyack depot by Mr. S. R. Bradley, Jr., the courteous son of the president of the company and a resident of Nyack, who had a stage in readiness to convey the party to the boat club-house from which the start was to be made. It was decided that a run of two hours' duration should be made, so as to afford ample opportunity of judging of the launch's capabilities.

Everything being in readiness, the trip was commenced without a hitch or break, under the management of Prof. Main, the inventor of the system, who manipulated the



THE VASHTI.

boat during the entire trip. The run was made from the boat-house landing to Sing Sing and back, a total distance of about sixteen miles, in a little less than two hours, the speed developed therefore being something over eight miles an hour and considering that the trip was made against the tide in one direction and the wind in the other, combined with the newness of the mechanism, we feel no hesitancy in saying that with everything in smooth running order there will be no difficulty in attaining an ultimate speed of ten miles an hour, if not more.

The launch, named "Vashti" after the goddess of that name, is 30 feet over all, 6 feet 6 inch beam, and draws two feet of water. The framework is of oak, with cedar planking and copper fastenings, the interior being of quartered oak. It weighs about 800 pounds. The cock-pit is 22 feet and free from all obstructions, as the cells 80 in number are placed out of sight beneath the flooring and with but a slight rise in the stern of the covering to the motor. Seats are arranged around both sides of the launch beneath which are commodious lockers. The boat is splendidly designed for comfort, affording great freedom of space.

The day was an ideal one for the purpose and the results of the trip certainly satisfied the most sanguine expectations of all on board and unquestionably must have been highly gratifying to those most concerned in the success of the trip; the inventor and those associated with him in the enterprise, all of whom were unceasing in their efforts to explain all the various details. The launch rode steadily without a jar or jerk, and one could not fail to be impressed by the absence of the noise, vibration and other concomitants so conspicuous where steam is the propelling power. After the trip had been completed photographs were taken of the launch under full speed, and of the mechanism, etc.

Eighty cells of battery connected in series are employed to operate the boat when going at full speed, and by the use of two snap switches half the battery can be used to reduce speed, if desired. A special feature of the batteries is the use of zinc instead of lead on the negative plates, which is electrically deposited in combination with mercury on thin copper plates, giving a higher voltage and less weight than the usual lead plates. The positive plate is an improvement on the old Planté principle. It is of compound construction, being composed of thin sheets of lead secured between two heavy outer sheets, the whole being pierced by numerous perforations and secured by lead rivets. The weight of these batteries is 36 pounds each and the 80 cells have a capacity of over 350 watt hours. The voltage is 200 and the maximum mechanical power developed about $5\frac{1}{2}$ horse-power.

It has always been an object with the inventor to use zinc in storage batteries, and although many difficulties were met with in the first experiments, they have been successfully overcome in this instance. The zinc dissolved during the discharge of the cell is redeposited upon the copper plates by the charging current. Owing to the presence of mercury there is no local action, and this feature is a surprise to practical electricians. Prof. Main is the inventor of these batteries, and says they do not conflict in any way with the fundamental principles of the storage batteries now under litigation.

The motor is also an invention of Prof. Main, the special feature being that there are no revolving wires, the armature being stationary and the field-coils also. The brushes are made of carbon and revolve around the commutator, being held in place by an ingenious contrivance. The motor weighs 600 pounds and makes 400 revolutions per minute. The propeller shaft is connected directly with shaft of motor and is made of Tobin bronze.

The electrical apparatus, consisting of voltmeter, ampèremeter, switches, rheostat, etc., and the steering gear, are compactly situated in the bow of the boat, occupying but little space and in no way interfering with the freedom of motion by those on board.

The launch was built by Charles L. Seabury & Company, of Nyack.

The batteries and motors were manufactured by the Union Electric Company at its works, and it intends to manufacture both on an extensive scale for all purposes where storage batteries are employed.

At the conclusion of the trip the entire party was conducted to the St. George, where an elegant dinner was served. Everybody had a splendid appetite and did not fail to do justice to the hospitality afforded. After coffee, cigars were lit and a unanimous vote of thanks tendered to Prof. Main, Mr. Bradley and Mr. Mullin for the magnificent reception given the visitors.

The officers of the company are: S. R. Bradley, president; H. E. Tremain, vice-president; S. R. Bradley, Jr., secretary and treasurer; Wm. Main, electrician.

INSULLAC.

It is a noticeable fact that the progress of practical electrical science has been so rapid that the allied chemical and mechanical arts have failed to keep the pace. Especially has this been apparent in the case of insulating compounds, shellac being the only practical agent for effective work in coil and armature winding and in the multitudinous applications where insulation resistance and waterproofing is required.

The following quotation is a volume in itself: "At the present day it is very difficult to buy really good shellac, the material of commerce being very much adulterated." (Prof. Ayrton in "Practical Electricity.")

The fact that shellac is manufactured abroad readily explains this condition of affairs, which is still further complicated by the adulterations of the dealers.

Shellac cut in grain alcohol is much superior in resistance to a solution in wood alcohol. A fact which is familiar to all electrical experts.

Some months ago the Massachusetts Chemical Company, of Boston, called the attention of their chemists to this state of affairs, believing that it should be possible to produce a varnish which could be marketed at a lower price than shellac, and at the same time be of uniform quality and high resistance.

That their efforts have been successful in a very great degree is demonstrated by the production of an alcohol varnish of an insulation resistance nearly four times greater than that of the best grain alcohol shellacs.

The Massachusetts Electrical Engineering Company is the authority by which this superiority is established.

This varnish is aptly named "Insullac," (isolating gum). It is of a beautiful transparent amber color, but to suit the public taste the manufacturers will produce it in any desired color.

Its appearance when applied, method of application and rapid drying qualities are identical with those of shellac, whose place in electrical work it will entirely supersede.

Prof. Babcock, the well known Boston chemical expert and assayer, reports that a careful analysis of the new compound shows no traces of any acids injurious to any materials to which it may be applied or any constituent in any way injurious to the health of workmen.

The fact that insullac is placed upon the market at a lower price than the poorest shellacs should at once attract the attention of all users of shellac for electrical purposes.

NEW ISOLATED PLANT.

Messrs. L. Strauss & Sons, the large glassware importers, of 42-48 Warren street, New York, have recently added an electric-light plant to their well-known establishment.

The plant consists of an 80-H. P. McEwen engine and an Edison 125-volt dynamo. The building is lighted by five hundred incandescent lights and sixteen "Ward" arc lamps, made by the Electric Construction and Supply Company, 18 Cortlandt street, New York.

The construction work, with the exception of the belting, was done by the Electric Construction and Supply Co., and the same does this company much credit. To use the language of one of the firm we might might add, "Although I have seen many arc lamps, I have never come across one that burns so steadily as the "Ward."

The belting was furnished by the Engineering Equipment Co., of 143 Liberty street; the steam pipes covered by the Magnesia Sectional Covering Co., 58 Warren street, New York.

The engineer, Mr. Hugo Kaiser, says that he has run many an engine but has never had one to run so smoothly as the McEwen engine, the feature of which is that the regulator or governor is in the fly-wheel. Mr. Hungerford, of 141 Liberty street, agent for the EcEwen Engine Co., received the contract.

Messrs. L. Strauss & Sons handle all sorts of glassware and crockery for use in hotels, railroads, etc. Buyers interested in these kinds of goods would do well to inspect their huge stock of goods before making purchases.

NEW BOOKS.

How to Make a Dynamo, by Alfred Crofts, 95 pp., with 35 illustrations. Excelsior Publishing House, New York. Price $1.

A third edition of the above work, revised and enlarged, has just been published. It is a valuable little treatise written for the purpose of instructing amateurs how to construct a small dynamo to produce the electric light. It has evidently been the author's aim to have his work thoroughly comprehensive and at the same time free from all puzzling technicalities. In this he has admirably succeeded, and the work will be found interesting not only by the amateur but by the layman as well.

Transformers, by Caryl D. Haskins, 150 pp., with 38 illustrations. Bubier Publishing Company, Lynn, Mass.

In this work the author has earnestly entered into a thorough treatment of his subject and handled it in a way that leaves but little if anything to be desired. He has been very painstaking in dealing with details, and covered the ground from beginning to end in a most intelligent manner. In it the student will find a valuable friend and the average electrician will be able to more thoroughly post himself regarding points about which his mind has hitherto been uncertain. There are seven chapters, seven appendices and a glossary.

The W. J. Johnston Company, Ltd., New York, will issue during the present week, a book entitled "Recent Progress in Electric Railways," by Carl Hering, containing about 400 pp, and 120 illustrations. Price $1.

This work is a compilation of current literature culled from various electrical and technical journals treating on or relating to the subject in question.

Of all the topics of the day none possess more prominence than that of electric street railways, and the advent of Mr. Hering's book will therefore be awaited with much interest.

CATALOGUES.

Catalogue No. 7, just issued by the Clayton Air Compressor Works, 43 Dey street, New York, contains illustrations and exhaustive descriptions of the air compressors, duplex and single, manufactured by them, with price of same. A portion of the book is devoted to the reproduction of some of the many testimonials received from various parts of the country in recognition of their great worth. The vertical tubular boilers made by this concern are thoroughly described and illustrated in the latter portion of the catalogue.

A copy of the very neat and attractive catalogue No. 1 of Mark & Sterling, Cleveland, Ohio, has been received. This firm deals in street-railway equipment, including rail joints, rail chairs, tie-plates, etc., all of which devices are fully described and illustrated in the catalogue. The firm invites those who will attend the Cleveland convention to make its offices their headquarters during their visit. The offices are rooms 743–744 Society of Savings Building, where samples of the firm's track equipment may be seen. A special exhibit will be made for the convention.

ERRORS IN THE DESIGN OF PULLEYS AND SHAFTING.*

BY ALLEN N. LUKENS.

In the following paper I propose to notice some of the causes of waste in power transmission by pulleys and leather belting, leaving the amount of loss to be determined in each special case.

A line of shafting is subjected to two strains, viz.: a transverse strain, due to the various forces applied perpendicularly to it between the points of support, and the torsional strain, due to the forces turning the shaft by means of the driving-pulley.

The transverse strain, due to the weight of the shaft itself and the pulleys it carries, is increased by the tension of a belt running downward from the shaft and decreased by that of a belt running upward. The resultant transverse strain, due to a combination of the foregoing with those due to horizontal or inclined belts, is to be found by the parallelogram of forces.

It will be seen at a glance that the less transverse strain there is the easier our shaft will turn. To keep the flexure of the shaft down to the minimum it is best to have the hangers so spaced that they will come as near as possible to the pulleys, especially the larger ones; and for the same reason, belts pulling off opposite sides of a shaft should be as near as possible to each other. Main driving-pulleys should always have a hanger on each side. This practically prevents all flexure of the shaft—a flexure which, when considerable, very quickly tells on the life of a plant.

I have no accurate figures at hand as to the cost of loss of power from this cause, but perhaps some of the members can recall something on the subject and present it in the way of discussion.

The torsional or twisting strain on a shaft is greatest near the main driver, and decreases as power is taken off the shaft, becoming zero (except for friction at the bearing) at the end of the shaft. When the shaft is very long and light, the torsional strain is apt to produce a very undesirable jerky motion at its extreme end. This can be reduced by placing the main driver in the centre of the line, thus reducing the strain upon the shafts. This arrangement allows the use of lighter shafts with a reduction in the first cost.

All possible care should be taken to have the bearings rigid, so that they shall hold the shaft firmly in place. At the same time they must not bind the shaft.

In a small mill in one of our Southern States, where I was at one time engaged, there was a very marked and expensive case of too tight bearings. On taking charge I found that while the boilers were doing exceptionally well, and while the indicator showed the engine to be working to perfection and developing nearly 125 horse-power, there was always a scarcity of steam. I at once ordered an examination, with the result that all the bearings in the place, from the head of the main shaft to the smallest journal on the ore-concentrator, were found to be so hot that water would boil when thrown on them. After going over these, putting in liners, repouring, etc., where necessary, until everything worked smoothly, the engine was found to be exerting only 115 horse-power, showing an enormous, almost preposterous, loss through this cause alone.

The fuel used was green pine-wood, and before the overhauling five and a half cords were required for a ten-hour day. After the readjustment the consumption of fuel fell to five cords per day. One cord of this kind of wood is equal to about 1,000 lbs. of coal, which, at $2.25 per ton, would be $1 ; so that the daily saving of half a cord resulted in an economy of fifty cents.

Shafting is often very greatly handicapped by the faulty application of the pulleys and belts. The most serious error made in this connection is that of running unreasonably tight belts. It is amazing how much power is wasted in this way, to say nothing of the trouble of broken pulleys, hot boxes, etc. The enormous and absolutely useless pressure thus put upon pulleys must in time break them, besides wearing out the system of shafting and bearings. If manufacturers realized what these ridiculously tight belts cost them in a year they would give vent to some very strong and expressive language. It has been calculated by several eminent engineers that the loss of power from friction alone, in some of the best equipped mills in the country, is from twenty-two to as high as thirty-nine per cent.

It is unreasonable to suppose that the minimum friction would consume this amount of power, and no other cause is so potent in increasing friction as undue tightness of belts, which, when they number by hundreds in a mill, easily account for the great loss of power referred to.

Estimating a horse-power as requiring a consumption of forty pounds of coal per day of ten hours, and granting that fifteen per cent. is a reasonable allowance for loss of power through unavoidable friction, and taking the actual loss of power at twenty-two per cent. (the lowest of the figures given), we have a balance of seven per cent. as the actual loss. This would be 2.8 pounds of coal per horse-power per day.

In a plant using 200 horse-power this would mean 560 pounds of coal per day, which, at $2.25 per ton, would cost sixty-five cents. For 300 days running in a year this would mean $195, to say nothing of the extra wear on the hangers, the shortening of the life of the belts themselves, and so on.

The point next in importance to the tension of the belts is the arrangement of the pulleys. These should be as large as is consistent with a proper regard for symmetry and proportion ; for the larger the diameter of a pulley the less the pull necessary to transmit a given amount of power.

The use of too small pulleys, by decreasing the liability to slipping of the belt, is often responsible for the employment of excessive tension in the latter. The following case in point came under my notice : A few feet from the end of a line of shafting and near the end hanger was an 18 x 6-inch pulley driving a line of counter-shafting with a duplicate pulley. Noticing an odor of hot oil about the mill, I made an examination, and found that it came from the end hanger referred to, which was too hot to bear one's hand on. The engine was shut down and a thorough inspection ordered, which brought word to the office that the shaft had worn through the babbitt in the box and was running on the cast-iron. As this was not a very satisfactory explanation of the trouble, I investigated further and at once saw the real cause. The belt had been slipping badly, and had been taken up. Still it slipped, so another piece was cut out, until the tension had caused the shaft to cut through the babbitt, and also pulled the hangers on both shafts considerably out of line. On questioning the man in charge it was found that this belt had always slipped ever since it was put in, being thus a continual source of trouble, besides wearing out the belt very quickly. A new belt had been put on only three months before, and was now entirely useless. The only spare pulleys available were two of thirty-four inches diameter by four inches face—that is, nearly twice the diameter of the former one and two inches face less. These two pulleys were put on and an old four-inch belt used having the proper tension. This has been doing the work with entire satisfaction ever since, now nearly two years, showing conclusively that the whole trouble came from the use of a small pulley

* Paper read before the Engineers' Club, Philadelphia.

which required an undue tightening of the belt in order to avoid slipping. The distance between centres of these shafts was twenty-two feet, and the cost of a single leather belt of this span, and six inches wide, would be about $19.

The opposite fault, that of too slack belts, is also to be avoided, particularly in long spans, as it will cause flapping and swaying of the belt. A very marked case of this kind came to the writer's notice in this way: A neighboring factory had recently put in a new span of some forty or fifty feet. The belt stretched so as to sag nearly sixteen inches, and the slack side swayed laterally with an even, regular swing, corresponding with the vibrating length of the building, and imparting its motion to it, so that the whole system of timbers swayed in unison. This would have soon loosened every joint and nail in the building had it been allowed to go on. The remedy which I prescribed was to take up the belt until it sagged only six inches, and then to support both top and bottom sides of the belt with an idler.

To sum up the evil of errors in the design of systems of shafting we notice, first, errors in the alignment of the shafting and in the spacing of hangers and pulleys; and second, errors in the adjustment of the bearings, in the size of the pulleys and in the tension of the belts. Lubrication I will leave others to discuss. All these errors add to the useless expenditure of power, and consume time and labor in keeping things in good order. That "time is money" every one knows.

CAR-WHEEL AND AXLE INDUSTRY.

The adaptation of new and improved machinery constructed on economic principles is thoroughly demonstrated in the shops of the New York Car-Wheel Works, Bank and West streets, New York, where will be found every appliance for the speedy execution of work at a minimized cost.

Nearly a year ago Mr. P. H. Griffin, the president, associated with Joseph R. Ellicott, the general agent of the above company, became alive to the necessity of a car-wheel works where street-railway companies could have their old wheels and bent axles repaired at little cost.

The works occupy the entire first floor at the above address covering a space of about 200 x 100 feet. The office—which is situated on the Bank and West street corner — contains every facility for the reception of guests, and the most convenient and improved fixtures for conducting business in the clerical department. Communicating with the rear of the office is a hall connecting with the various departments of the works. The first department is the storeroom for tools, finished wheels, axles, etc. You are next shown the big machine —the invention of this company—for grinding car-wheels and working them into a perfect circle.

New or old wheels are placed in this machine after they are bored out by their big four-ton boring machine that occupies a portion of this department, and a large emery-wheel grinds off uneven surfaces, while a smaller one is employed to polish the surface of the wheel. Two car-wheels can be placed on this machine, which works automatically and needs only one attendant.

After being ground the wheels are carried by an overhead system to another department, where are two large lathes. Alongside one of these lathes is a strongly built wooden frame filled with new and old axles waiting to be centred, a process most necessary to insure even running. On the lathe next to this one the journal-bearing part of the axle is cut into shape, after which it is carried by means of skids to a newly constructed hydraulic wheel-press in the same department, where the wheels are forced on to the axles. This press by actual rough test ran as high as ninety tons pressure.

In this same department are stored a large quantity of second-hand wheels and axles joined together waiting to be stamped with a number on the ends of the axles for reference, as a record-sheet is kept so that at any time it can be readily ascertained exactly just what process they went through.

Some have bent axles, in others the axles are broken, wheels are broken or the edges damaged. They are placed separately in the hydraulic press and the wheels taken off and placed in position alongside of a small drill to test for the depth of chill left on the old wheels by boring diagonally into the rim of the wheel. Immediately the drill strikes the chilled iron, which is harder than steel, the tool will screech; the depth of the chill is then determined by measurements, and if deep enough, the wheel is put on the machine and rounded up.

The crooked or bent axles are taken to a powerful screw-press machine and straightened out; they are then carried to the centreing lathe from which they are taken to the next one where the jonrnals are cut, and finally to the wheel-press, where the old wheels which have been renewed are joined on.

The works have to carry sixteen sizes and styles of new car-wheels, to meet the requirements of the various street cars in operation in New York, Brooklyn and Jersey City, also axles of different weights, etc,

In connection with the grinding machine there is an exhaust wheel to draw off the iron dust and place it in a receptacle in the storeroom.

They have a large truck that will carry sixteen sets of wheels and axles at one time. This truck can be brought right up to the door of the wheel press-room, and the wheels are run on to it in a most convenient manner. Outside of the wheel press-room is a place for the scrap heap into which is thrown old wheels not having chill deep enough, broken axles, etc.

Two large boilers and a 150 H. P. Wright Corliss engine are used to operate the plant.

They are doing a very extensive business in this line, and are in an excellent position to submit proposals to street-railway companies at a very low figure. As many old and damaged weeels can be repaired and renewed by a slight expenditure, the street-car companies can in this way save no little amount of money. Trucks are sent by the works to call for and deliver wheels and axles, and thus the companies are freed from all bother and annoyance as well as the expense of cartage.

"JUST THE BOOK I WANT."

"I want to get a book which will tell me all about voltaic batteries of all kinds, magnetism, electromagnetism, electric measurements and instruments for the same, dynamos and motors, electroplating, storage batteries, the telegraph and the telephone. Is there such a book published?"

Yes! The Elements of Dynamic Electricity and Magnetism, by Atkinson, is just the book you want. Its price is $2.00 and you can get it, as well as all other electrical books, at the office of the Electrical Age Publishing Company, World Building, New York City.

INCORPORATIONS.

Ashland, Pa.—Schuylkill Traction Company. Capital $600,000.

Chicago. Ill.—Chicago, Harvey and Glenwood Rapid Transit Company. Capital $300,000. Incorporators: Clayton Lee Hawley, W. R. Jones and Calvin C. Hall.

Chicago Union Elevated and Tunnel Railway Company. Capital $17,000,000. Incorporators: John Tyler, James G. Cozzens, Franklin Landis, Herman Hurlbut, and George M. Eckels, all of Chicago.

ELECTRICAL SOCIETIES.

CALIFORNIA ELECTRICAL SOCIETY.

At the regular meeting of the California Electrical Society of San Francisco, Cal., which was held at room 55, Academy of Science Building, on the evening of Monday, September 5, Mr. F. F. Barbour, of the Thomson-Houston Electric Company, read a paper upon the method of controlling electric railway motors.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 69th meeting, and the first of the present season, will be held at the headquarters of the institute, 12 West 31st street, New York, on Tuesday evening, September 27th, at 8 o'clock. A paper will be presented by Mr. Charles P. Steinmetz, "On the Law of Hysteresis, II.," and other phenomena of the magnetic circuit.

The report of the committee on rules for the election of officers will be taken up.

After the discussion, should time allow, members will be invited to contribute notes of their "Vacation Experiences," embodying observations on new or curious features of electrical work in this country and abroad.

The council will meet in the secretary's office at 5 P. M.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Sept. 17, 1892.

W. R. FLEMING & Co., Mail and Express Building, agents for the Harrisburg Ideal self-oiling engines manufactured by the Harrisburg Foundry and Machine Works, Harrisburg, Pa., are meeting with big success in the sale of these engines. They have just completed a large steam plant to run the Edison isolated plant in the Century Building, 43d street near 5th avenue, consisting of one 60 H. P. and one 50 H. P. Harrisburg Ideal self-oiling automatic engines. A twin engine plant was also placed in the lightship at Staten Island, consisting of a pair of twin Harrisburg Ideal self-oiling engines connected direct by the Evans friction system to operate an electric-light plant on the Thomson-Houston system. Two 200 H. P. Harrisburg Ideal self-oiling simple engines are being installed in the Navarro Flats, 59th street and 7th avenue. One 75 H. P. and one 40 H. P. Harrisbug Ideal self-oiling engines are being placed in the Racket and Tennis Club, 43d street near 5th avenue. Messrs. H. Ward Leonard & Co. are the bulk contractors for this plant.

MR. JAMES H. MASON is still as lively as ever at 366 Myrtle avenue, Brooklyn, although he has been reported dead. No doubt it was due to his ever persistent spirit and strong constitution that he was able to pull through his recent illness. Mr. Mason will be found at the above address with a full line of his very popular batteries for electric lighting, running motors and households purposes, such as operating sewing machines bells, annunciators, etc. Mr. Mason claims that one cell of his battery will do the work of three ordinary open-circuit batteries. He is just completing a very cheap and simple power motor of unique construction, a roughly constructed sample of which your representative saw run by three small cells of Mason's batteries at very high speed, and with power enough to run a jeweller's lathe or large sewing machine. Mr. Mason is also carrying a full line of motors of various makes and sizes for general power purposes, and a large line of electrical supplies. He contracts for electric-light plants of any size under 100 lamps of 16 candle-power to be operated by Mason batteries for house, office, or other uses; also power plants. Mr. Mason is arranging a large collection of Mason's specialties to be exhibited at the American Institute Fair during October and November next, where one of his new motors will be running a sewing machine and others, power machines. W. T. H.

NOTICE.

All corporations organized under laws other than the State of New York, which do business in New York State, are obliged to file a certified copy of their charter with the Secretary of State of New York before January 1, 1893, under penalty.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	60 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	203 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	135 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	156 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*106
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	101 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	111 00
General Electric Co., 5s	4,000,000		*103
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	22 25
Laclede Gas pref.	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	57 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	78 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00

Names of Companies.	Capital.	Par.	Price.
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	95 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	37 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	51 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

It is well worthy the attention of investors in electric securities to study the development of the local Edison Electric Illuminating Companies in the various large cities. Beginning generally with a small plant and modest capital on a few commercial contracts, the familiar tubes follow the edge of the streets, always extending, and serving both light and small power, first to a few, but soon to the entire community. There is nothing aggressive in the companies' operations; they simply occupy the land and the public naturally request the luxury. The great mass of the service is to private individuals, supply and demand covering the business. There are no public boards to consult beyond the procuring the right of way through the streets, and as there are so many avenues waiting, after the first year, it is substantially an unimportant matter to the company what portion of the city it installs at any given time. Should there be an objection in one direction or ward, it proceeds in some other, leaving that territory until the people clamor for the service. New York, Brooklyn, Boston and Philadelphia are pretty well occupied by the Edison system under separate local management. The Philadelphia company has just increased its capital from one to two million dollars. Investments in these local companies are of the safest. Among the notable dividends are The Commercial Cable Co. quarterly of 1¾ %, payable on Oct. 1; The Manhattan Railway Co.'s quarterly dividend of 1½ % payable Oct. 1. The City of Columbus, O., has called in for payment Sept. 15, $334,500, and the Western Union Telegraph Co. has declared the regular quarterly dividend of 1¼ %, payable Oct. 15. The board of directors adopted resolutions recommended by the executive committee authorizing and directing proper steps to be taken for an increase of $13,800,000 to the capital stock of the company, making the aggregate capital stock $100,000,000, to be issued at such time or times and for such lawful considerations as the board of directors may thereafter direct and determine. A special meeting of the stockholders will be held on Oct. 25 to vote upon this proposition. The regular annual meeting of the stockholders will be held on Oct. 12, and the transfer books for that event and for the payment of the dividend will be closed on Sept. 20. It is understood that $8,620,000 of the new stock will, if authorized, be used to pay the shareholders a scrip dividend of 10 % to represent net earnings diverted from them and expended in making additions to the property. The remaining $5,600,000 will be held in the treasury of the company. For the quarter ending Sept. 30 the company reports partly estimated earnings as follows:

	1892.	1891.
Net revenue	$2,200,000	$2,000,000
Interest and sinking fund	242,960	242,388
Balance	$1,957,040	$1,757,612
Dividend	1,077,410	1,077,405
Surplus	$879,630	$680,207
Total surplus	14,455,757	12,097,948

From the quarterly reports issued by the company an approximate statement of the results for the year ending Sept. 30 shows:

	1892.	1891.
Net revenue	$7,398,545	$6,605,583
Interest and sinking fund	970,523	931,218
Balance	$6 428 022	$5,674,365
Dividends	4,309,637	4,309,606
Surplus	$2,118,385	$1,364,759

The market both in volume and prices has fallen somewhat in the industrial list of stocks with all others, and the bears, who live on speculation, are correspondingly happy, but it offers the chance for all real investors to procure their securities at a low price and does not change the intrinsic value or income. To those who are inclined to speculate or take a flyer, quite a number of new patents are seeking capital for filling orders, offering in return large interest coupled with the labor of years, business knowledge and experience. These range from $500 up to $20,000 and will average 100 per cent. profit per year. Some of course are Bell Telephones and pay better. They run from the latest telegraph Key and Sounder at half present prices with equal efficiency, up to complete electric light, heat and power systems. Experience is not required as much as book-keeping or office work. These grand chances for fortune in Electrics won't last forever.

TRADE NOTES.

Mr. G. d'Infreville, 434 Canal street, New York, the inventor and manufacturer of the "Wasteless" zinc for gravity batteries recently placed on the market, has issued a neat circular price-list giving full particulars. These zincs are an improvement on the "Crowfoot" pattern, also an invention of Mr. d'Infreville, and are rapidly becoming very popular. Mr. d'Infreville has all he can do to fill the orders being constantly received from all over the country Large sales were recently made to the Kings County Elevated Railroad Company, of Brooklyn, N. Y.; Novelty Electric Company and Delaware and Atlantic Telegraph and Telephone Company, of Philadelphia, Pa., and Prof. Elihu Thomson, Lynn, Mass. The Electric Secret Service Company, of 45 Broadway, N. Y., has been using the "Wasteless" zinc for over a year, and is extremely well pleased with it.

The following copy of a letter received by The Wilcox & Howe Co., of Birmingham, Conn., from the Eagle Bicycle Manufacturing Co., offers a very good proof of the superior character of the steel or iron forgings manufactured by the former concern:

Torrington, Conn., Dec. 23. '91.

The Wilcox & Howe Co,
Birmingham, Conn.

Gentlemen: The balance of the forgings have been received, and we wish to say that we are exceedingly well pleased with the work you have done for us; both for the prompt manner in which it has been executed, and the excellent quality of the forgings themselves. You may be sure that you will come in for a large proportion of our future work. Yours truly,

The Eagle Bicycle Mfg. Co.
L. B. Gaylor, *Supt.*

The following copies of letters are self-explanatory:

Des Moines Water-Power & Electric Co.,
Des Moines, Iowa, July 2, 1892.

James Leffel & Co., Springfield, Ohio.

Gentlemen:—Replying to yours of June 30th, will say, we never used your wheel for street-railway service. We

have used them for power circuits, which load is varied rapidly.

We have had no trouble in governing same with our electric water-wheel governors.

Any other information you may desire will be cheerfully given. Very truly,

(Signed) C. K. MEAD,
Sec'y and Manager.

(They are using 5 James Leffel 5½ foot wheels.)
J. L. & Co.

CENTRAL RAILROAD COMPANY OF NEW JERSEY,
OFFICE OF SUPT. OF MOTIVE-POWER,
ELIZABETHPORT, N. J.

MESSRS. FORREST SILVER BRONZE PACKING CO,
No. 115 LIBERTY STREET, N. Y. CITY.

Gentlemen:—Answering your letter regarding the metallic packing, furnished by Mr. H. E. Forrest for locomotive No. 145 of the Central Railroad of New Jersey, which was put in in the latter part of the year 1889, will state that I ran the locomotive for over a year and never had any trouble with the Silver Bronze Packing whatever. It never required any attention and never leaked.

It was taken out once for examination while the engine was in the shop and one of the case rings was found to be broken, although the packing never leaked. That was repaired in as short time as it would require to pack with fibrous packing. With this exception, the packing has received no attention whatever. The engine has run with this packing at least 100,000 miles. I did not run the engine long enough to wear the packing out. Since I left her it has continued and is now giving entire satisfaction without requiring or receiving any further attention. No. 145 is at Communipaw daily at about one o'clock P.M. Yours truly,

(Signed) C. W. HOUSTON,
Engineer C. R. R. of N. J.

P. S.—The case-ring which broke was made of soft metal. Now it is made of yellow metal and no breaks occur.

JOHNSTOWN ELECTRIC LIGHT CO.,
JOHNSTOWN, PA., Juue 28, 1892.

THE ELECTRIC CONSTRUCTION & SUPPLY CO.,
18 CORTLANDT STREET, NEW YORK.

Gentlemen:—Replying to your inquiry of the 24th inst., we will cheerfully state that your "Ward" lamps are giving us perfect satisfaction. We have twenty-four of them in use and we are yet to hear a word of complaint. Trusting that the above will be of help to you, we remain, Yours respectfully,

JOHNSTOWN ELECTRIC LIGHT CO.

The Electrical Age's Illustrated Patent Record.

Issued September 13, 1892.

482,339. Electric-Light Fixture. Edwin R. Crolius, Chicago, Ill. Filed Jan. 4, 1892.

482,343. Inclosed Conductor for Electric Railways. George A. Dupuis, Detroit, Mich. Filed May 16, 1891.

482,374. Automatic Electric Cut-Out. Cyprien O. Mailloux, New York, N. Y. Filed Sept. 9, 1890.

482,397. Ventilating-Armature for Dynamo-Electric Machines. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 2, 1885.

482,420. Adjustable Thermostat. Melvin D. Compton, Newark, N. J. Filed Nov. 21, 1891.

482,422. Railway-Crossing Protector. Robert J. M. Danley, Columbus, Ohio. Filed Mar. 2, 1892.

482,423. Railway-Crossing Protector. Robert J. M. Danley, Columbus, Ohio. Filed Apr. 20, 1892.

482,425. Galvanic Battery. Thomas T. Eckert, New York, N. Y. Filed May 16, 1892.

482,433. Safety Device for Electric Circuits. Llewelyn B. Atkinson, London, England. Filed Sept. 12, 1891.

482,435. Electric Arc Lamp. Henry H. Cutler, Waltham, Mass. Filed June 25, 1891.

482,440. Telegraph-Relay. William Maver, Jr., New York, N. Y. Filed July 18, 1891.

482,444. Voltaic Pile. William E. Washburn, Cedar Rapids, Iowa, assignor of two-thirds to F. S. Washburn and F. E. Washburn, same place. Filed June 14, 1892.

482,486. Line-Wire-Tightening Device for Electric-Lamp Supports. Charles A. Pfluger, Chicago, Ill. Filed May 3, 1892.

THE
"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighth inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of strand and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



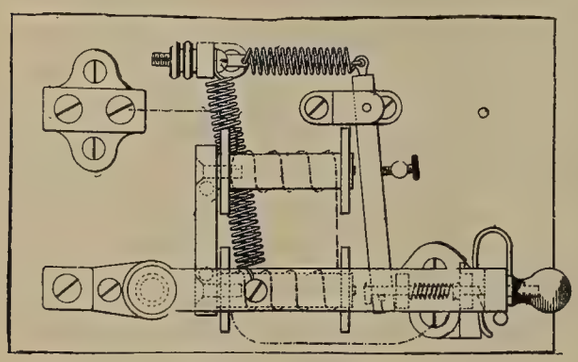
EASTERN ELECTRIC CABLE CO.,
61 to 65 Hampshire Street, Boston, Mass.
HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

482,506. Underground Trolley. Joseph Fischer, Cleveland, Ohio. Filed March 5, 1892.

482,535. Clamp for Arc-Lamp Carbons. August Weber, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Nov. 4, 1891.

482,549. Means for Controlling Electric Generation. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed March 12, 1881. Patented in England, in Germany, in Italy, in Belgium, in Victoria, in India, in New South Wales, in France, in Spain, in Austria-Hungary, in Queensland, in New Zealand, and in Canada.



482,374.—AUTOMATIC ELECTRIC CUT-OUT.

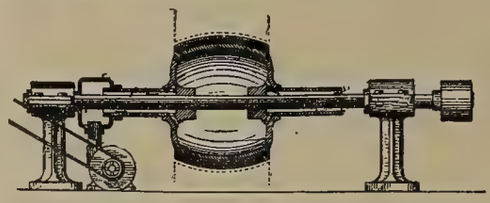
482,568. Electric-Arc Lamp. Hubert H. Bigland and John Burns, Newcastle-on-Tyne, England. Filed April 20, 1892.

482,586. Electrical Furnace. Thomas Parker, Newbridge, England, assignor to the Electric Construction Corporation, Limited, same place. Filed July 5, 1890. Patented in England, in France, in Germany, and in Italy.

482,594. Electric Locomotive. William H. Soley and William W. Perkins, Philadelphia, Pa., assignors of three-fifths to James Wolstencroft, William O'Neil, and William H. Yelland, same place. Filed Jan. 7, 1892.

482,668. Electrical Apparatus. Leonidas G. Woolley, Grand Rapids, Mich. Filed June 6, 1892.

482,352. Railroad-Crossing. Ezra B. Gibson, Cadillac, Mich., assignor of one-fourth to Harry Wood, same place. Filed Nov. 28, 1891.



482,397.—VENTILATING-ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

482,378. Automatic Brake. Thomas A. McCandless, Irving, Kans. Filed April 9, 1892.

482,426. Street-Railway Switch. Tom L. Johnson, Cleveland, Ohio. Filed Nov. 16, 1888.

482,699. Railway Time-Signal. Walter Scott, Hot Springs, S. D. Filed May 13, 1892.

LEONARD'S 3-WIRE SYSTEM.

Identical in Cost and Efficiency

WITH EDISON SYSTEM.

SIMPLER TO OPERATE.

Copper required guaranteed to be not over 30% of that required for 2-wire system, under same conditions.

Royalty, 1 cent per lb. of Copper Installed.

PATENTED JUNE 7, 1892, No 476,544

CHARLESTOWN, W. VA., June 18, 1892.

MESSRS. H. WARD LEONARD & CO.,
136 LIBERTY STREET, NEW YORK.

GENTLEMEN: The central station plant, which you installed for us here under your new patented 3-wire system, has given entire satisfaction ever since it started, which was about six months ago.

The operation of the plant is quite simple and economical, and as a result the plant is making very satisfactory earnings, although our town is rather small, having only about 3,000 inhabitants.

Yours very truly,
(Signed) CITY ELECTRIC LIGHT CO.,
WM. CAMPBELL, *Sec'y*

For bids for complete plants, or conductors only, address
H. Ward Leonard & Co., 136 Liberty St., New York City.

VULCANIZED FIBRE COMPANY,

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ELECTRICAL AGE

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SUPPLY MEN ORGANIZE.

The supply men at the Saratoga Convention last week formed an association auxiliary to the Street Railway Association of New York, for the purpose of aiding the latter in carrying out its constitutional objects. Incidentally they will create considerable business for themselves, and they will do good all round.

PROGRESS IN JAPAN.

The remarkable social and industrial revolution now going on in Japan is exemplified in part in the communication from our Japanese correspondent, which our readers will find on another page. He gives some facts concerning the electric light and telephone industries in that interesting country that will no doubt surprise many of the readers of the ELECTRICAL AGE. The Japanese people are imbued with the progressive spirit of the English-speaking nations, and are determined to make their mark in the industrial world.

OF INTEREST TO THE LADIES.

At one of the meetings of the American Electro-Therapeutic Association which will be held in this city October 4, 5 and 6 next, a paper will be read on the subject of forming dimples by electricity. This piece of information will deeply interest our lady friends, and it is safe to say that if the method involves the use of electrical apparatus, electrical instrument makers will experience an activity in trade, the like of which is without parallel, for where is the woman who will not have a dimple machine if nature has not been kind to her in this regard?

MEDICAL ELECTRICITY.

Whether "electricity is life" or not it will be the life of the annual meeting of the American Electro-Therapeutic Association which will be held in this city on October 4, 5 and 6 next. The uses of electricity in the cure of the pains and aches that flesh is heir to will, on this occasion, receive by far the greater part of the attention and consideration of the members. The meetings will be essentially electrical; when the members are not at work in session they will be visiting some centre of electrical force. The programme, which is published on another page, includes a visit to the telephone exchange, and one to the laboratory of Mr. Edison, also a social reunion at the Electric Club. If that is not electrical through and through we would like to know what is. Long life to the union of electricity and medicine!

CONVENTION IN SARATOGA.

We publish in this issue the report of the proceedings of the convention of the Street Railway Association of the State of New York, which was held at Saratoga Springs, September 20 last. While the membership of the association includes horse-car companies, not a word was said about horse cars; everything was electricity. Of course a great deal that was said was applicable to horse cars as well as electric cars, and to that extent the horse-car men were interested.

The report of the committee on recent improvements in electric traction, while containing nothing especially new, was full of interest. It refers briefly to the storage battery, with which, the report says, little progress has been made during the past year, and nothing can be hoped for in this direction until a better financial showing can be made in its favor. The greatest progress, says the report, has been made in the matter of armatures for motors and dynamos, and a good word is said in favor of the iron-clad motors, which reduce the bills for repairs and maintenance.

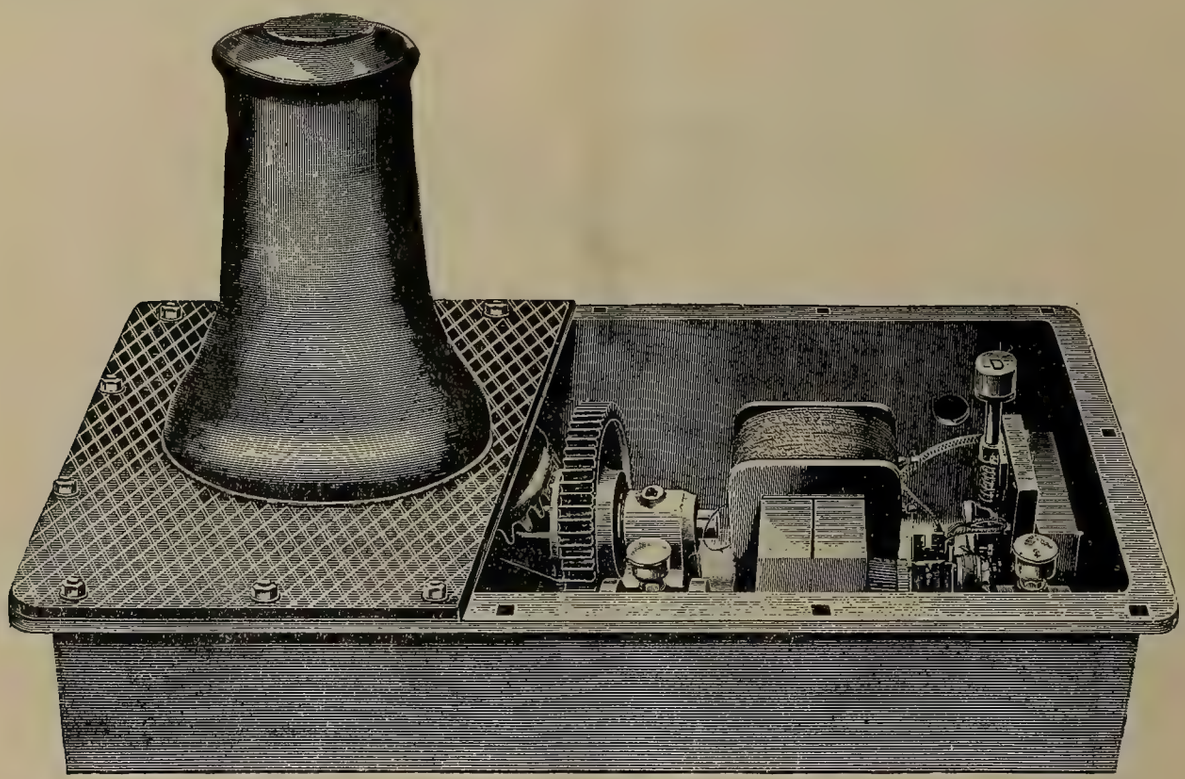
The report of the president contains many bits of information valuable to street-railway companies. There is one point particularly that we think electric-railway people cannot afford to overlook; that is, the matter of employing competent men to run the electric cars, who will know what to do in cases of emergency. The president gives his own experience on his own lines in Rochester as a proof of the ultimate benefits to the operating company of paying the motor-men good wages and instructing them as to management of the motors under all circumstances.

ELECTRIC CAPSTAN.

The accompanying illustration shows a capstan operated by an electric motor, designed by Messrs. Crompton & Co., London, for use in railway yards, to take the place of switching engines. According to our contemporary, the *Railway World*, of London, such capstans are now in extensive use in every-day railroad practice in England, and in one large railway car-building yard trains of half a dozen loaded cars are hauled around the small curves and up the steep gradients with ease. The gearing, motor, switch, etc., of the electric capstan are all contained in a water-tight iron case, the cover of which is flush with the ground. A loose cover is provided to enable easy access to the motor for oiling or cleaning. The wires conveying the current to the motor are carried through an iron pipe laid under the surface of the ground, and the switch for starting and stopping the motor is controlled by means of a pedal operated by the foot of the p erson in charge of the capstan.

In the plant illustrated the motor, which is of the Crompton type, runs at a speed of 1,200 revolutions a minute, the motion being transferred to the capstan by means of gearing. The machine runs smoothly and is said to be very convenient and valuable on docks and in railway and other yards where ready power is required to move cars.

This use of electric power suggests many other valuable applications of the same idea.



AN ELECTRIC CAPSTAN.

HISTORICAL FACTS OF INTEREST.

In these matter-of-fact days people seldom bother themselves by looking into the history of things with which they are most familiar, yet there is nothing so interesting as to be familiar with the origin as well as with the things themselves. The simplest objects are full of interest when we study them in a historical light. The same is true of the names of things. Every name is based on a reason of some sort. Take the word "Electricity" for instance. Every one knows what it means but how many know its origin. Dr. Gilbert, an English philosopher, who lived in the 16th–17th centuries, gave the name electricity to the force causing electric manifestations. Time has dissociated the word and the name of its author, but the interesting fact is recorded in history.

It is equally interesting to note that Plato, the Greek philosopher, who lived 400 years before the Christian era (2292 years ago,) propounded the first electric theory. Since then many other theories have been born and died. It would hardly be correct to say that we are no nearer the truth than Plato was. Men have increased in knowledge since his time, yet they are still in darkness regarding the truth of the simplest of natural effects.

TIGHTENING PULLEYS.

Tightening pulleys sometimes become necessary evils, and like all other evils should never be tolerated nor indulged in except when actually necessary, says *Mechanical News.* The life of a belt is almost sure to be shortened when a tightener is used on it, as the operator can be depended on to work the tightener hard against it whether required or not,and right there exists the great evil. If well enough is or could be let alone, and the tightener used in moderation, it would not prove so bad an agent on general principles. The tightener's presence is a constant temptation to do wrong by forcing it against the unoffending belt; besides, what is a tightener for, anyway, if not to tighten the belt? And so each one gives the wheel another turn or the lever another notch.

But, nevertheless, tighteners have sometimes to be used to make belts already in operation do the work required of them, or else a rearrangement must be made which implies a good deal of expense, and to avoid that the tightener becomes a necessary evil. Tighteners are mostly required in cases where belts are running on pulleys largely differing in size, and they should be run near to the smaller pulley, whether it be the driver or driven, provided, of course, it is practicable to do so. There may be cases where the tightener cannot be applied close

to the small pulley. The object of having the tightening pulley close to the smallest of the two pulleys is to use it for the purpose of increasing the lap of the belt on that pulley. When great variation in the diameters of the pulleys exists, there is an excess of lap on the large pulley and a deficiency on the small one.

Therefore if the tightener is used for equalizing the lap the difficulty will be overcome without having to work the tightener very hard against the belt. The belt is put on slack, and the tightener is used for taking up the slack, and at the same time forcing the belt further around on the face of the pulley. If by that means the arc of contact on the small pulley is made equal to that of the large one, the belt willl adhere as tenaciously to to the small as to the large, and will at once cease slipping.

When both pulleys are the same or about the same in diameter then the arc of contact will be about the same, and the tendency to slip, if any, will be about the same on both. In such cases the location of the tightener is immaterial. It may be close to either the driver or driven, or half-way between, as convenience may dictate. Never fail to have the tightener on the slack fold of the belt.

TRAMWAY SOCIETIES AT THE WORLD'S FAIR.

It has been suggested to the Permanent International Tramways Union, which held its seventh general assembly in Budapesth, Hungary, September 7–12 last, that its next general meeting be held in Chicago next year during the World's Fair. The suggestion comes from the *Railway World* of London.

In a letter to the secretary of the society the editor of that journal refers to the advisability of holding the next meeting in Chicago, setting forth the advantages of such a course of action. There next year opportunities will be afforded for a complete and elaborate study of transportation methods and systems and of tramway appliances and details.

The writer of the letter states that it is practically settled that the meeting of 1893 of the American Street Railway Association will be held in Chicago, and suggests that the Permanent International Tramways Union appoint a small committee with powers to confer with the officials of the American Street Railway Association at the Cleveland convention October 19, in order to arrange for a joint meeting, at which the members of both these associations may meet in friendly intercourse, and to mutual advantage.

ANNUAL MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

The tenth annual meeting of the Street-Railway Association of the State of New York was held at the United States Hotel, Saratoga Springs, September 20, 1892.

The president of the association, Mr. John N. Beckley, of Rochester, presided.

The following delegates of railway companies were present: John W. McNamara, president Albany Railway, Albany; Daniel F. Lewis, president Brooklyn City Railroad Co., Brooklyn; W. J. Richardson, secretary At-



DELEGATES TO THE SARATOGA CONVENTION, SEPTEMBER 20, 1892.

lantic Avenue Railroad Co., Brooklyn; James A. Powers; superintendent Glens Falls Electric Railway, Glens Falls, John N. Beckley, president, and Charles J. Bissell, counsel, Rochester Railway Co., Rochester; Charles Cleminshaw, president, and Charles H. Smith, superintendent Troy and Lansingburgh Railroad Co., Troy.

The press was represented by T. R. Taltavall, STREET RAILWAY NEWS; T. C. Martin, *Electrical Engineer;* James H. McGraw and C. B. Fairchild, *Street Railway Journal;* M. J. Sullivan and E. G. Reynolds, *Street Railway Gazette*, Chicago; F. L. Kenfield, *Street Railway Review*, Chicago, and N. D. Webster, *Electrical World.*

There were also present: H. C. Evans, Johnson Company, New York; J. A. Hanna, McGuire Truck Company, Chicago; W. F. D. Crane, H. W. Johns Mfg Co., New York; D. W. Pugh, John Stephenson Co., New York; W. J. Clark and A. Lewis, General Electric Co., New York; Thos. H. Fearey, General Electric Co., Syracuse, N. Y.; W. H. Delaney, Royaline Mfg Co., New

York ; W. S. Silver, Graduated Car Spring Co., New York ; F. D. Russell and E. Packer, Rochester Car Wheel Co.; C. S. Merrill, Engineering Equipment Co., New York ; G. N. McKibben, Reed & McKibben, New York ; Elmer Morris, Thomson-Houston Co.; J. E. Wallace, Smith & Wallace, Boston ; A. R. Cook, Q. & C. Co., New York ; J. F. Ostrom, Pennsylvania Steel Co., Philadelphia ; Frank R. Ford, Short Electric Railway Co., New York ; Willard S. Brown, American Casualty and Insurance Co.; John Patterson, Taylor Truck Co., Troy, New York ; Frank A. Magee, The E. S. Greeley & Co., New York ; J. H. Jones, West Troy, and Louis Pfingst, Boston ; T. E. Crossman, official stenographer.

The first business was the address of the president, which was as follows :

ADDRESS OF THE PRESIDENT.

The Street Railway Association of the State of New York:

GENTLEMEN : The past year has been without special incident, so far as the street-railroad interests of the state are concerned. I shall take your time but a few moments in giving a brief summary of the record of the year, and in calling your attention to a few practical matters.

Many members of the association feared that the street-railroad interests would be subjected to uncalled-for attacks on the part of the legislature at its late session, and much apprehension was felt that unjust and hostile legislation might be successful in impairing the value and usefulness of street-railroad properities throughout the state. The executive committee of this association took early action looking to the protection of our common interests. The report of the work done by the committee in this regard will, I am sure, meet your approval. The success which has attended the efforts put forth is evident to every member of the association. No bill striking street-railroad interests, and no bill which injuriously affected street-railroad interests became a law. The obligation of protecting the properties which we are called upon to manage against adverse and iniquitous legislation is lost sight of. Certain of our brethren seem to rely upon the success of efforts which they trust will be put forth by others who, perhaps, have no larger interests to protect than have they.

The most important function of a state street-railroad association is to furnish information to the members of the legislature as to the needs of street-railroad companies, and to combat before legislative committees and in personal intercourse with senators and assemblymen the erroneous propositions which are often advanced without adequate knowledge of the condition of things. A great majority of the members of our legislature are honest men, who, when informed as to the facts, will act intelligently without injury to any legitimate industry or business. There always have been and there always will be others in every legislative body who take advantage of every opportunity which ingenuity can suggest, to strike corporations by the medium of unjust and hostile legislation. Thus far, the street-railroad companies of the state have not been injured by unwise or dishonest legislation. But immunity cannot always be secured, except as the result of diligent and intelligent effort on the part of the street-railroad companies themselves. A fair and intelligent presentation of the facts as they exist, made at the proper time, I believe will always protect the interests with which we are identified ; but such presentation ought to be made by the representative of this association, and such representative ought to stand for every street-railroad corporation in the state.

I trust the time will very soon come when every street-railroad company in this commonwealth will not only have its name enrolled on the books of this association, but will be as well an active, earnest and enthusiastic member. Our interests are common ; our efforts should be united.

During the past year much progress has been made in the education of the people of the larger cities of the state upon the subject of the "trolley system" of propelling street cars. Even in the city of New York, where a year ago it seemed electric cars could never be operated because of the intense and unreasonable prejudice of the people, franchises are now being obtained, and there is every reason to believe that the old-fashioned, slow-moving and nuisance-causing horse-car system of that great and prosperous city will soon give place on all the lines to the modern systems of propulsion by electricity or cable.

Our Brooklyn friends have carried on their campaign of education with skill and unceasing effort, and the complete success of such effort seems now to be assured. So, throughout the state, until as error, ignorance and hostile interests are cleared away, the people of every community are coming to realize that they live in the last decade, and not in the middle of the nineteenth century. The improvements which have been made in electric and cable railroad appliances, machinery and construction, may be said to have kept pace with the demand for the same. The electric motor of to-day represents a great advance over the electric motor of last year, and the cable roads under construction in the city of New York represent the cable system at its best.

We shall have the pleasure and the honor to-day of listening to papers from two gentlemen, each of whom is in the front rank of his profession, and from them we shall learn what science, skill and experience have done in perfecting the two systems of street-car propulsion, which are doing so much to make life the more worth living in the cities of our state.

Street-railroad men are learning that in the management of our properties it pays to be liberal. I do not mean that it is wise to be extravagant, or reckless, or improvident in the management of such properties, but that a broad and progressive policy, which furnishes to the people increased facilities for travel, adds to the net income to be derived from the operation of street railroads. The public, as most of us have come to know, are quick to appreciate improvements made, and as quick to respond with their nickels to the effort of a company to intelligently and efficiently serve them.

It seems to me wise, and in accordance with the best business principles, to keep a little in advance of the reasonable demands of the people with reference to improvements, additions and extensions. I do not mean that a company should heed the request or demand of 100 families to extend a line where it will require 1,000 families to support that line when extended. But constructing an extension somewhat perhaps in advance of the time when such an extension will pay operating expenses, is, in my opinion, as a rule, the wise thing for a railroad company to do. The same principle obtains as to the number of cars to be run on each line, and as to other improvements and betterments of the system. We depend upon the people for our patronage, and every street-railroad man knows that a good feeling on the part of the people towards the company which serves them adds to the receipts of the line, makes it easier to obtain needed concessions from city governments as well as from individuals, and prevents the granting of franchises on parallel lines to competing companies where, perhaps, only one line can be made a commercial success.

While upon this subject of liberality of treatment on the part of railroad companies I desire to call your attention to the advisability, from a business standpoint, of adopting, whenever local conditions will warrant, a transfer system. It seems to railroad companies who now obtain two fares from passengers who desire to go

rom one part of the city to another by means of the cars on two lines, that the income of the company must necessarily be decreased if passengers are carried for a single fare of five cents.

After a careful study of this whole question, we decided at Rochester to introduce a transfer system under which a passenger can ride from any point in that city reached by the lines of the Rochester Railway Company to any other point reached by said lines for a single fare. We commenced giving transfers on this plan on October 5 last. We provided reasonable restrictions and necessary conditions. The experiment has proved an undoubted success, not only from the standpoint of the passengers, but from the point of view of the company as well. There is no question that the receipts of the company have been materially increased by the adoption and use of the transfer system. Perhaps the location of lines and other local conditions prevailing in other cities of the state may prevent the successful introduction of a transfer system. But I thought it might be of interest to members of the association to know of the pronounced financial success of the undertaking, so far as Rochester Railway Co. is concerned.

Until March 1 the conductors and motormen of the Rochester Railway Co. were paid the same wages as were formerly paid to conductors and drivers of horse cars. We very soon found after commencing operating electric cars that we required men of higher capacity to perform the duties of motorman and conductor than seemed to be necessary with the old system. It seemed to us that as the duties of the positions which the men held under the new system were more onerous and exacting, and as it required more judgment and skill to properly handle electric cars, that the men should be paid a somewhat higher compensation than they had before received. Therefore, the company, before the men themselves made any request for an increase of wages, advanced such wages. The action of the company, of course, gave great satisfaction to the men, and the result has been very beneficial, so far as the company itself is concerned. It has been found that while the item "wages of employés" has been materially increased the cost of operating the road per mile has in fact been diminished. This is accounted for by the fact that the men are more attentive to duty than before, and more careful in the handling of cars, by the greater freedom from accidents, and by the material lessening in the cost of maintenance.

I am satisfied that the management of many street-railroad corporations, where electricity is the motive-power, have not as yet given sufficient attention to the thorough instruction of their motormen as well as conductors, as to the function of each part of the motor, and as to the proper thing to be done by the motorman and conductor when trouble develops while the car is in service on the line.

Some weeks since I had occasion, while riding on an electric car in a city of another state, to ask the motorman some questions about the motor he was running. I found he did not know whether the motors were Thomson-Houston, Westinghouse, Edison or Short. He did not know whether they were double or single reduction. He did not even know whether he had under his car-body one or two motors. I asked him what he did in case he had any trouble on the line, and he said, "If the motor don't work I wait until another car comes along and pushes me in." I found that this motorman had been for nearly nine months in regular service as motorman in that city. This motorman knew enough to turn on and turn off the current, and to set and loosen the brake. This, of course, is an extreme case, but it illustrates a principle. My own judgment is, based upon some experience, that too much pains cannot be taken to thoroughly instruct the motorman as well as the conductor, so that each will know the cause of trouble when trouble develops in either of the motors in service.

The plan the company with which I am connected has adopted is to select from among the motormen one of the men who is pronounced by the master mechanic, the electrician and the superintendent the best posted as to the construction and use of a motor, and make such man, for the time being, instructor of motormen on cars in actual service. This instructor rides with motorman after motorman, observes the manner in which he handles his car under all conditions and gives detailed instructions as to exactly what to do whenever trouble of the usual sort develops. The instructor spends from half a day to three days with each man until he pronounces him in every way qualified to run a car on every portion of the line, and to do that which needs to be done when trouble develops.

I might call your attention to many other matters of practical interest if occasion seemed to call for further statement. It is, perhaps, presuming in me to say what I have said, addressing as I am many who have had more experience than I. My only object in calling your attention to the matters I have referred to is to make some suggestions which may be of value to some who have had less experience than I have, brief and limited though that experience may be. JOHN N. BECKLEY, *President.*

The report of the executive committee was then read. It shows that five companies had become members in the second class during the past year, and that the effect on the association of the consolidation of street-railway interests throughout the state was to decrease the membership. The committee recommends that the association provide a social dinner at its annual meetings to promote good fellowship between the officers and members, and it suggests that the annual dues of the first class members be fixed at $50, instead of $35, as at present. It refers to the great boom of the electric railroad in this state, particularly in Brooklyn, where, the report says, the overhead system will be "on a scale nowhere equalled in the world."

The committee calls attention to the change of sentiment towards the trolley by many of the leading daily newspapers of New York. "They will soon be tumbling over one another," it says, "in their enthusiastic advocacy of a system regarding which they have finally decided to learn something, and no longer to depend upon their imagination for their facts."

No strikes have occurred on surface lines in the state during the year, and the community of interest between employer and employé is not only recognized but appreciated by both parties.

In closing, the committee states that the outlook was never better, and that happiness and contentment reigns among street-railway companies because they are prosperous.

The treasurer's report was read and showed during the year, receipts, $945.66; expenses, $918.17.; balance, $27.49.

The president then introduced Mr. Charles J. Bissell, the counsel of the association, who briefly stated the work that had been accomplished at the state legislature, at Albany, during the recent session. Mr. Bissell said that he had been retained by the association to appear before the committees and the governor, and by argument and reason to restrain the enactment of legislation injurious to the interests of the street-railway companies of the state, and other corporate bodies. Mr. Bissell stated that the result of his experience was that he believed that the great majority of the members of the legislature were honest and straightforward, and needed only to have matters presented to them in a logical and open manner, to properly appreciate the right side of any question, and

vote accordingly. He believed that there was but a very small minority in either house whose votes could be influenced by any other means.

Mr. McNamara, of Albany, followed with a statement to the same effect, which was seconded by Mr. Powers, of Glens Falls, as also Mr. W. J. Clark, of the General Electric Company, the latter statement referring to the legislature of Ohio.

Mr. D. F. Lewis then called attention to the fact that much more effective work could be done in this direction if the smaller companies in the state could be brought into membership in the association, the dues in such cases being merely nominal ; and suggested that the supply men present could be instrumental in bringing the matter of joining the association before the smaller companies in the state in the course of their business calls upon them.

Mr. Ostrom, of the Pennsylvania Steel Co., on behalf of the supply men present, said that he believed that he could say that they would be willing to use their best endeavors in this direction. This was indorsed by Mr. W. J. Clark. The result was that during a brief recess of the association a meeting of the supply men was held, of which Major Evans was chairman, and a committee appointed to report measures for the formation of an auxiliary to the association to secure this end. The committee consisted of Messrs. Ostrom, Clark and McGraw.

Later in the day another meeting was held, and a permanent organization effected. Details of the formation of the auxiliary association will be found elsewhere in this issue.

The report of the committee on "Recent Improvements in Electric Traction" was then read as follows :

REPORT OF COMMITTEE ON RECENT IMPROVEMENTS IN ELECTRIC TRACTION.

GENTLEMEN : We understand that anything which tends to an increase of reliability or economy of operation of an electric railway is an improvement; and it is with the intention of bringing before you in a brief manner the results of my experience and observation during the past year upon these points that this article has been written.

As you of course know, electric systems as first constructed were built on altogether too light a plan, and the increasing tendency year by year has been, and is, for heavier and more solid construction in every department, but particularly in the way of track and station equipments. It has been well said that no new departure is ever perfect at the beginning, and no one realizes this more than he who has watched the development of electric traction during the last few years.

The storage battery has made but little progress during the past year, and is not likely to cut much of a figuse in electric traction until it is able to make a better showing, financially, than it has in the past.

It may seem strange that the management of roads, even at present operated by horses, cannot see that a change of some kind must come soon owing to the great cry for rapid transit; and yet I know of roads at present being laid with flat centre-bearing rails on stringers in streets being newly paved. I do not mention this as an "improvement," but simply to show that what may be regarded as an improvement by some would be called simply a makeshift or temporary piece of work by others.

The general tendency of the times to consolidate all common interests under one management is showing its effects in electric traction, more now than ever, and scarcely a week passes that we do not hear of some syndicate obtaining control of some horse road, and the information usually ends with the statement that "it is intended to equip all the lines with electricity." From many points of view this is an improvement, and a marked one.

TRACK.

The improvement in track construction has been very great, and although many expensive errors have been made, we ought on the whole to feel satisfied with the progress.

The early forms of track construction were too light and soon went to pieces, but during the past year heavier rails have been rolled and better joint-plates made, so that it is possible to keep the roadbed in perfect line and surface. This improvement has been a great help to the electric equipment and has reduced the cost of maintenance. As the cost of laying tracks is about the same, whether light or heavy, it is economy to put in only the best.

Now, on the question of what constitutes the best form of track there is considerable variance of opinion. My experience and observation have convinced me that the deep-girder rail, about nine inches high, spiked directly to the ties, is the best form for paved streets, and in dirt or macadam streets, a six-inch girder-rail laid in the same manner. In the country, and where the local authorities are willing, I would lay a T rail, spiked directly to the ties

The weakest place in all forms of track construction is at the joint. Every manufacturer of rails and many of the railroad companies have tried to overcome this trouble. There are probably as many patents upon rail-joints as upon car-couplers, and most of them about as impracticable. Up to the present time there has been nothing brought out which surpasses a properly designed "fish-plate."

While speaking of track construction, it might be well to call attention to the bonding of rails for the return circuit. Many forms have been used, and some of them are still in operation. I believe that a No. o copper bond wire long enough to connect with the web of the rail on each end of the fish-plate is the best plan, and then grounding the whole system at frequent intervals, and abandon the supplementary wire which it has been the custom to use with the common form of bonding.

ELECTRIC EQUIPMENT.

Probably the greatest advance in any particular line has been in the matter of armatures for motors and dynamos. I consider that the introduction of the "iron-clad" type will do more towards reducing the bill for repairs in that direction than any other one thing that has been introduced during the year. The electric companies have all, I believe, now adopted this form as their standard, and all roads that have tried them will, I think, agree with me that for simplicity, ease of repair and ability to stand the hard usage they receive, they stand at the head.

In the manner of controlling the motors most of the companies still use the time-honored rheostat; although I believe one company is endeavoring to introduce a new type of controller, which they will, doubtless, be happy to explain at a later date.

Many roads, acting under a misapprehension of the requirements, started off with motors too small for the work, and endless trouble has been the result. Some new classification should be adopted by the electrical companies for designating the power of their motors, as the present "office classification" does not afford a proper understanding of its capacity, and the "horse-power" term is but little better, depending on so many limiting conditions. A more satisfactory way would be to specify the number of pounds the motor can pull at different speeds, with the maximum current for which it is designed.

TRUCKS.

The first car-trucks employed in electrical work were of the pedestal form; that is, the trucks were fastened to the car-body and oscillated with the car. The

motors, of course, had to be suspended from the car-body, and the result was that the grinding of the gears was transmitted through the whole car; also, the oscillation of the car-body caused the motors to correspondingly rise and fall. This was very undesirable, and it was soon found necessary to adopt the post form, in which the truck was complete in itself and the motors supported directly on the frame of the truck. The body was connected with the truck only by springs, thus being entirely free from the jolts and pounding of the truck.

In this form slight spiral springs were first used, the same as in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side-bars beyond the axle-boxes a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support, coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car-body 28 feet over all, practically without oscillation. This last modification has been a very great improvement, and has settled the long-car question on most street railways. I mean by this that but very few double-truck cars will be used, though, of course, there are places where two trucks can be used to advantage, and in such places they will still be employed. But where we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that there is no possibility of lack of traction, there can be no gain to the railroad company using eight wheels.

CARS

The car-bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electrical purposes; first, the framing of the roof was too weak and would not support the trolley-board properly; second, the framing of the floor was not adapted for the use to which the cars were put; for not only was the framing too weak, but it also was not well planned for putting in the trap-doors which are required in order to inspect the machinery underneath the floor.

The car which it seems to me is best adapted for the present service is one 18 feet 6 inches long inside, with platforms 3 feet 6 inches long. The rafters should be strengthened with steel plates and the framing throughout should be heavier.

The coloring of the cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part, I believe that all of the cars on a system should be painted the same color; that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes; preferably by means of the well-known reversible sign on the top of the car both at the sides and front. At night the lines might be distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

OVERHEAD CONSTRUCTION.

There has been a general improvement in all parts of the overhead material. We are using stiffer poles, stronger span wires, better trolley-wire insulators and handsomer curve fittings; so that the general appearance of the system is much pleasanter. The quality of insulation now in general use is far superior to what we had two years ago, and as double insulation is now employed on the span wires, very little trouble from leakage is experienced.

The method of feeding the line is a very important matter and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

THE POWER STATION.

This may be rightly called the heart of any electric system. The trolley and feeder wires form the arteries, the rails and return wires the veins, and the cars the capillaries connecting them. The Biblical injunction to "Guard thy heart with all diligence, for out of it are the issues of life," would certainly seem applicable to the station. The chief element to be considered should be reliability, and, after that, economy. Just what means shall be used to attain this end seems so far to have been a disputed matter, as shown by the stations now in operation, which contain almost every conceivable device, good, bad and indifferent; all shapes, sizes and descriptions of engines, boilers and dynamos. Many designers of stations—if some of them can be said to have been designed at all—seem to have gone at their task utterly regardless of the future and oblivious to the experiences of the past. However, through it all I can say that a very marked improvement is observable lately. The designers of stations are learning wisdom from their past experiences, and the makers of apparatus are more alive to the requirements of the system, and better material and workmanship can be had where required.

The recent introduction of large multipolar dynamos has brought about a change in station arrangements not heretofore obtainable, and in all large stations now being built countershafting is dispensed with entirely, and the general tendency is toward reduction of parts, which in turn means simplicity. It is very probable that we have reached now a form of station that will be fairly permanent, and the main point in the future will be the size of the units. For medium-size stations engines with releasing-valve gear belted direct to a multipolar dynamo will be the best where the price of land is not excessive, and direct-coupled engines and dynamos for larger stations. To my knowledge there have been no comparative tests made as to the economy of the various types of stations, although all reasoning would point to these latest types as being by far the most economical.

There has been heretofore too much taken for granted or assumed in electrical work, and the rapid growth of the business has called into it many who were totally unqualified for the positions which they obtained. I attribute much of the unsatisfactory work in the past to this course, but am happy to note that the great majority of these are passing into the background, and their places are being filled with men of good judgment and mechanical resources.

Respectfully submitted,
L. H. McINTIRE, *Committee.*

A discussion of the report followed,* after which the president announced that the report of Mr. George W. McNulty on "Recent Improvements in Cable Traction" had been deferred till next meeting, owing to the fact that it had not been possible to get the road in operation before the time of this meeting, as was expected; Mr. McNulty, therefore, had requested that the report be deferred until next meeting.

The meeting then adjourned, to meet in Rochester, the third Tuesday in September, 1893.

In the afternoon all in attendance at the meeting were invited by the Union Railway Company, of Saratoga, to participate in a trip on the electric road to Saratoga lake. The ride was enjoyed by all.

*The verbatim report of the discussion will be found in STREET RAILWAY NEWS of current date.

THE MATERIAL MEN'S AUXILIARY ASSOCIATION.

In accordance with a suggestion made in the Convention, that a Material Men's Auxiliary Association should be formed, the material men present met on the United States Hotel piazza at 1.45 P.M.

On motion, H. C. Evans acted as chairman, and appointed John F. Ostrom, W. J. Clark and J. H. McGraw, a committee to report organization and name, and to name officers for ensuing year.

After a trip over the line of the Union Railway Company, of Saratoga, the material men met in parlor 8, United States Hotel, at 5 P.M., and received the committee's report as follows :

"The name of this organization shall be 'Association of Dealers in Street Railway Materials of the State of New York.'

"The object of the association shall be to make possible concerted action on any matters that may affect the business of its members, and to aid the New York State Street Railway Association in its efforts to prevent any legislation which it may consider hostile to the interests of the street railways of the state of New York, as well as to aid it in promoting beneficial legislation.

"The officers of the association shall be a president, two or more vice-presidents, and a secretary and treasurer, to be elected annually.

"The work of the association shall be performed by the officers and committees as follows :

"a. An executive committee of nine members, to be elected annually.

"b. A legislative committee of five members, to be appointed by the president annually.

"The dues of the association shall be, initiation dues, $5; annual dues, $5."

"This association shall hold an annual meeting on the date and at the place of the annual meeting of the New York State Street Railway Association, and other meetings at such time and place as may be called for by the president.

"Membership : Any individual, firm or corporation dealing in street-railway materials, any engineer, individual, firm or corporation engaged in street-railway construction work, or any trade paper published in the interest of the street-railway profession, may become a member by registering with the secretary and treasurer and paying the initiation fee and annual dues.

"Each member to carry one vote.

"Your committee would suggest the following as officers and committees to serve for the ensuing year:

"*President*, Wm. J. Clark, New York.

"*Vice-presidents*, Jno. W. Fowler, Brooklyn; D. W. Pugh, N. Y.; John Jones, Troy; E. J. Gilbert, Troy.

"*Secretary and treasurer*, C. E. Stump, N. Y.

"*Executive committee:* W. J. Clark, N. Y.; H. C. Evans, N. Y.; Jno. A. Wood, N. Y.; Wm. S. Silver, N. Y.; C. E. Stump, N. Y.; T. C. Martin, N. Y.; S. W. Baldwin, N. Y.; F. D. Russell, Rochester; D. C. Breckenridge, N. Y.

"It would also suggest that the president be authorized to appoint a committee to perfect a constitution and by-laws as embodied in the above.

"Respectfully submitted,

"(Signed) JOHN F. OSTROM, *Chairman.*"

After some discussion the report of the committee was adopted and the officers declared elected. It was decided that only residents of New York state be eligible as officers or committee men, and that the constitution contain such a provision.

Also resolved, that the president be appointed a committee of one to advise with the New York State Street Railway Association, and advise it of the action of the meeting.

ELECTRIC LIGHTING AND THE TELEPHONE IN JAPAN.

BY S. KATOGI, TOKIO, JAPAN.

It may be of interest to the readers of the ELECTRICAL AGE to know how we in Japan stand in electric lighting and telephone matters. Although we are far away from America, which country is considered here at the head in electrical progress, we are not deterred in the least by distance in our determination to keep in the front ranks of advancement. The Japanese people appreciate the advantages of improvements, especially in electric lighting and the telephone, and that they are availing themselves of these advantages may be inferred from the following statistics :

In Tokio city there are no less than four electric-light companies with a total capacity of 17,790 16 C. P. incandescent lamps, and 145 arcs of 1,200 C. P. Of these 14,671 incandescent and 108 arc lights are in actual use.

The Tokio Electric Light Co. operates the Edison, Mather-Platt (alternating) and the Brush (alternating and arc) systems, and has a capacity of 15,140 16-C. P. incandescent and 145 arc lights, of which there are in actual use 11,913 incandescent lamps and 108 arcs.

The Shinagawa Electric Light Company operates the Mather-Platt system of lighting, and has in actual use 1,500 incandescent lamps, which represents the total capacity of the station.

The Fukagawa Company has 808 incandescent lamps on the Thomson-Houston system, and the Teikoku Company operates the Westinghouse system with 450 incandescents in actual use, being but 50 less than its full capacity.

In other cities in Japan a very good showing is made as may be seen from the following table :

Place.	*System.*	*Capacity* Incand.	arc.	*In actual us* Incand.	arc.
Osaka	Thomson-Houston.	6,700	75	6,539	75
Kobe	Edison	2,400		2,400	
Kyoto (Old capital, near Osaka)	Edison	1,600		1,344	13
Kyoto	Brush	——	40	——	
Nagoya	Edison	1,280		1,800	
Yokohama	Edison and Brush (alt)	2,800		1,700	
Kumamoto	Edison	640		860	
*Nagasaki.	Thomson-Houston.	650	15	——	
Hokkwaido (Sapporo)	Edison	800		600	
*Hakone	Edison	400		250	
Tokio City (Totals).		17,790	145	14,671	108

* Just started.

The Hakone plant is operated by a turbine made in Tokio. This place is near Yokohama.

The Kyoto city government has just completed the installation of a Pelton water-wheel which will supply power for carrying on a variety of industries. A 1,300-light Thomson-Houston dynamo for the Kyoto Electric Light Company is also driven by this wheel.

Grimshaw white-core wire, made by the New York Insulated Wire Company, New York, is used in the Kyoto Electric-Light Company's installations, and it is giving excellent satisfaction.

Besides the central stations above enumerated there are in Japan about 30 isolated lighting plants ; in one cotton-spinning mill alone there are 800 lamps used.

Electric motors are rapidly coming into extensive use in mining operations. There are several coal mines north and south of Tokio, and the use of electric power is becoming more and more appreciated in such operations.

The telephone is making satisfactory progress in Japanese cities, and is rapidly enlarging its field of usefulness. The Japanese people find it a very great convenience, and its extension is rapid, as the following statistics

will show. The table shows the number of subscribers in Tokio and Yokohama, December, 1891, and the number at the end of each of the first six months of 1892, and indicates prosperity for the company.

	1891.	1892.					
	Dec.	Jan.	Feb.	Mar.	Apl.	May.	June.
Tokio	637	677	703	751	803	852	905
Yokohama....	145	158	169	179	186	193	199

New telephone exchanges are being built at Osaka and Kobe, and they will be ready for practical operation by the end of the year. New poles are being put up now, and in every way the systems will be first-class.

RAPID TRANSIT IN BERLIN.

The rapid-transit question is one that is engaging the attention of engineers in large European cities as well as in this country. In Berlin there is a great need for some satisfactory method of communication between the various sections of the city and the suburbs, and many are the schemes that have been proposed to meet the requirements in the case. The overhead lines seemed to be in favor for awhile, but since the city and South London electric-railway enterprise in London has proved to be a complete success, sentiment is now in favor of an underground system of electric railways.

The accompanying illustration shows the plan of a scheme for an underground electric system developed by the Allgemeine Elektricitäts Gesellschaft, of Berlin, which seems to be considered with favor. The idea is to build two concentric circular railways, each with a double track; across these circular lines are run diagonally a couple of lines at right angles to one another, thus forming axes of the two circles, large and small.

Trains are to pass continually, not only round each circular railway in both directions (as indicated by the arrows), but also along the cross lines as well; for instance, from C to D and from A to B, and *vice versa*, the loops at each end avoiding any necessity for shunting the trains. The lines are double throughout except at the loops, which are practically the doubled axial lines opened out into two single ones, in order to avoid shunting trains for the return journey.

Stations are to be built at the intersections and touching-points of the different lines, as well as between these places at any desired locality. Their number is given as follows: On the inner circle, 12; on the outer circle 20; on the axial lines, 14 and 18 respectively; or, a total of 64 stopping-places on the whole system. Some of these are, of course, common to both lines—where, for instance, one radial line crosses the other, and meets or crosses one of the circular lines; but since in such a case the lines are at different levels, the stations are in reality quite separate, although their exits to the upper air may be identical.

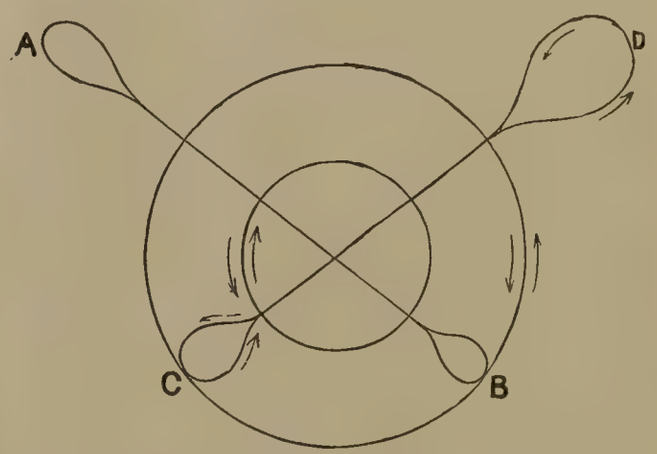
The locomotives and carriages are designed to run upon four-wheeled bogie trucks, so that even curves of smaller radius than 25 metres (the lowest proposed) could be arranged for if necessary.

To secure efficient drainage throughout the entire length of the tunnels, levels are to be almost entirely avoided, the minimum gradient being 1 in 2,000. On the axial lines the steepest grades are respectively 1 in 730 and 1 in 50, over lengths of 1,604 and 684 metres; the inner circle has one gradient of 1 to 150, but only over the short distance of 237 metres.

In the tunnelling process it is proposed to employ a shield with boring heads being pushed forward from time to time into the yielding soil under air pressure. The material loosened is to be carried away by a flow of water through a length of heavy piping to the outlet from which the tunnel proceeds, whilst the iron lining of the tunnel is built up behind in sections of some 70 centimetres in width. Between the outer skin of this lining and the inside of the hole excavated by the boring shield, cement is forced in by pressure so as to fill up the whole of the space and thus act as a grouting.

The sections of which the tunnels are to be built up are formed each of five segments with flanges, by means of which they are bolted together.

The thickness of the iron is about 10 millimetres, and of the flanges half as much again. The bottom segment is designed of such a size or width that the longitudinal flanges on each side may serve to support iron chairs intended to carry one pair of rails through each tunnel. These chairs—one of which is erected on each ring composing the tunnel—are of inverted channel iron form, bolted to the flanges, and with wide angle extensions to afford a good seating for the rails (which are bolted down) as well as to carry a transverse metal brace on which are fixed the insulators for the electrical conductors. The rails are of the Vignoles type, 10 centimetres high, and weighing 20 kilogrammes per metre.



PLAN OF RAPID-TRANSIT SYSTEM IN BERLIN.

Lifts are also provided for carrying passengers from one level to the other at the crossing stations—where one line crosses another at a different level.

Two central power-supply stations will be required at the outset, each furnishing current for one of the axial lines and one-half of the circular railway. Large compound engines are proposed to be employed driving suitable dynamos. No decision as to the method of distribution has yet been made, although it apparently means employing either continuous currents or else the three-phase alternating system.

If the former be used, a tension of 500 volts will be adopted. From the generating stations are to be run feeders and working conductors, the former of heavily armored lead cable, the latter of bare copper wire or copper strip.

No definite arrangement of the feeders, cables or conductors generally has, however, been worked out as yet, nor is it even decided whether or no to use the rails as return circuit.

All trains on the line are to run in parallel, so far as the electrical working is concerned. Slow-speed motors are proposed, so that the armatures can be mounted either directly upon the axles or else a single reduction gear be employed, which in this case would be run immersed in oil in a dust-proof casing.

Series-wound motors are to be used, the speed being

regulated by varying the intensity of the magnetic field.

We are indebted to the *Railway World*, London, for the above facts.

AN ELECTRIC CLUB IN ST. LOUIS.

A meeting was recently held at the Mercantile Club in St. Louis by electricians and others interested in electrical pursuits for the purpose of discussing the question of forming an electrical club.

The meeting was called to order by Mr. James I. Ayer, general manager of the Municipal Electric Lighting and Power Company, who explained the object of the meeting, and said that in view of the fact of the National Electric Light Association having chosen St. Louis as the place for holding its next convention he thought that steps should be taken to effect an organization or club, and having thoroughly canvassed the field found the time ripe for such a movement.

At the invitation of Mr. Ayer, Capt. McCullough, W. L. B. G. Allen and Louis Nahm gave their views and heartily endorsed the proposition.

A temporary organization was then formed with Mr. Ayers as chairman, and C. R. Scudder as secretary. A committee on permanent organization was named consisting of Messrs. Ayers, McCullough, Wagner, Allen and Bohle, and they were instructed to draw up a constitution and by-laws and report at the next meeting of the body, which was set for Friday, Oct. 14. Among the gentlemen present were: F. Schlosser, superintendent electric department Laclede Gas Light Co.; George F. Durant, general manager Bell Telephone; C. R. Scudder, secretary St. Louis Electric Light and Power Co.; James I. Ayer, general manager Municipal Electric Lighting and Power Co.; H. P. Broughton of the Municipal Electric Lighting and Power Co.; H. A. Warner, superintendent Missouri Electric Light Co.; Robt. McCullough, general manager St. Louis Railway Co.; J. A. J. Shultz, president Shultz Belting Co.; R. H. Bohle, manager Western Union Telegraph Co.; H. L. Parker, A. W. Meston, F. W. Churchill of the Emerson Electric Co.; Louis Nahm, American Electric Manufacturing Co.; W. Mathews, St. Louis Electric Supply Co.; R. V. Scudder, Western Electric Manufacturing Co.; C. E. Sharpe, Southern Electric Supply Co.; E. J. Bagnell, engineer Lindell Railway Co.; H. C. Henley, inspector St. Louis Board Fire Underwriters; W. L. B. G. Allen, St. Louis Engineering Co.; W. H. Bryan, mechanical engineer.

Letters of regret were received from a number of gentlemen who were prevented from attending, expressing themselves as being thoroughly in accord with the sentiments of the meeting and promising their hearty co-operation.

HINE ELIMINATORS.

Figs. 1 and 2 represent the Hine Eliminator, horizontal and vertical styles respectively.

A competitive test of steam separators was made at Sibley College, Cornell University, in 1891, and in twelve trials with steam, varying in moisture from 10 to 35 per cent., the Hine Vertical Eliminator developed an efficiency of 98.7 per cent.

Subsequently the Hine Eliminator Company, being desirous of comparing the efficiency of the horizontal type with that of the vertical, had a test made at the Polytechnic Institute, Worcester, Mass., by Prof. Geo. I. Alden, who reported that after thorough and exhaustive trials an efficiency of 99.38 per cent. was developed. Practically the same method was followed in the test as that adopted in those made of the vertical style at Cornell.

The special features in the construction of these eliminators are that in the horizontal style (Fig. 1) a corrugated vertical diaphragm interposes between the inlet and outlet side. By force of the incoming current the steam is driven against this diaphragm, and by expansive impingement of the transverse corrugated surfaces, the initial separation takes place before the turning of the steam into the outlet side. At proper arial distances below this vertical diaphragm are two converging discs between which the particles eliminated pass into the chamber below out of and away from the steam current,

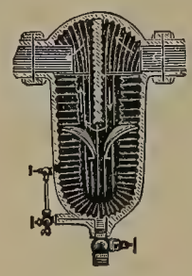


FIG. 1.

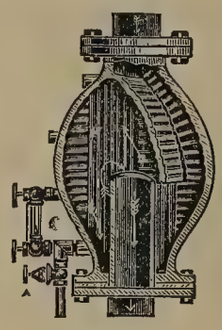


FIG. 2.

and are discharged from a valve, while the clean dry steam passes on under the diaphragm, being deflected by an inward extending pipe at the point of outlet.

In the vertical style (Fig. 2), at the side on one end, a corrugated deflecting partition extends half the length of the body, forming the inlet. At the opposite end a vertical pipe cast with a flange and standing out from the body forms the outlet. The steam in passing through the deflecting partition obtains centrifugal action, and by expansive contact with the inner corrugated surfaces is broken up, and the water, oil, grease or other particles eliminated, readily flows down the vertical corrugations and out, while the steam, diverted from its direct current, passes through the vertical pipe to point of delivery. The eliminator is not a filter, its functions being the separation of particles from steam while it is steam, and not after it is condensed into water.

ENAMELLED REFLECTORS.

What are claimed to be the most serviceable and satisfactory electric-lamp reflectors on the market are those described and illustrated below.

These reflectors are made of thin steel sheets, stamped out in one piece and afterwards enamelled. White enamel

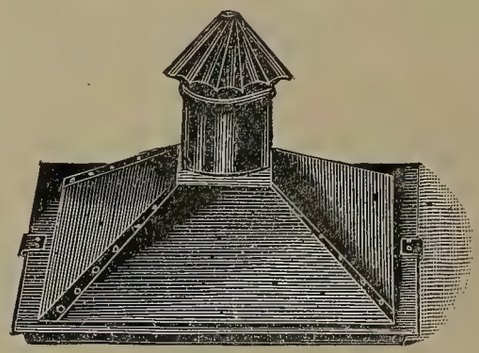


FIG. 1.—ENAMELLED ARC-LAMP SHADE.

is applied on the inside, while on the outside enamel of green, blue, white and other colors is used.

These reflectors are practically indestructible and are the most economical in the end. The enamel never turns yellow with age or by the action of light or heat, and it does not chip off. Its color and brilliancy are always retained, and as its surface is hard and bright it is not in the least degree affected by the atmosphere,

consequently it is very easy to keep clean. The enamel resists the action of heat and acids, and these reflectors cannot be broken. They are made in any shape to order, although a large stock of standard sizes and shapes are kept on hand.

They are made by the Thale Iron Works, of Thale-a-Harz, Germany, for which concern Mr. Hermann Aich

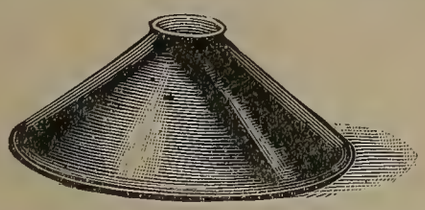


FIG. 2.—ENAMELLED INCANDESCENT SHADE.

is the sole agent for the United States, at 43 Murray street, New York City.

Mr. Aich carries a large stock of these enamelled reflectors, which are adapted for lamps, gas or arc and incandescent electric lights.

The two accompanying illustrations show an arc and incandescent lamp shade of this enamelled ware. They are very attractive in appearance.

FUEL ECONOMY IN BOILER FIRING.*

BY BERTRAM FLINT.

With the variety of fuels on the market the problem how to most economically fire a boiler is a perplexing one, varying for every locality. The owner of the sawmill finds his fuel near at hand in the form of slabs and sawdust, and like many others is relieved of the necessity of choosing. But to the average steam-user who has hard and soft coal alike offered him by dealers, and equal transportation facilities, the question which kind of fuel, hard or soft, or if hard which size will give him the best economy, is an important one. Soft coal will give the greatest evaporation per pound of fuel, but it is very possible that a cheaper coal, though more of it may be used, may be more economical.

Or further, it may be found possible to so alter the conditions of burning by use of forced draught, thin fires, etc., that the cheaper coal may be really the cheaper. Of course the proper way for every steam-user to deal with the matter is to make his own evaporation tests. This, however involves expert work or knowledge, and the use of apparatus not available to every one. The next best thing is to get the evidence of some one who has tested the fuels at various prices and in various ways. Then, though the prices for fuel under which the tests were made may differ from those in the vicinity of the reader, still, having a scale of the relative evaporative efficiencies of the different fuels, it is easy for him to determine which is the most economical for him to use.

Among the conditions governing economical running of a boiler plant there is probably no one more important, no one in which there is more variation in practice, than the management of the draught. Ordinary attendance implies keeping the boiler clean inside, preserving an even water level while steaming, clean, bright fires, etc. But in the kind of draught and its management lie the fine points of boiler firing, in getting a draught that will supply the greatest amount of air to the fuel, yet will not carry too much heat up the chimney.

The complaint commonly urged against forced draught is that it allows too much heat to escape up stack. If the damper is wide open that is the case. However, in order to get the advantages claimed for forced draught—namely, high power, quick fuel consumption, a hot fire—it is not necessary to run with wide-open damper. Forced draught can be so used as to give a greater output of power without evaporating less water per pound of coal than with the use of the natural draught. Of course there will be more fuel burned, as more power is developed. The philosophy of keeping the damper down as far as possible is that thereby the fire spaces become packed with burning so highly heated gases, which go off at a high velocity, instead of as a comparatively lazy current through a wide opening, as in the case of natural draught. In general there should not be such an excess of pressure as to inconveniently drive out the ashes around the ash-pit doors.

With a 156 horse-power Babcock & Wilcox boiler two tests of soft coal gave 8.70 pounds water evaporated per hour at 212° F. per pound of coal. Three tests of pea coal gave 7.87 pounds per pound of coal, forced draught. Four tests buckwheat coal gave 7.86 pounds per pound of coal, forced draught. Two tests washed culm gave 7.46 pounds per pound of coal forced draught.

Hence it follows that for an equal economy (providing the fuels do not have more refuse than the amounts to be given further on) in any district, pea and buckwheat must not cost more than five per cent. more than washed culm, and soft coal not more than 16 per cent. more than culm or 11 per cent. more than pea or buckwheat. The average per cent. of refuse for the soft coal was seven per cent.; for culm, 18 per cent.; for buckwheat, 18 per cent.; for pea, 15 per cent. With so large a percentage as in these last the question of getting rid of the ashes becomes serious, and the extra expense of handling should, of course, be taken into account when the contest between hard and soft coal is close.

Mechanical News.

THE AMERICAN ENGINE COMPANY'S PLANT.

The accompanying illustration gives a bird's-eye view of the extensive plant of the American Engine Company at Bound Brook, N. J. Here is manufactured the celebrated American High-Speed Engine, which was illustrated and fully described in the issue of the ELECTRICAL AGE of March 5 last.

In the construction of this plant every care and attention was given to have each department complete in its minutest detail so that nothing should be lacking to insure a superior quality of work.

In the boiler-room there are three large boilers which can be used separately or conjointly as may be desired. Near it is a large fire-pump with the necessary apparatus to be used in case of necessity. The electric-light and power plant which consists of three dynamos, one for running the cranes in the foundry and machine-shop, and the other two for lighting the shops and adjacent village, immediately adjoins the boiler-room. The capacity of the dynamos used for lighting purposes is 810 lights each.

In the shops are placed every convenience for the handling of heavy loads with ease; tramways are arranged around and through the shops, running from one department to another, with turn-tables, cars, etc.

The raw materials used in the construction of the American High-Speed Engines, including pig and scrap iron, coal, coke, moulding-sand, etc., are run into the yards from the various railroads by means of switches and unloaded directly into bins conveniently arranged along side of the foundry, thus saving all unnecessary handling.

In the foundry is found every convenience for casting.

A twenty-ton travelling crane controlled by electricity and operated with ease by one man does the work of many men. The core ovens are at the north and a pickling-room at the south side of the foundry.

The machine-shop adjoins the foundry, and no expense has been spared to make it one of the most complete in the country. The largest machine, probably, is a giant planer thirty-six feet long, capable of planing seventy-two inches square and twenty feet in length. Near by are three large tandem planers specially designed with a capacity of working eight pieces of the engine at once on each machine, and being especially constructed for doing portions of the work on a larger scale than ever attempted before.

Five large horizontal and three vertical boring-mills, capable of doing work of large dimensions, half a dozen Brown & Sharpe universal grinders and milling-machines, sixty or more lathes, upright and radial drills, numerous jigs and special tools from such standard makers as the Pratt & Whitney Co., Brown & Sharpe Manufacturing Co., Putnam Machine Tool Co., Niles Tool Works, and others, go to make up the complement of one of the best appointed works in the country. An important adjunct is the blacksmith-shop with annealing ovens, forges, cutting and punching machines, etc.

Immediately adjoining the buildings on the south, and parallel with the shops, are arranged three other buildings; one being a carpenter-shop for making flasks and miscellaneous work, another for storage of patterns, while the third is a general storage-room and warehouse for all sorts of stock, such as steel, bar-iron, nuts, bolts, hardware, belting, pulleys, hangers, etc. The two latter buildings are covered with iron and fitted with the sprinkler system, and in fact every protection used to make them secure against fire.

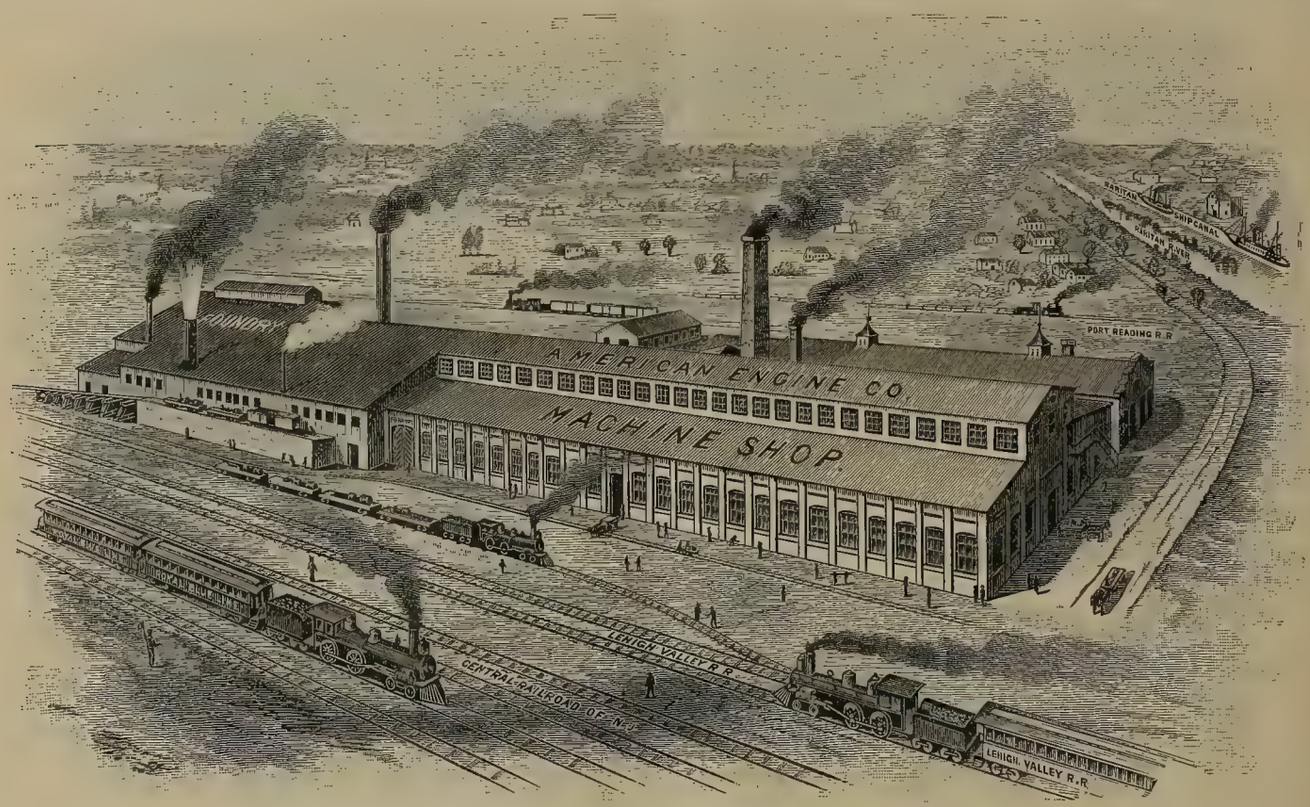
The draughting and pattern rooms are well lighted and contain every modern appliance for accurate work.

As the plant of the American Engine Company stands to-day it represents an expenditure of something like $400,000.

So far as railroad facilities are concerned, the company is exceedingly fortunate, as will be seen by a glance at the illustration.

The officials of the company are: R. V. Pierce, president; V. Mott Pierce, secretary and treasurer; Elmer S. Smith, general manager.

Mr. Smith is the inventor of the American High-Speed Engine, and devotes all of his time and energies to its development and improvement. His efforts have so far been entirely successful, and to-day it is looked upon as one of the best engines in the market.



MACHINE-SHOP AND FOUNDRY, AMERICAN ENGINE CO., BOUND BROOK, N. J.

HOW TO MANAGE DYNAMOS AND MOTORS

"I want a book that will give me plain directions to aid me in the selection of a dynamo or motor, and tell all about these machines in practical work. I want also directions for installing these apparatus under different conditions, and I would like to know what to do when anything goes wrong with them. A book that will tell me the causes of sparking; heating of armatures, fields and bearings; noises; failure to hold proper speeds; inability and failure of dynamo to generate current and motor to start, and the remedies for these troubles is what I, with many others, am looking for. Is there such a book?"

"Yes! 'Management of Dynamos and Motors,' by Crocker and Wheeler, is just what you want. It covers every one of these points and more too. The price is but $1.00."

For sale by the Electrical Age Publishing Co., first floor World Building, New York city.

ELECTRICAL SOCIETIES.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

The Brooklyn Institute of Arts and Sciences has issued its prospectus for the season of 1892–3.

An elaborate programme has been arranged for the

department of electricity. Fifteen illustrated lectures are to be given and a large electrical exhibition will be held under the auspices of the department, at the Clermont avenue rink for three weeks. A special announcement will be made later on, when all the arrangements have been completed. A special feature will be the reproduction of prominent new experiments under the supervision of a special committee.

MEETING OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The second annual meeting of the American Electro-Therapeutic Association will open on October 4, at the New York Academy of Medicine, 17 West 43d street, and will continue three days, Oct 4, 5 and 6.

An extensive programme is provided. The following are the portions thereof relating to electricity:

Tuesday Oct. 4, 10 A. M.

Address of the President, Dr. W. J. Morton, of New York.

REPORTS OF COMMITTEES.

Report of Committee on Standard Coils.
Report of Committee on Standard Metres.
Report of Committee of Arrangements.

PAPERS.

The Use and Abuse of Electricity in Medicine. By Dr. A. D. Rockwell, of New York.

The Rôle and Range of Electricity in Therapeutics. By Dr. Thomas W. Poole, of Lindsay, Ontario.

New Contributions of the Electrical Treatment (both Faradic and Galvanic) to the Diagnosis in Gynæcology. By Dr. G. Apostoli.

AFTERNOON SESSION.—AT 3 O'CLOCK.

DISCUSSION :

Electric Cataphoresis and Its Practical Application as a Therapeutic Measure.

a. Opening of Discussion. By Dr. Frederick Peterson, of New York.
b. The Physics of Cataphoresis. By A. E. Kennelly, Esq., Chief Electrician of the Edison Laboratory, and Prof. E. J. Houston, of Philadelphia.
c. Its Uses in General Medicine. By Dr. W. J. Morton, of New York.
d. Its Uses in General Surgery. By W. H. Walling, of Philadelphia.
e. Its Uses in Gynæcology. By Dr. Augustin H. Goelet, of New York.
f. Its Uses in Skin Diseases. By —— ——
g. Its Uses in Nervous Diseases. By Dr. Frederick Peterson, of New York.

Stabile Electrodes. Old Materials Newly Arranged. By Dr. R. J. Nunn, of Savannah, Ga.

The Value of Voltaic Alternatives in Optic Nerve Atrophy. By Dr. C. Eugene Riggs, of St. Paul, Minn.

EVENING SESSION.—AT 8 O'CLOCK.

The Present Status of Electrolysis in the Treatment of Strictures. By Dr. Robert Newman, of New York.

Rotary Transformers for Medical Use. By Dr. R. L. Watkins, of New York.

A Contribution to the Electrical Treatment of Cystic Goitre and Hydrocele. Also a Note on Psoriasis. By Dr. Charles R. Dickson, of Toronto, Canada.

Wednesday, October 5.

MORNING SESSION.—AT 9 O'CLOCK.

The Need of Greater Simplicity and Uniformity in Electro-Therapeutic Apparatus. By Dr. W. J. Herdman, of Ann Arbor, Mich.

Medical Electricity from an Electrician's Standpoint By John J. Carty, Esq., vice-president of the N. Y. Electrical Society.

Anæsthetical Electricity. By Dr. Wm. F. Hutchinson, of Providence, R. I.

Some Physiological Experiments with Magnetism at the Edison Laboratory. By Dr. Frederick Peterson, of New York, and A. E. Kennelly, Esq., of the Edison Laboratory.

The Effect of Electrolytic Action in the Removal of Certain Neoplasms. By Dr. D. S. Campbell, of Detroit, Mich.

AFTERNOON SESSION.—AT 3 O'CLOCK.

DISCUSSION.

The Relative Fœticidal Value of the Galvanic and Faradic Currents in Ectopic Gestation.

The following points are to be emphasized :

1. How does electricity destroy the life of the fœtus ?
2. Which current should theoretically be more certain in its results ? And what is the individual experience ?
3. Can electricity be depended upon to accomplish the desired end ? And why ?
4. Should the galvanic current be used interrupted or constant ?
5. What is the best method of applying the agent ?
6. What are its dangers ? And how are they to be avoided ?
7. Who should apply it ? Can it be safely intrusted to the general practitioner ?

To be opened by Dr. A. D. Rockwell, and continued by Dr. Wm. T. Lusk, Dr. Alex. J. C. Skene, Dr. Franklin H. Martin, Dr. Augustin H. Goelet, Dr. A. Lapthorn Smith, Dr. A. Brothers, Dr. Malcolm McLean, Dr. E. H. L. McGinnis, and Dr. A. H. Buckmaster.

Speakers are requested to confine their remarks to the questions under consideration, and to speak briefly to the point.

The Treatment of Salpingitis by Depletion and Drainage Secured by Electricity. By Dr. Augustin H. Goelet, of N. Y.

Some Successes and Failures with Electricity in Gynæcology. By Dr. A. Lapthorn Smith, of Montreal, Canada.

The Negative Pole of the Galvanic Current an Aid to Uterine Development, with Cases. By Dr. Charles G. Canaday, of Roanoke, Va.

Thursday, October 6.

MORNING SESSION.—AT 10 O'CLOCK.

Electro-Therapeutics and the Systematic Treatment of Morbid Growths. By Dr. John A. Cutter, of New York.

EVENING SESSION.—AT 6 O'CLOCK.

The Constant Current in Glaucoma and Cataract. By Dr. S. T. Anderson, of Bloomington, Ill.

Note upon a New Application of Alternative Sinusoïdal Currents in Gynæcology. By Dr. G. Apostoli.

The Electrical Treatment of the Paralysis due to Acute Poliomyelitis. By Dr. Graeme M. Hammond.

How to Make Dimples with Electricity. By Dr. Ernest Wende, of Buffalo, N. Y.

Anatomical Regression of Intra-Mural Fibroids under Galvanism. By Dr. Margret A. Cleaves, of New York.

After adjournment on Tuesday evening the members will be entertained at the Electric Club, at No. 17 W. 22d street.

On Wednesday evening a lecture on "The Phonograph and Microphonograph," with illustrations, will be given by Dr. J. Mount Bleyer.

On Thursday at 9 A.M. the members will visit the telephone exchange, and in the afternoon, by special invitation, they will make an excursion to Mr. Edison's laboratory, Orange, N. J. The boat will leave the foot of 23d street at 1.25 P.M. for the Erie depot in Jersey City, where the members will take the train to Llewellyn. The party will return at about 6 P.M.

The exhibition of electrical batteries and instruments will take place at Room 40, adjoining that of the meeting room of the association. The exhibition will be open from 9 A.M. till sunset, and the following concerns will be represented: Edison Mfg. Co., J. H. Bunnell & Co., Waite & Bartlett, Galvano-Faradic Co., W. F. Ford, O. Flemming, McIntosh, Law Battery Co., The F. A. Davis Publishing Co. and George S. Davis.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, Sept. 24, 1892.

MR. PERCY H. HOWARD has recently entered the service of the Perkins Electric Lamp Co. as special salesman for N. Y. City and vicinity.

MR. H. A. CLEVERLY, of the Cleverly Electrical Works, 1,018 Chestnut street, Philadelphia, was in town during the week and gave us a pleasant call.

MR. PAUL T. KINNEY has severed his connection with the Elektron Mfg. Co., and joined the staff of the Mather Electric Co., in New York, as special salesman.

MR. W. E. STOW, electrical engineer, has recently connected himself with the New York office of the Mather Electric Co., in the capacity of electrical engineer.

EUGENE MUNSELL & CO., 218 Water street, have received an order for the mica to be used on 12,000 cut-out boxes that are to be placed throughout the World's Fair grounds and buildings.

WATSON & STILLMAN, in order to keep up with their orders, have been compelled to run their hydraulic machinery works at 204-210 East 43d street, night and day. They report the prospects for future business as very promising.

JOHNSON girder-rails, manufactured by the Johnson company, of Johnstown, Pa., are being used exclusively on the reconstruction of the De Kalb avenue line of the Brooklyn City Railroad Company into an electric line. The trolley poles will be those of the Morris and Tasker Company, of Philadelphia.

MR. SAMUEL BOGART, electrician of the Electric Secret Service Company, 45 Broadway, has an extensive exhibition of the company's railway signal and other devices, for the operation of which the currents are taken from six Edison-Lalande batteries and one Callaud battery. These batteries have been in continual use since June last. When your representative called upon him last week his assistant was cleaning the zinc of the Callaud battery, and Mr. Bogart remarked that the Edison-Lalande battery was the best one in the market, and that he had tried them all.

TRUEX & VAIL have secured the exclusive agency for the "Brilliant" high-grade incandescent lamp manufactured by the Electrical Manufacturing Company of Oconto, Wis. This lamp, although not as long on the market as some others, has proved to be superior to any other manufactured, and in the hands of this firm will be thoroughly introduced in their territory, which consists of all the New England states, New York state and the northern part of New Jersey. This lamp is now on exhibition at their office at 136 Liberty street, city.

MR. A. B. LAURENCE, general manager of the Shultz Belting Company, 225 Pearl street, has secured a big order for 300 feet of 10-inch, and 100 feet 8-inch dynamo belts, for use in the Brokaw building Fourth avenue and Astor place. Mr. Laurence is out for scalps, and generally succeeds in capturing them. He has one of the best line of belts in the market, and they are spoken of in the highest terms by all who have used them. The Shultz patent sable dynamo belt cannot be surpassed, and the company's pulley-covering is a marvel of science which no station or power-house should be without.

AN interesting sight at the Easton Electric Company's Works, 643 Kent avenue, Brooklyn, was that of a big armature being packed for shipment. It weighed about 1,200 pounds, and contained 112 pounds of Eureka tempered copper on the commutator and 60 pounds of No. 1 J. A. Roeblings' Sons insulated wire. This armature is to be used to generate a current of 350 ampères at 125 volts, for lighting purposes. There were several more in various stages of completion. The body of the machine was being transferred to the heavy machinery department on the main floor for finishing touches. Its weight was about 4,500 pounds and, like all of their dynamo frames, cast in one solid piece.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	200 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N. B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	117 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	7 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*106
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	102 00
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	114 50

Names of Companies.	Capital.	Par.	Price.
General Electric Co., 5s	4,000,000		*104
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 00
Laclede Gas pref.	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	59 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	78 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	95 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	37 50
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

There seems to be a deep and determined belief among the handlers or controllers of large capital that the storage battery is the acme of their desires, and from all sides rumors of successful experiments and introduction continue to roll in. One day it is an electric yacht—and a company has already secured the contract for the Chicago exposition—which occupies attention; the storage battery is tested and proves a grand success for a full day's work; all hands are happy and the amount of money required to construct and equip is secured. During the time consumed in this operation the yacht battery is lost sight of by the outside world, and up comes one for running the entire works of a factory requiring small power; the battery does the work bravely, and another lot of money is put in by the knowing ones; it at once begins earning its own living, and the owners being satisfied with their investment say little concerning it. Then comes a battery for illuminating a large hotel, shop, office building, mill or whole block of houses. The inventor, patentee or adapter, as you will, exhausts his resources in reaching the point of lighting, but seems to find in a great many cases, for an interest, the necessary funds, and in a short time this part of the storage battery quiets down and performs its duty. Then comes the surface car. There are at least nine ways of running it by storage battery, and there are more than that many capitalists always prepared to float the business on to a certain success; and what I consider of the most importance, such men as Col. Goundie, of the Brooklyn, and Col. Hain, of the New York elevated, never for a moment waver in their belief that all elevated trains will eventually be propelled by storage battery. The business grows constantly and several fortunes are lying in escrow for investors who reason out for themselves. There really is only the one question of economy, but it completely involves the introduction of the battery and its operation. John Wise, the counsel for the General Electric Co., at a meeting of the railroad commissioners at the New York Chamber of Commerce, when the Huckleberry road was young, and his whole interest centred in praise of the trolley, stated that "the man who secured the storage battery for city car propulsion, would be a Crœsus indeed; that money beyond reasonable desire awaited him;" and I shall be happy to see it in more general use for all light work.

The Argentine difficulty and the failure of Baring Bros. assumes a more definite phase this month. It upset the financial conditions in all parts of the world, and to a certain extent does so to-day. Gov. Lidderdale, at the directors' meeting of the Bank of England, held on Sept. 15, rendered a statement of the present condition of the liquidation of Baring Bros., showing that the liabilities are now £5,113,613, as compared with £7,017,666 in March last. The total assets at the end of August, were £8,381,261, securities to the amount of nearly £2,000,000, having been realized upon since March. There is probably no other house in the world except the Bank of England which could close up those accounts except through chancery, which I believe is one station beyond eternity.

The New York Central Railroad is doing wonderfully well for a steam concern on its last legs as such. Its annual report, ending June 30, '92, shows gross earnings of $45,478,625, an increase of $7,576,510; net earnings $14,399,511, an increase over last year of $1,808,245, and surplus of $62,216. The gross earnings are the largest in the history of the road. The general balance sheet shows cash on hand, $1,092,384; cash in transit, $276,224; profit and loss excess of assets over liabilities, $13,359,348, and the funded debt shows a net increase of $2,700,000. In a few short years, when this road is fully equipped and operated by electricity, the income will be nearly doubled, while the expense will be reduced more than fifty per cent., and the noble stock and bondholders will be able to ride over their property in company with the public surrounded by luxuries to-day unknown. No more flaxseed to clean out cinders, or throat specialists to recuperate overworked speech organs on account of noise. The Central will not be lower than No. 6 in the roads adopting electricity; and it is just as well to hang on to your holdings until that happy day.

CARBON BRUSHES.

The Partridge Carbon Co., of Sandusky, Ohio, is one of the foremost concerns of its class in the country. Its motor, dynamo and generator brushes are found in very extensive use, which is a testimonial of their worth that speaks more than words.

They are made with the greatest of care and of the best materials, and from all reports it is evident that they are second to none in all of the desired features in a carbon brush.

The company makes brushes for all of the standard dynamos—Edison, Thomson-Houston, Short and Westinghouse motors—and for railway generators in general. It makes brushes of any special sizes for motors and generators, and gives prompt attention to such orders, as well as to all others.

The facilities of the company are utilized to their fullest capacity to keep up with the orders. The works are favorably situated, and the company seems to be on the high road to prosperity.

The company has just received a report of a test to which all the brushes on the market were submitted. The report states that its carbon brushes were found to be superior in all respects. An exhibition of these brushes will be made at the Cleveland Convention in October.

SAFETY APPLIANCE FOR ELEVATORS.

Within the past two years thirty-seven persons have been killed or frightfully injured in this city alone through doors leading into elevator shafts having been carelessly left open or failure of the latch to catch. Such accidents as these can entirely be avoided by the use of the safety appliances manufactured by the Elevator Safety Company, 172 Broadway.

There should be a law passed compelling all buildings using elevators to be equipped with every known device for the protection of the lives of passengers, and none can be found better suited for the purpose than that employed by the above-named company.

LARGE CONTRACT.

The Giant Electric Motor Company, of Portland, Me., has contracted to supply the Tourist Light and Power Company, of New Hampshire, with an electric plant of 6,000 lights capacity, with provision for an increase to 10,000 lights if desired. This contract will involve an expenditure of about $50,000. The Giant company is now the principal electrical concern in eastern Maine.

NEW WIRE MILL.

The United States Cold Rolled Wire Company has been organized at Hammond, Ind., with a capital of $500,000 for the purpose of manufacturing cold-rolled copper wire. The plant will be located in Hammond, and work on the erection of buildings commenced at once. Its cost, together with that of necessary machinery, will be about $1,500,000.

STEADINESS IN POWER.

CLAY CENTRE, KANS., July 22, 1892.

JAMES LEFFEL & CO.,
SPRINGFIELD, OHIO.

Gentlemen: I am using three of your turbines in my business, for running elevators, mills and my electric-light plant. I can run my electric-light plant with either of my wheels, but can use two or three on the plant at the same time. I get the best results with two or three wheels together, as the power is steadier with two or three wheels than with one. I use no regulator to control the power of the wheels, only by the hand wheels, which only have to be changed occasionally as the demand of power increases or falls off. My plant is equal to 100 arc lamps of 2,000 candle power each. Am using about 500 incandescent lamps also. Can run the mill and plant together or separate, as I choose.

Many have visited my plant, and pronounce it equal to the best steam plant for steadiness of power and light.

My wheels have power of 250 to 325 H. P. as per head of water. Yours truly,

(Signed) A. F. DEXTER.

QUEEN & COMPANY.

Queen & Co., of Philadelphia, report steadily increasing sales of their "Magnetic Vane" ammeters and voltmeters, which instruments meet with much favor for switchboard use. They have now been on the market long enough to show real "staying" qualities, and combine a handsome appearance with accuracy and moderate prices. An entire absence of permanent magnets and other changeable parts renders them constant in indication, so that recalibration is unnecessary, unless required mechanically. Four manufacturing concerns have adopted these instruments and install them with both light and power plants, while numerous others use them to a considerable extent.

The Queen factory is taxed to its utmost capacity, and every effort is being made to keep up with the demand. Descriptive circular No. 330 will be mailed by them upon request.

TRADE NOTES.

The Electrical Engineering and Supply Company, of Syracuse, has secured an order for 12,000 cut-outs to be used in connection with the electrical equipment at the World's Fair.

The Mather Electric Company is about completing the addition to its factory, Manchester, Conn. It has just completed the installation of a 50-light plant for the Photochrome Engraving Co., 162 Leonard street, New York, also closed a contract with the Vulcanite Mfg. Co., Lindenhurst, L. I., for a 150-light plant, and with Messrs. Weil, Haskell & Co., 485 Broadway, for a 450-light plant, to be installed in their new factory now being erected at Glens Falls, N. Y.

H. M. Sciple & Co., of Philadelphia, are installing two tandem-compound automatic "Belmont" engines in the power station of the Brightwood Electric Street Railway Co., Washington, D. C. The engines are coupled with Hill clutches, so that it is possible to run them singly or together. The complete plant, including boilers, etc., will be installed by this firm. The railroad people themselves are very pleased with the designs of the plant, and say that it will be one of the finest in the United States when completed.

Up to date there are 132 Ide and Ideal engines manufactured by A. L. Ide & Son, of Springfield, Illinois, being used in Chicago, having an aggregate of 11,899 horse-power. Recent orders filled were: Chicago City Railway Company, one 125 H. P. engine; "The Potomac," one 100 H. P. engine; Sperry Mining Machine Company, one 110 H. P. engine; Jacob Brown & Company, one 45 H. P. engine; Standard Hotel Company, one 80 H. P. engine; Northwestern Electric Light and Power Company, one 80 H. P. engine; Wellington Hotel, two 145 H. P. engines, and Cook County Hospital, two 250 H. P. engines.

The E. W. Bliss Co., Limited, of 17 Adams street, Brooklyn, has found it necessary to open an office and store at No. 14 Canal street, Chicago, in order to accommodate the steadily increasing volume of its business in the West. Mr. C. W. Ellsworth, late superintendent of the Chicago Stamping Company, will be in charge of the office, and he will keep on hand a representative line of the celebrated presses, drop hammers, shears and sheet-metal machinery. The size of the store is 25 by 140, and it is located in the very centre of the "machinery district" of Chicago. This store is the only one in the country devoted entirely to the sale of presses, dies and sheet-metal machinery, and as the company has for years past made nearly all of the machinery sold in that line, it expects to make its Chicago store western headquarters for anything that pertains to punching, shearing, drawing, stamping, perforating and embossing by means of machinery.

The following is a list of contracts closed by J. G. White & Co., electrical engineers and contractors, 29 Broadway, N. Y., during the present season, for the construction and equipment of electric street-railway systems: Wilmington Street Railway, Wilmington, N. C., 3 miles overhead construction; Yonkers Railroad, Yonkers, N. Y., 4½ miles overhead construction; Steinway Railway, Astoria, L. I., 5 miles overhead construction; Pawtucket

Street Railway, Pawtucket, R. I., 2½ miles overhead construction; New Orleans and Carrollton Railroad, New Orleans, La., 16 miles iron pole, overhead construction, same amount track construction; Baltimore Traction Co., Baltimore, Md. (recently completed), 7½ miles overhead construction, Carey street extension, 4 miles overhead construction; Central Railway Co., Baltimore, Md., 11 miles overhead construction; City and Suburban Railway Co., Baltimore, Md., 7 miles overhead construction; Lake Roland Elevated Railway Co.. Baltimore, Md., 20 miles overhead construction, 12 miles track laying; Newport Illuminating Co., Newport, R. I., erecting 20 miles incandescent and railway feeder, 15 miles arc and pressure wires; Binghamton Street Railway, Binghamton, N. Y., 12 miles new overhead construction, 8 miles old overhead construction; Tonawanda Street Railway, Tonawanda, N. Y., refitting 4 miles overhead construction; Highlandtown, Towsontown and Point Breeze branches of City and Suburban Railway, Baltimore, Md., 2½ miles double-track iron pole cross suspension, 12 miles double track octagonal wood pole, bracket and cross suspension, about 13 miles track construction; and Interstate Consolidated Rapid Transit Co., Kansas City, Mo., 13 miles overhead construction.

THE Easton Electric Company, of 643 Kent avenue, Brooklyn, will install an incandescent electric-light plant in the Prospect Hill station of the Brooklyn waterworks. One of the new 150-light P. & C. dynamos being brought out by this company will be used. The whole machine has less than two hundred pounds of wire on it. Its remarkable feature is the small armature, which is but 10 inches in diameter. The armature develops the low peripheral speed of 11.4 feet per second and is laminated. No. 7 wire is used in the armature coils. The dynamo occupies a floor space of 40 x 28 inches, and is 28 inches high. The massive commutator is of tempered copper; automatic carbon brushes are used, and the bearings are self oiling. The machine is compound wound, and at full load it takes 75 ampères at 120 volts. The company has a 7 H. P. motor temporarily running an elevator which takes on an average 10 H. P., and it is doing the work without any perceptible injurious effect. This motor is constructed on the same principle as the new P. & C. dynamos, and a new one, 12 H. P., is now being constructed to run the elevator. The company is also constructing a 120 H. P. generator for Piedmont, Va.

CENTRAL RAILROAD OF NEW JERSEY,
Elizabethport, N. J.

MESSRS. FORREST SILVER BRONZE PACKING CO., NEW YORK CITY.

Gentlemen: In reply to your inquiry relative to packing, known as "Silver Bronze Packing," will respectfully say: The steamer "Monmouth" has been using it for the past two seasons with entire satisfaction. I examined it a few days ago and found it in good order and condition. We are also using this packing on our electric-light plant engines, at Jersey City. These engines make 370 turns per minute and without the slightest leakage of steam or water.

I am having under consideration the adoption of it for our other steamers, putting it on this winter.

Yours very truly,
(Signed) W. L. HOFFECKER,
Supt. Motive Power.

The Electrical Age's Illustrated Patent Record.

Issued September 20, 1892.

482,719. Conduit for electric railways. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 4, 1890.

482,724. Electrolytic apparatus. Thomas Craney, Bay City, Mich. Filed Jan. 2, 1892.

482,727. Suspension-bracket for electric lamps. Thomas Dillon, Indianapolis, Ind., assignor of one-half to John Caven, same place. Filed July 9, 1892.

482,753. Insulated electric wire. Thomas L. Reed, Providence, R. I. Filed May 31, 1890.



482,825.—ARMATURE-WINDING FOR DYNAMO-ELECTRIC MACHINES.

482,778. Electric signalling device for firemen. Geo. L. Barnard, Milwaukee, Wis. Filed July 24, 1891.

482,780. Signal-telegraph. Claudius V. Boughton, Buffalo, N. Y. Filed July 22, 1891.

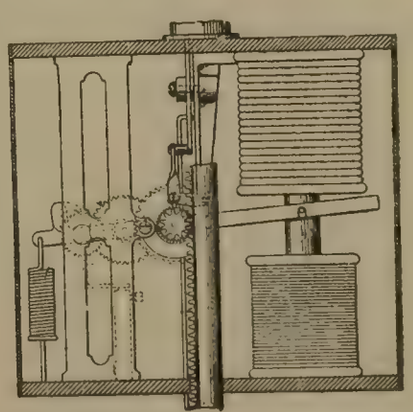
482,820. Carbon-holder. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 21, 1892.

482,825. Armature-winding for dynamo-electric machines. Rudolf Eickemeyer, Yonkers, N. Y. Filed Sept. 3, 1890.

482,863. Electric locomotive. Conrad M. Conradson, Madison, Wis. Filed Dec. 2, 1891.

482,872. Insulator. Charles T. Lee, Boston, Mass., assignor to the Johns-Pratt Company, Hartford, Conn. Filed Nov. 14, 1891.

482,913. Insulator. Herbert H. Brooks, Cambridge, assignor of one-half to Augustus T. Clark, Boston, Mass. Filed Oct. 26, 1891.



482,986.—ELECLRIC-ARC LAMP.

482,936. Electric switch and case. Augustus Wright, Providence, R. I., assignor to the Hope Electric Appliance Company, same place. Filed May 31, 1892.

482,939. Securing device for cables. William F. Bossert, Utica, and John H. Findlay, Ogdensburg, assignors to the Utica Electrical Manufacturing and Supply Company, Utica, N. Y. Filed Oct. 24, 1891.

482,940. Frame for electric-arc lamps. William F. Bossert, Utica, and John H. Findlay, Ogdensburg, assign-

PATENTS.—Continued.

ors to the Utica Electrical Manufacturing and Supply Company, Utica, N. Y. Filed Oct. 24, 1891.

482,964. Electric-railway conduit. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed Sept. 23, 1886. Divided and this application filed June 16, 1888.

482,974. Alternating-current motor. Otto T. Blathy, Buda-Pesth, Austria-Hungary. Filed Dec. 7, 1891.

482,979. Storage-battery. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

482,986. Electric-arc lamp. James A. Stuart, Philadelphia, Pa., assignor to himself and John Buchanan, same place, and Thomas Marrin, Brooklyn, N. Y. Filed July 20, 1891,

482,993. Closed conduit for electric railways. Levi P. Bunce, Minneapolis, Minn., assignor of one-eighth to William Heggum, same place. Filed Sept. 10, 1891.

483,044. Attachment for electric lamps. Joseph Clift, Dorking, England. Filed March 2, 1892.

483,061. Trolley stands for electric railways. John C. Hough, Pittsburg, Pa. Filed Dec. 21, 1891.

483,074. Joint for electric conductors. Joseph W. Marsh, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed Dec. 21, 1891.

483,108. Electric stop-valve. Adolf Franke, Berlin, Germany, assignor to the Urania-Uhren-und-Saulen-Commandit-Ges. Breslauer and Dr. Von Orth, same place. Filed May 6, 1892.

483,123. Circuit-switch. George W. Russell, Jr., and Daniel B. Minor, Denver, Col., assignors to said Russell, Jr., and Alexander V. Officer, same place. Filed June 1, 1892.

H. WARD LEONARD & CO.,

136 Liberty Street, New York City.

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ELECTRICAL AGE

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COOKING BY ELECTRICITY.

A unique exhibit may be seen at the fair now being held at Ottawa, Canada. It is a baking oven heated by electricity, and the buns baked therein are as edible as buns baked in the ordinary oven, as we have had recent occasion to prove. While it is all very interesting, is it economical? If electric cooking can be accomplished economically, then every housekeeper will prefer it. Electric cooking presents some very interesting features in the culinary art.

TRIPLE-EXPANSION ENGINES.

The necessity for a perfectly steady and economical primary power for the driving of electric-light current-generators has resulted in the highest degree of perfection in steam-engines. There are many admirable engines on the market that are in every way adapted to fill all the exacting requirements of electric-light work; they are at once efficient and economical, and leave little to be desired. We publish on another page a description and illustration of a vertical triple-expansion engine which is especially designed to meet all the necessary qualities of a perfect engine for electric-light and street-railway work. It is constructed as simply as possible compatible with efficiency and economy. Mr. G. S. Strong, the designer, is a well-known mechanical engineer, and he fully appreciated the task he had before him when he undertook to produce an engine that would answer every requirement of electric work. How well he has succeeded, engineers will be able to judge from our article.

ART IN LAMP MAKING.

The ordinary arc lamp is a useful thing, but it is not a thing of beauty, and no attempt was ever made to make it so until the incandescent circuit arc lamp made its appearance. As the incandescent lamp has hitherto been used almost exclusively in interior work, all the artistic efforts have naturally been concentrated upon it, but it now has a formidable rival—not only in its artistic aspect but in practical utility—in the arc lamp for incandescent circuits. Such lamps are valuable for lighting large spaces, such as churches, halls, theatre entrances, etc. Some beautiful designs of arc lamps for incandescent circuits are given in this issue on another page, which will at once strike the reader as being a harmonious combination of art and science, or the beautiful with the practical.

The manufacturer of these lamps is accomplishing an educational work in their production, for no one can look upon them without a feeling of appreciation of their beauty. They are not made solely for educational purposes, however; that feature is, in fact, an incident; we simply refer to the poetic side of the lamp as a matter of interest.

INFORMATION ABOUT THE CLEVELAND CONVENTION.

We publish on another page the full programme of the convention of the American Street Railway Association which will be held on the 19th, 20th and 21st insts. in Cleveland, Ohio. Several papers of practical value to street-railway men are to be read, and in every way the meeting promises to be an interesting and profitable one. The exhibition of manufactures and supplies promises also to be a feature of the convention, and ample space has been secured for the proper display of the exhibits.

There is only one thing in connection with the convention that many of those interested wish were different—that is the close proximity of the dates of this meeting and the World's Fair exercises in Chicago. We fear that the latter ceremonies and attending festivities will exert a strong influence on some of the members and draw them to Chicago. We hope this will not happen, however, at least not to any appreciable extent.

Cleveland is a beautiful city, and its choice as the place of meeting was a wise one. The streets and avenues are broad and clean, and are equipped extensively with the most modern method of street transportation. Electric cars run in every direction, and all the conditions for their successful operation are present in Cleveland in an eminent degree.

ARTISTIC "WARD" ARC LAMPS.

It can be truly said that the electric light is one of the most positive educational influences of recent times. The education has been an æsthetic one, and people, who formerly gave little attention to artistic effects in the lighting of homes, stores and warehouses, since the introduction of electric light have come to look upon beautiful fixtures as necessary accompaniments of the same. The result of this sentiment is that the electrical lamp manufacturers have been required to produce lamps of the most elegant design and workmanship to meet the constantly growing demand for more attractive goods.

Some of the electric lamps of to-day are truly works of the highest art, and this state of things is due to the fact that the character of the electric light is such as to render possible the utmost development in artistic effects. One improvement has led on to another, and at the present time electric lamps are made that meet the most fastidious tastes.

We present to our readers herewith some illustrations of artistic "Ward" arc lamps manufactured by the Electric Construction and Supply Co., of 18 Cortlandt street, New York, which may be justly regarded as representing the highest development of the art of æsthetic electric lighting.



FIG. 1.—PLAIN SHORT LAMP.

The "Ward" arc lamp has a wide reputation as being the most practical and serviceable arc lamp for incandescent circuits that can be found on the market. It is designed to light large spaces where it would be impracticable to use incandescent lamps, and where the running of arc circuits would be undesirable and objectionable.

Wherever incandescent circuits are run, "Ward" arc lamps can be used with most satisfactory results. We find them largely used in lighting large halls, corridors, entrances, windows and open squares, and for such special uses as lighting steamship holds, pit mouths, refineries, furnaces, factories, etc. In any place they are under the safe control of the customer or attendant, and there is no danger whatever in handling them.

In some situations, such as basements with low ceilings, an arc lamp of the usual size would be in the way. The Electric Construction and Supply Company, to overcome this objection, has constructed a short "Ward" arc lamp.

Fig. 1 shows the plain short lamp. It will burn 6½ hours, using a ⅝ inch carbon for the top and a $\frac{7}{16}$ inch solid carbon for the bottom. These lengths will burn out evenly as to time. In every essential point this lamp is the same as the standard "Ward" arc lamp, save that of length and the use of carbons of greater diameter to secure greater length of run.

As low ceilings are becoming fashionable in dwellings, many of which are installed with the electric incandescent light, the company has, with characteristic foresight, adapted the short lamps to domestic lighting by encasing them in ornamental fixtures of most artistic design, as shown in Figures 2 and 3. These lamp fixtures are made almost entirely from brass castings, and their appearance is extremly rich and imposing. The resistance required for each lamp may be placed in the canopy of the lamp (shown in the various engravings), or, in case the lamp is not furnished with canopy, the resistance can be placed in any other convenient location in the circuit.

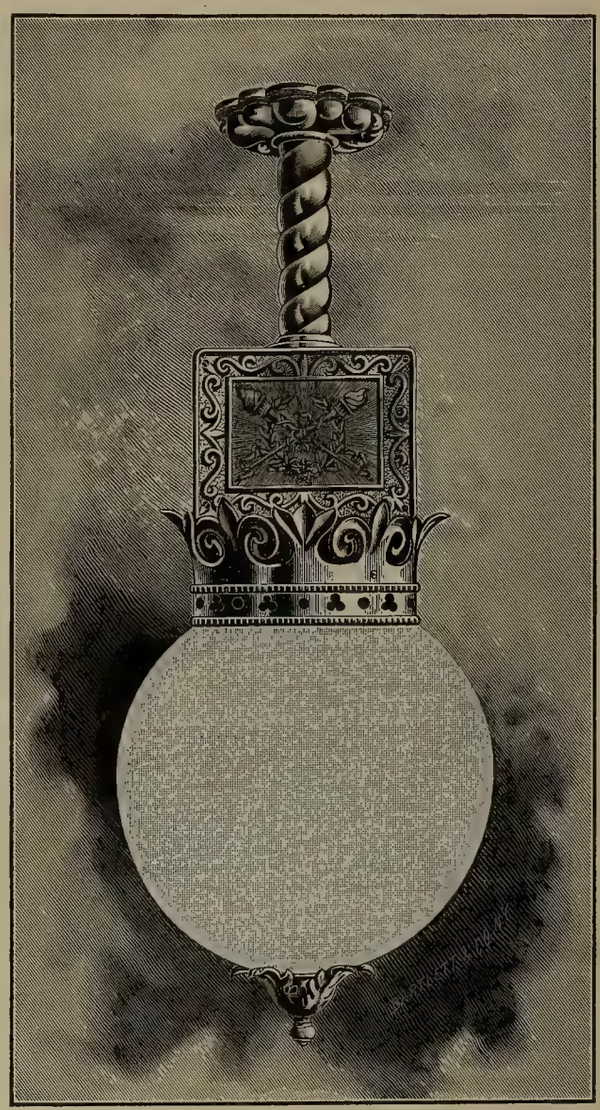


FIG. 2.—SHORT LAMP WITH ORNAMENTAL FIXTURES.

The top of the lamp shown in Figure 2 is made of brass and is supplied with covers in which tiles are placed surrounded by the brass; these tiles, of any color or design, give a very attractive appearance to the lamp.

The leading feature of the lamp shown in Figure 3 is the globe, which is short and broad, and of very pleasing

design. It is hinged at one side so that it can be easily cleaned and the lamp trimmed without trouble or interference with the service. The size of the lamp is 16½ inches in diameter.

Full-sized "Ward" arc lamps are also made with artistic and decorative fittings. Figures 4 and 5 are illustrations of lamps of this class. The "Chain" lamp, shown in Figure 5, is made to suit any height of ceiling, and that shown in Figure 4, and called the "Coronal" lamp can be built up and fitted with pieces to any desired length.

The Electric Construction and Supply Co. carries these ornamental lamps in stock in polished brass only, but to suit purchasers special designs will be made and



FIG. 3.—SHORT LAMP OF ANOTHER DESIGN.

the parts can be finished in black, antique, or any other style of brass or bronze.

These ornamental lamps are particularly suitable for use in such places as private dwellings, halls, churches, hotels, railway depots and approaches to theatres, where artistic effects are usually considered.

When we consider the fact that for incandescent lighting the wires may be entirely concealed from view, the beauty of such lamps as these described need not be marred in the least by the appearance of unsightly wires.

THE FUTURE OF ELECTRICAL TRANSMISSION OF POWER.

We believe that the rôle electrical transmission will play in the future is less pretentious than some people now picture it (says *Industries*), but that it is capable of infinitely greater development than any of the schemes we have discussed. It will displace leather belting in workshops. This may not sound much, but the amount

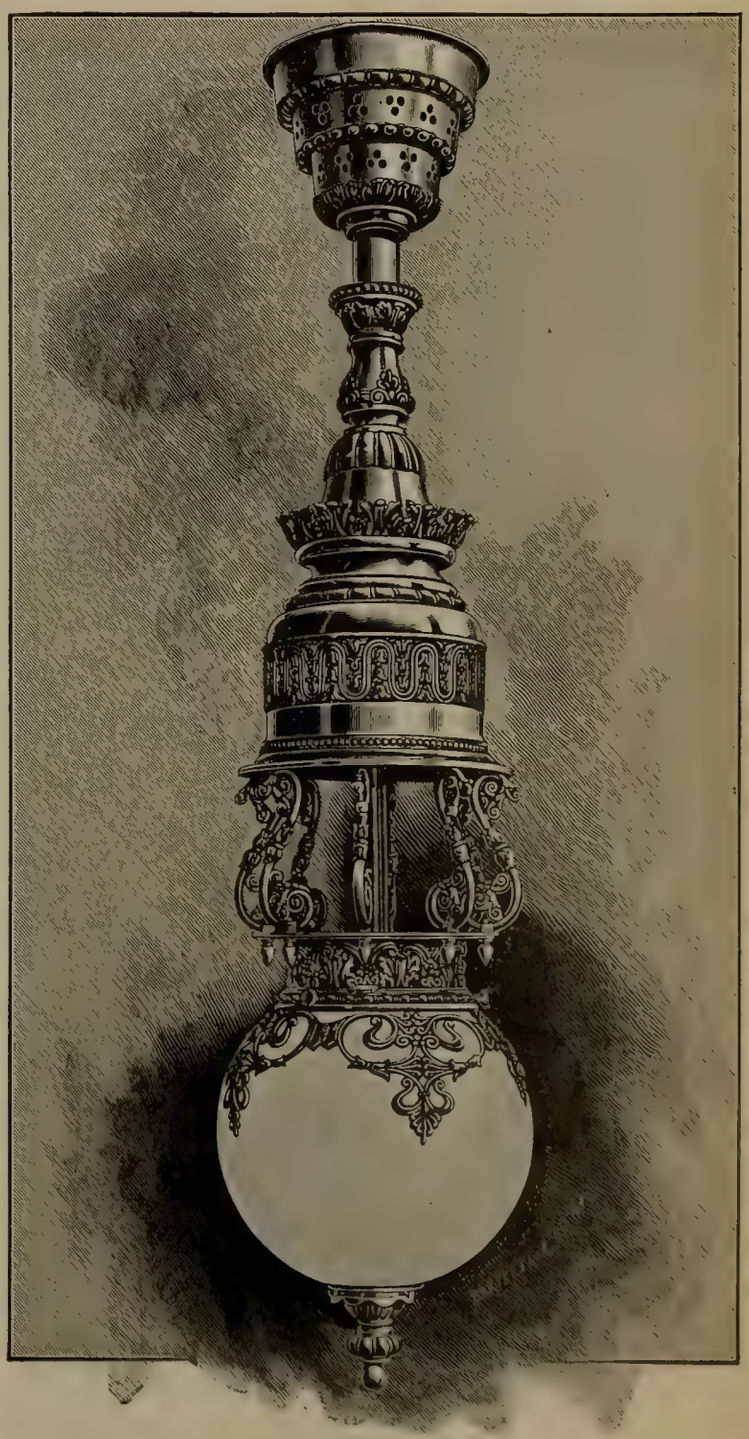


FIG. 4.—"CORONAL" WARD ARC LAMP.

of power transmitted through small belts would, if added up, come to a figure that would astonish even those who revel in the numerous ciphers needed in discussing Niagara problems. Electrical engineers, or rather electricians, have been reproached with being unable to design their machines to fit the work to be done, and with expecting the work to be arranged to fit the motor. This, we think, is deserved. High-speed motors are

still used with belts or gearing, the motors not being specially designed and made practically integral with the machines they work. In the future, however, we may expect machine tool makers to replace the coned pulley with electric motors. Workshops will no longer be forests of belts. The hum and roar of the countershafting will be gone. Machines will be arranged in shops to suit the convenience of the work, and not to fit the countershafting. And each shop will be fitted with suitable overhead cranes with a clear path over the whole

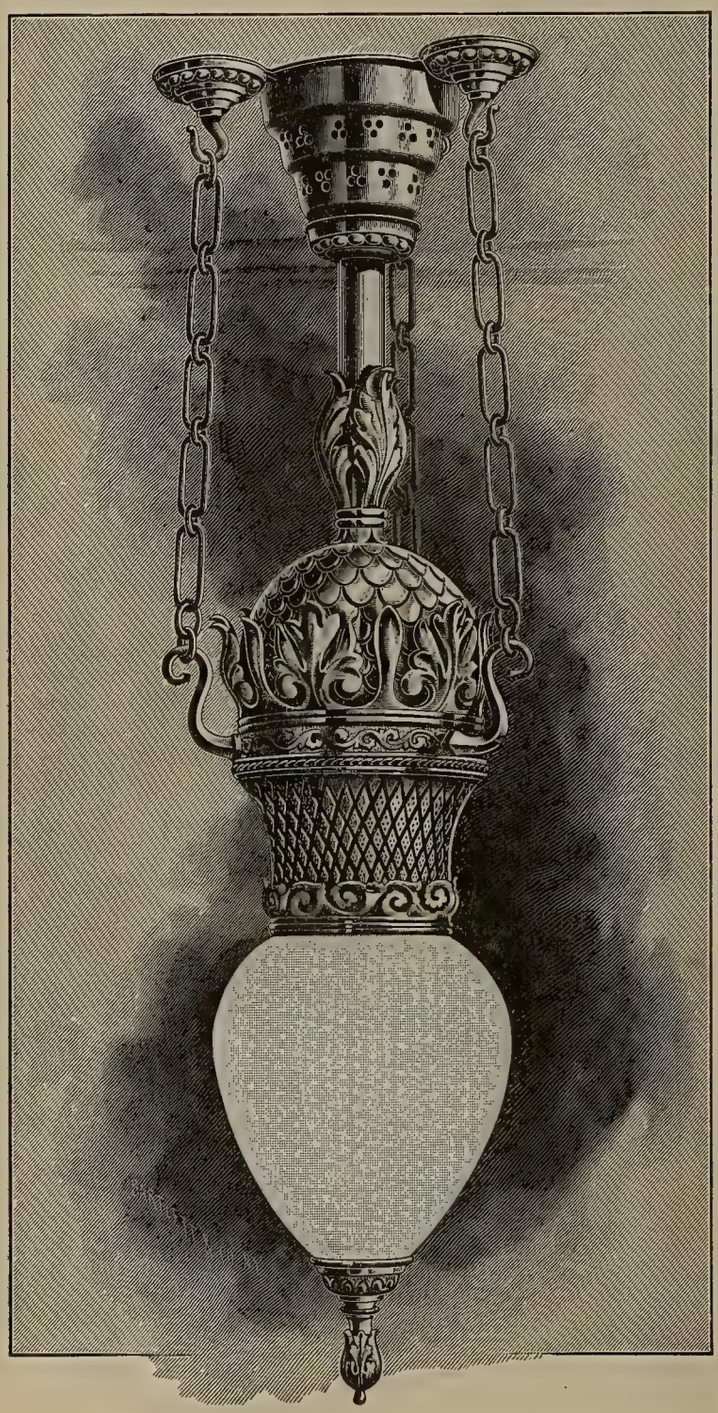


FIG. 5.—THE "CHAIN" WARD ARC LAMP.

shop. The main engine will be much smaller, as the efficiency of an ordinary system of shafting taken over the whole day is very low. Most likely the motors will be for multiple currents, so that they will be cheap to make and will have no commutators. The generators will then produce multiple currents of several frequencies, and the turner will be able to switch his lathe to run at any of some four speeds, just as with the cone pulley and countershaft. Though the works is not the least likely to take its power from central stations it will run all its machinery from one place instead of having engines and boilers dotted about to save shafting as is usual at present. In addition to driving ordinary lathes and planing machines and so on, portable punching, drilling, boring and milling machines will be used all over the works. A portable milling machine may sound strange, but in the future, when the flange of the column of a marine engine projects an inch or more beyond the cylinder a fitter with a hammer and a chisel will not be set to chip it away. A portable milling machine will be attached, and will finish the flanges off in a workmanlike manner in a few minutes.

It may be said that we have taken a gloomy view of the future of electrical power transmission. This is not really the case, as we certainly believe that electric power transmission has a very bright future, but it is most important that a clear understanding should be arrived at as to the directions in which development may be expected. In a new business there is always a chance of making great efforts to extend in the wrong direction and ignoring the most profitable developments.

ELECTRIC PLANT ON THE U. S. S. "PHILADELPHIA."

Capt. Frederick Rodgers, U.S.N., has just issued a neatly gotten-up handbook of the U. S. S. "Philadelphia." It describes the ship in every detail, and the electric plant receives a good share of attention. There are 3 Edison compound multipolar dynamos designed to run at 400 revolutions, and generate 200 ampères at 80 volts. There are 8 poles, four outside being north poles and four inside being south poles. The armature core is laminated, the sheet-iron discs being insulated from one another by specially prepared paper.

The dynamo engines are of the direct-acting Armington & Sims, 7″ x 5″ stroke horizontal. Each engine is fitted with Armington & Sims governor, adjusted to maintain a speed of 400 revolutions. The engines are of the two-cylinder type and with the dynamos are bolted on light steel foundations, a light white-pine floor, covered with sheet lead, lying between the bed plate and the steel foundation. Each dynamo steam-pipe is fitted with Foster reducing valves.

At full load the dynamos generate 16,000 watts. The ship is lighted by 486 lamps with a total candle-power of 6,498. The lamps used are of 10, 16, 32 and 50 C. P. Three 50 C. P. lamps are used on the starboard spar deck, and two on the port spar deck.

ALUMINUM FOR DOMESTIC USE.

M. Balland has communicated to the Academy of Sciences, Paris, the results of his investigations as to the corrodibility of aluminum, with special reference to its use for domestic cooking utensils, etc. He concludes that this metal is not so easily attacked as iron, copper, lead, zinc or tin by air, water, wine, beer, coffee, milk, oil, butter, gas, urine or saliva. Vinegar and salt attack it, but not to such an extent as to render its use undesirable. German chemists condemned the use of aluminum for such purposes, but their declarations evidently do not receive any support from their French contemporaries.

The number of electric incandescent lamps used in the decorations and parades of the Knights Templar in Denver, last August, aggregated 12,800. Where is the tallow dip?

ELECTRIC CIGAR-CUTTERS.

The adaptation of electricity as a contributing agent to the creature comforts of man, is well illustrated in the accompanying illustrations of two types of an electric cigar-cutter invented by Mr. H. E. Hawksworth of the S. S. White Dental Manufacturing Company, Philadelphia, Pa. It will fill the hearts of smokers with delight to know that these cutters perform their work in a perfect manner, the knife being so set that its edge meets the body of the cigar at an oblique angle, instead of striking it squarely. It thus avoids all risk of crushing the tobacco, as the blade shears through, after the manner of a paper cutter, slicing the end off smoothly and squarely, and leaving a clean-cut surface.

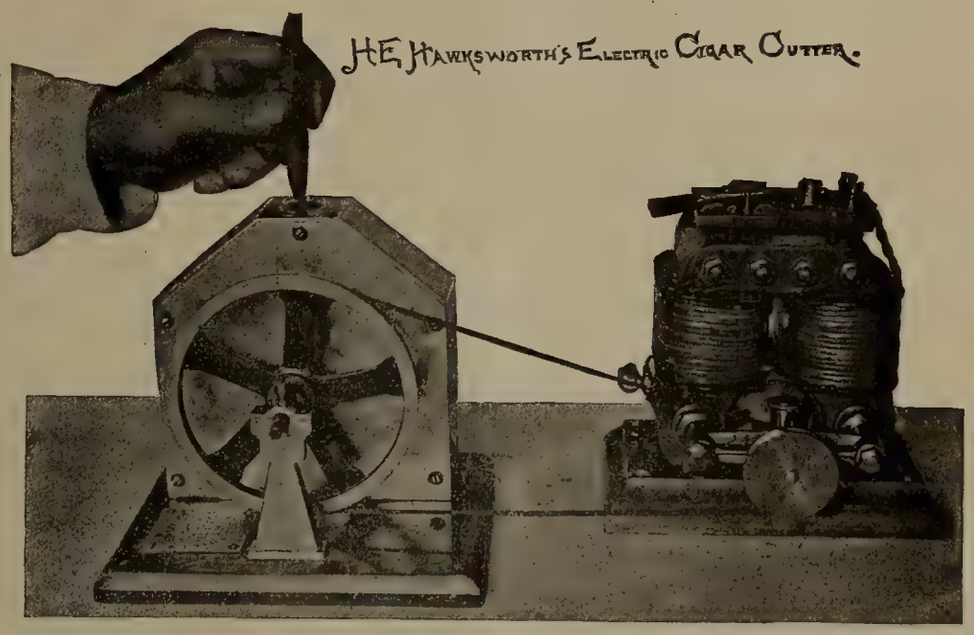


FIG. 1.—SINGLE CUTTER.

These cigar-cutters are of the rotary type. The knife is of steel, glass-hardened, mounted on a balance-wheel. The shaft is also of steel, glass-hardened, with phosphor-bronze bearings. The height of the case is 7 inches; length 6 inches; breadth 2¼ inches; space occupied about 7½ x 6¾ inches. The case may be made of vulcanite or of brass, silver or nickel-plated. In vulcanite case, the entire weight is 8½ pounds. It can be made lighter, but the heavier weight helps to overcome the jar and the buzzing noise. For this reason, as well as for its greater substantiality, the metal case (Fig. 1) is preferable. The machine can be run by any ⅛ H. P. motor (the inventor prefers the Perret) with the Edison incandescent light current of 110 volts, reduced by passing it through a slate resistance box, which may be placed in the cellar or wherever is most convenient. A switch should be located between the resistance and the motor.

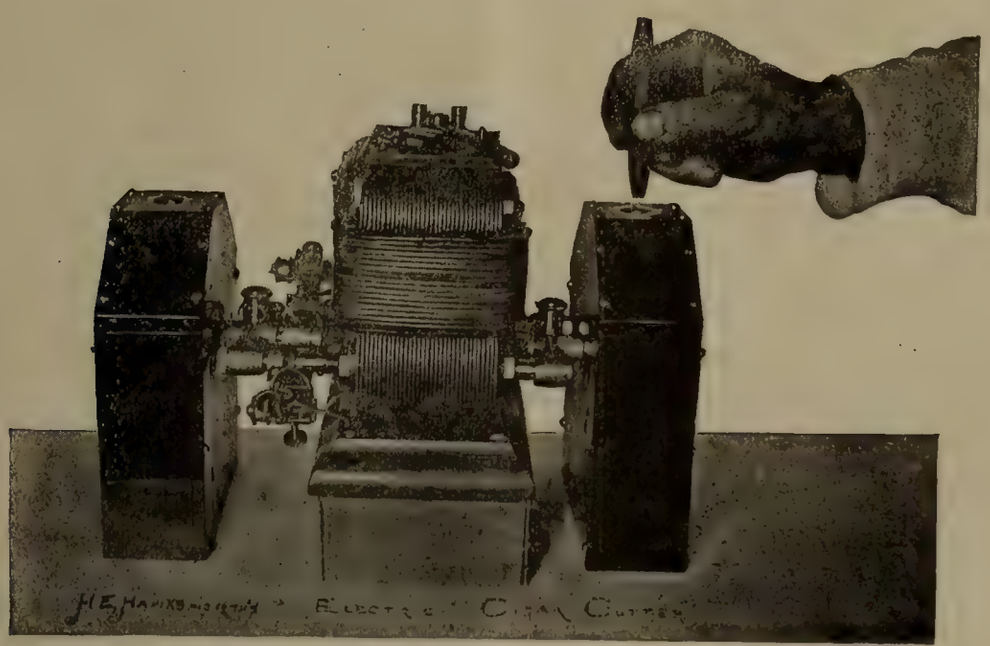


FIG. 2.—DOUBLE CUTTER.

Fig. 1 is a single cutter. The case is made of brass, silver-plated. A cutter of this description with (Perret motor) was placed in one of the most prominent cigar stores in the country some two years ago. It has been in daily operation from 8 A.M. to 11 P.M., and has cut many thousands of cigars—hundreds each day—and its

blades have not yet been renewed or even sharpened, but continue to give perfect satisfaction to the proprietors and their patrons.

Fig. 2 is a double machine, giving a choice of large or small cut to suit the smoker. The cases are of hard rubber or vulcanite.

THE STRONG VERTICAL TRIPLE-EXPANSION ENGINE.

In the installation of an electric light or power plant the one absorbing question is to have the engines occupy as small a space as possible without impairing the speed or efficiency.

After devoting much time and study to this question, Mr. G. S. Strong, M.E., designed the engine described and illustrated herewith. This engine is of the triple-expansion type, constructed in the simplest and most compact form compatible with efficiency and economy. It may be used as a condensing or non-condensing engine as desired, as the condenser and air-pump are entirely separate. As in many cases it is not always practicable to use a condenser, this engine has been specially designed to produce the same economy with very high steam-pressure.

A marked feature of the engine is that it is self-contained and balanced. The two cranks being set 180 degrees apart, the reciprocating parts simultaneously move in opposite directions, and in this way balance each other.

The result of this is, that in connection with a counter weight on each crank, by which each side is independently balanced, less foundation space is required, and at the same time the engine runs with a greater freedom from noise. Should it be desired to have it run noiselessly, a layer of cork can be placed beneath the foundation of the engine, and by the use of packing, vibration will be prevented from affecting the walls.

As from 180 to 200 pounds pressure of steam is to be used in the engine, the high pressure and intermediate cylinders are controlled by piston-valves, and the low-pressure cylinders by gridiron slide-valves. This secures frictionless valves for the high and intermediate cylinders where the pressure is high.

To the matter of clearance in these cylinders but little consideration has been given, although in the low-pressure ones, however, provision has been made for a small clearance, which is considered very necessary for economy, and gridiron valves are used for the purpose.

In operation, the steam enters the high-pressure cylinder through a central piston-valve placed between two exhaust piston-valves and in the same valve-chamber. This valve acts independently of the others and regulates the point of cut-off at both ends of the cylinder. Two piston-valves are employed to exhaust the steam from the high-pressure cylinder, and they also control the exhaust from the intermediate cylinder by allowing it to escape through a passage leading to the low-pressure cylinders. The gridiron valves govern the entrance to and exit from the low-pressure cylinders.

All of the valves, with the exception of the central valve, have a fixed travel and point of cut-off and are moved by the one pin in the end of the Fink link. The high-pressure piston-valve is actuated by a block sliding

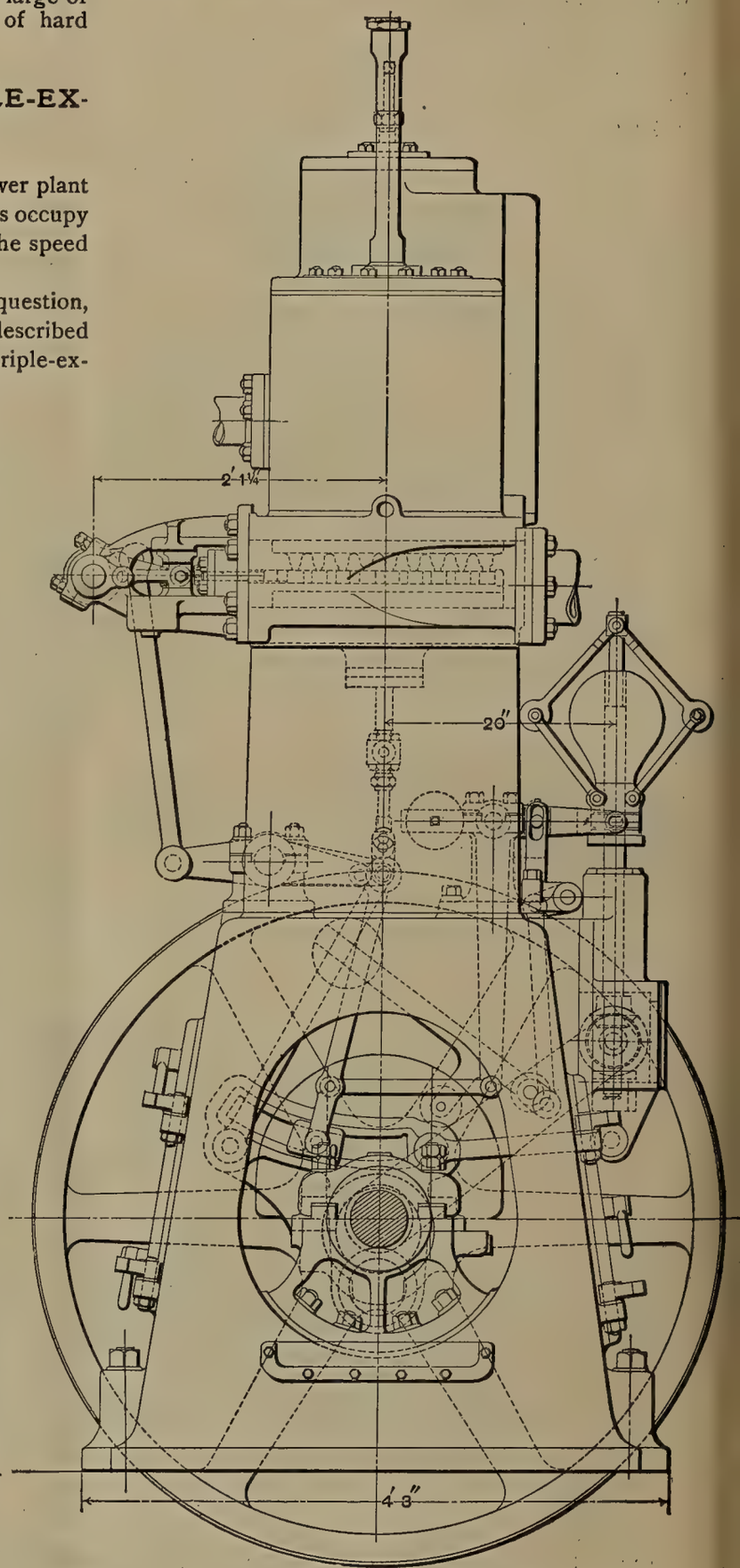


FIG. 2.—SECTIONAL SIDE VIEW OF STRONG ENGINE.

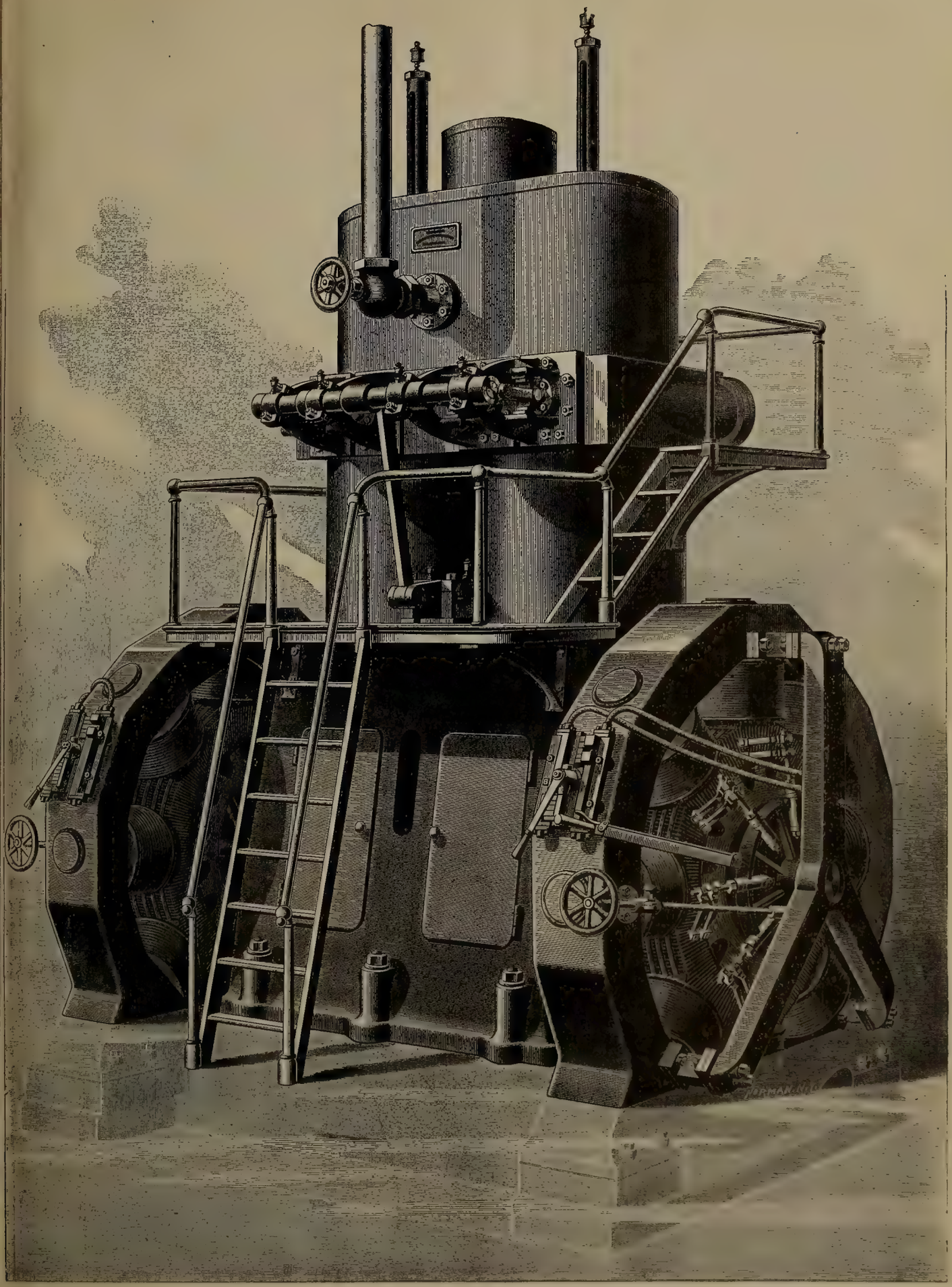


FIG. I.—PERSPECTIVE VIEW OF STRONG VERTICAL TRIPLE-EXPANSION ENGINE.

in a Fink link, so designed as to give perfectly equal lap and lead, and equal cut-off at the end of the cylinder.

This block and cut-off is controlled by a sensitive device is provided, consisting of a weighted arm which rises and throws the link-block to an extreme position, shutting off the steam and causing the engine to stop.

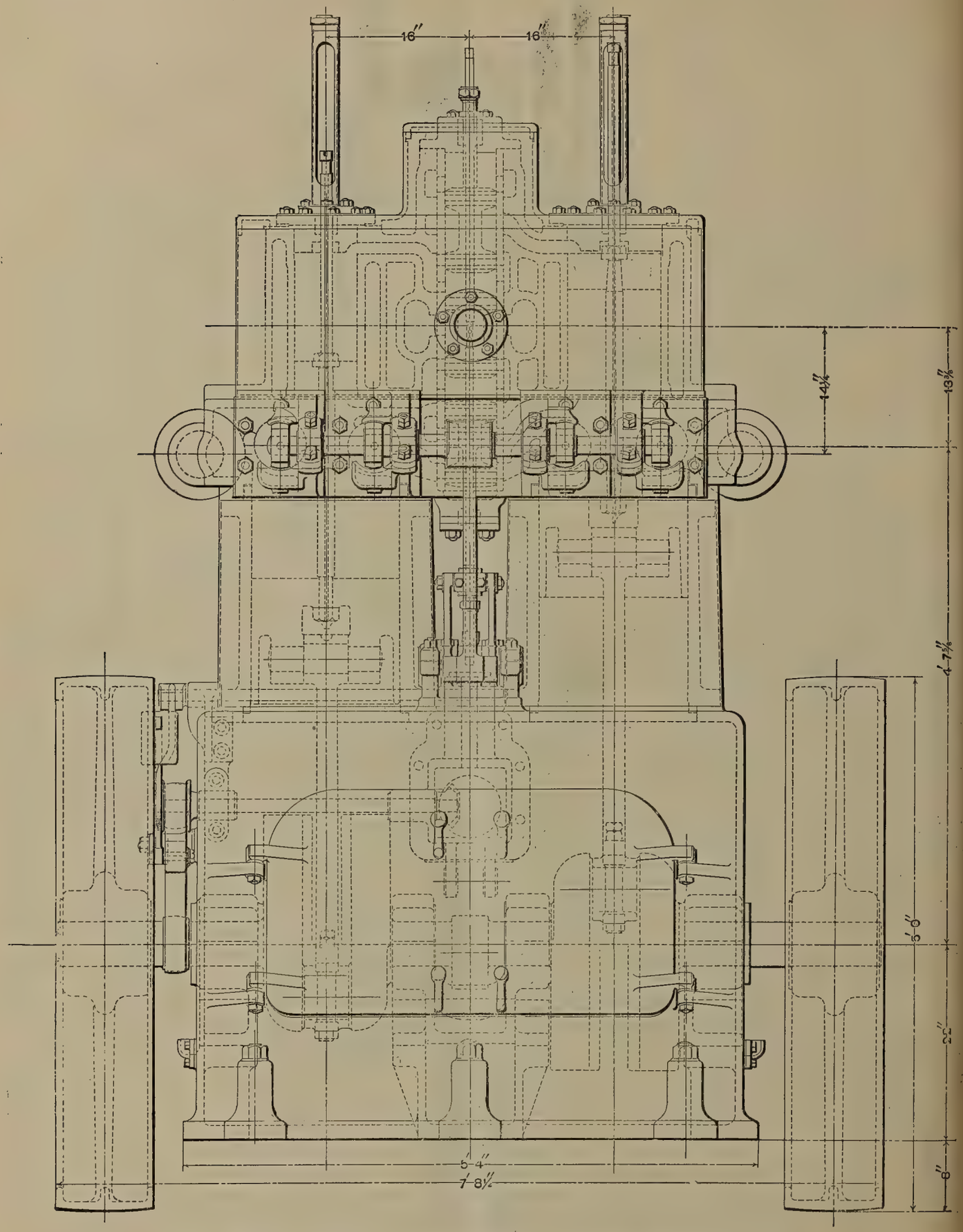


FIG. 3.—SECTIONAL FRONT ELEVATION STRONG TRIPLE-EXPANSION ENGINE.

high-speed governor, operated by a belt from the main shaft. In case the governor belt should break, a safety

As cross-heads are not used, the frame of the engine is extremely simple. The bed of the engine is formed

of a single casting, that extends up to the bottom of the low-pressure cylinders. The castings of these two cylinders are duplicates and perfectly plain. The high-pressure and intermediate cylinders are formed from another casting. Hardened steel is used on all pins and bushings in the valve-gear, insuring long life and at the same time being easily replaced.

The crank-shaft is forged from a solid steel ingot, and the counter-weight bolted on. The pedestals are bored, and turned on their bases to fit a bored seat on the bed-plate or frame of the engine, to which they are secured by bolts. The seats for these pedestals are bored by a single setting of a boring-bar, and are consequently in perfect alignment.

Fig. 1 shows the engine in perspective, with dynamos mounted on main shaft. It is of 250 H. P., makes 225 revolutions per minute, occupies 7′ 8½″ x 4′ 3″ floor-space, and is 10′ 6″ high. Figs. 2 and 3 are sectional side and front elevations respectively, of a 150 H. P. engine at 300 revolutions.

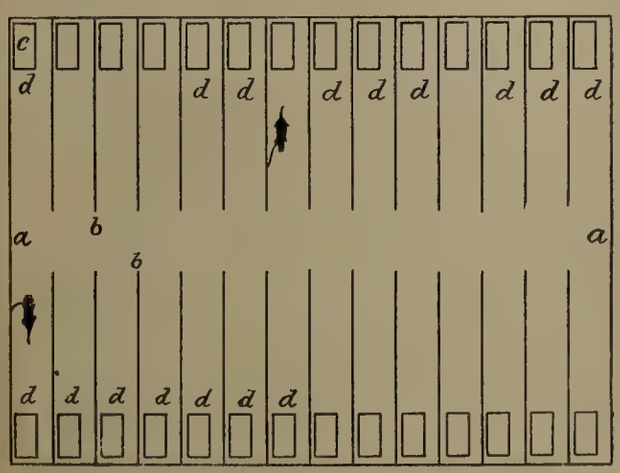
These engines are built by the Providence Steam Engine Company, builders of the well-known Greene automatic cut-off engines, and it is the intention of the company to build the Strong engine in sizes up to 2,500 H. P. The details of the engine were worked out under the supervision of Mr. F. W. Dean, M.E., of Boston, Mass.

The Strong engine has come to stay, and we do not doubt that large sales to electric light and street-railway stations will soon be reported. The salient features—economy of space, compact form, and high efficiency—entitle and will surely win for it deserved recognition wherever steam is employed for power purposes.

LIGHTNING'S DEADLY WORK.

Lightning accomplished some deadly work among a lot of valuable dogs in the kennel-yard of the Brooklyn Gun Club on the night of September 24 last.

The club's country-house, where the kennels are located, is in Smithtown, Long Island, and in the kennel-yard as high as 50 or 60 dogs are kept at times. During the night of September 24 a storm occurred, accompanied by lightning, during which 16 out of 23 dogs were killed in a most peculiar manner.



PLAN OF KENNEL-YARD.

The accompanying diagram will aid the reader in better understanding the circumstances attending this remarkable affair.

The kennel-yard is about 200 x 150 feet, extends east and west, and is enclosed by ordinary iron telegraph wire (*a* in diagram). Every 16 feet along the two longer sides of the enclosure were posts, from each of which a piece of wire 60 feet long extended towards the centre of the enclosure, as shown at *b* in diagram. The inside end of each lateral length of wire was also fastened to a similar post, and to these wires the dogs were fastened by means of a steel chain four feet long. The wire end of the chains was provided with rings, so that the dogs could move along the length of the wire with the utmost freedom. In one corner of each enclosure a kennel was placed, as shown at *c*. This arrangement gave the dogs all the freedom and exercise they needed, and in every way proved satisfactory. The author of this plan, however, little suspected that this arrangement of wires would prove especially dangerous in a thunder-storm as it subsequently did.

During the storm the dogs went into their kennels, and the next morning when John Downer, the keeper, went to feed them he found 16 out of the 23 dead—lightning having, during the storm, struck the wire and probably reached the ground through the bodies of the dogs, which were in metallic contact with the entire wire system.

A peculiar feature of the affair was the escape of some of the dogs. The enclosures marked *d* in the diagram represent the places where the deaths occurred. It will be noticed that the lightning skipped one or more dogs in some places, and altogether it maintained its record for erratic course of action.

Some of the dogs that escaped death were stunned to a more or less degree, and why they should have escaped the fate of the others who were less fortunate is a problem that would be hard to settle. Apparently no damage was done to the wires or their fastenings, the strength of the lightning having been expended on the bodies of the poor brutes.

ELECTRIC COOKING AND HEATING.

Mr. T. Ahearn, of Ottawa, Ont., will have a novel exhibit at the fair in Ottawa. He is the well-known inventor of electric heating appliances for domestic use. In the ELECTRICAL AGE of September 17 last was published the bill of fare of an electrical dinner given recently at the Windsor hotel in Ottawa, every one of the dishes of which was cooked by electric heat. Mr. Ahearn will exhibit at the fair an electric oven about 7 feet square and 6 high, outside dimensions. The interior dimensions are 4 feet square, the ceiling being low and oval in form. On one side is a window which will permit visitors to watch the progress of baking bread, etc.

Besides the oven a dough-mixing machine will be operated by an electric motor.

House heating by electricity will also be demonstrated. This will be accomplished by heating water by electricity, the hot water in turn heating the rooms by means of radiators.

Two 12-gallon electric heaters connecting by pipes with five smaller heaters will be used for making tea and coffee in the refreshment-room.

Considerable interest is manifested in this novel exhibit, which, it is said, will be the greatest attraction of the fair.

STRIKE ENDED.

The strike of the trimmers employed by the Detroit Electric Light and Power Co., Detroit, Mich., ended on September 22, after a conference between the company and the strikers, which resulted in the company acceding to nearly every demand made by the men. The strike began on September 13. The men claimed that the company was trying to break up their union, and demanded the discharge of the foreman, who was obnoxious to them. Considerable annoyance resulted from the strike on account of the reduced number of lights.

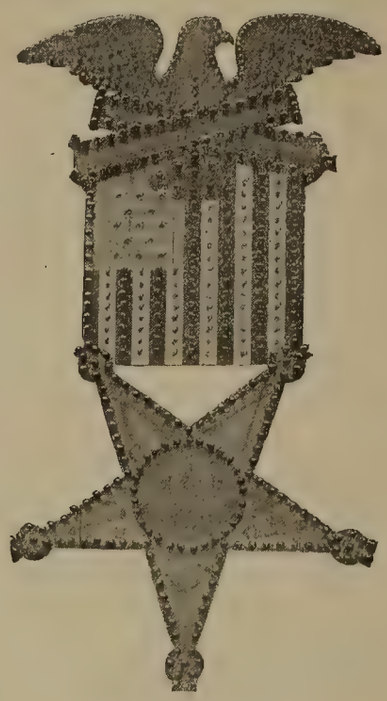
GRAND ARMY ILLUMINATIONS IN WASHINGTON.

That public fêtes and celebrations without electricity to enhance their splendor and give to them the necessary éclat, are becoming rarer, has been very adequately proved during the recent gathering of the veterans of the Grand Army at Washington. The celebration was to be so grand in the daylight, that for it to have failed in the evening when, parades over, the visitors were free to promenade Washington's magnificent thoroughfares, would have cast a serious reflection on the committee in charge. It was felt that electricity only would satisfactorily answer the purpose, and therefore it was adopted as the only means by which a thoroughly brilliant illumination could be obtained.

To the decorative lamp department of the General Electric Company, which distinguished itself at the Actor's Fund Fair, last May, was confided the arduous task. The results were beyond compare the finest yet obtained, and elicited admiration and approval from every one, either visitor or resident.

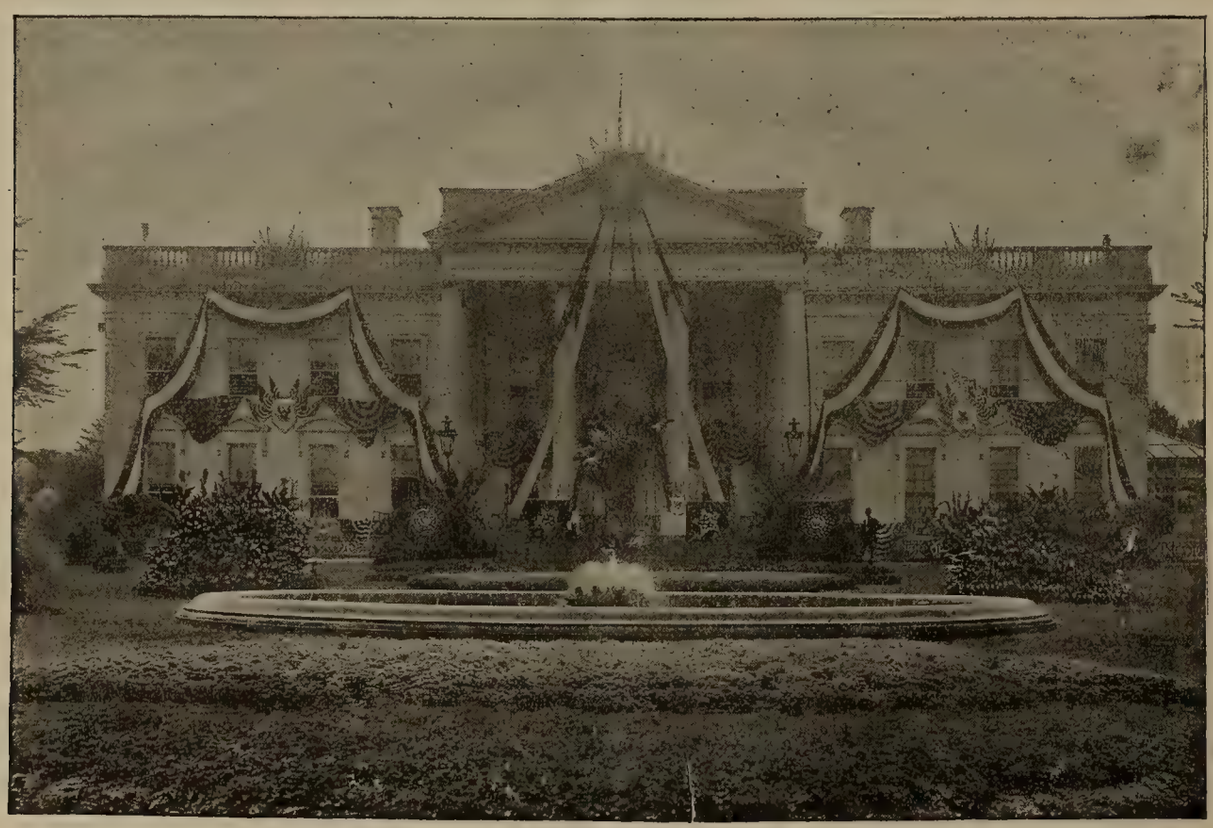
The interest in the reunion centred itself about Pennsylvania avenue, stretching from the Capitol to the Treasury and the Executive Mansion, and it was determined that the electrical display should also be centred there.

Running from near the Pennsylvania railroad depot to the Treasury, pole lines were erected on both sides of the avenue. At short intervals along these two lines different corps badges were designed in small but intensely brilliant incandescent lamps, each badge being repeated three times at various points on the avenue, in the national colors of red, white and blue. Above each badge the name of some notable fight in which the corps took conspicuous part, or well-remembered sojourning place during the war, was set forth in electric lamps. At rarer intervals the portraits in oil of the leading war generals were suspended, each surrounded by a double border, the inner one of very small lamps, the outer of lamps of a larger size and higher candle-power. At the corner of Tenth street, in front of the Washington *Post*, was erected a splendid anchor, about



GRAND ARMY BADGE.

twenty feet high. When lighted it blazed so brilliantly as to make it the most attractive set-piece on the avenue. In front of the Washington *Star*, twin stars of red and blue were placed, and a patriotic device gleamed from within the office windows.



ILLUMINATION OF THE WHITE HOUSE.

At the head of the avenue, at the entrance to the White Lot, was erected the most conspicuous design of the occasion. It was a monster fac-simile of the G. A. R. badge, eighteen feet high, entirely made up

of incandescent lamps. The eagle was outlined in white lamps, the cannon in blue, the stars and stripes in the regulation colors, and the pendant star in amber lamps. This piece was duplicated at the corner of Seventeenth street, below the White House. From the children's stand, at the head of the avenue, the name of Lincoln, in white lights, evoked pathetic reminiscences from the veterans.

The illumination of the Treasury building presented considerable difficulty. This was overcome by arranging along the cornice, at the top of the fluted columns, a line of colored arc lamps, which stretched from the entrance to the White Lot almost entirely around the building. The red, white and blue globes of the lamps lent themselves admirably to the colors of the flags with which the building was hung. Colored arc lights were also used to illuminate the camp on the White Lot.

On the White House lawn, in front of the Mansion, a most fairy like effect was produced. Every bush, tree, fern and flower-bed glistened with the light of innumerable miniature lamps, so suspended as to conceal all the mere practical details of installation. No less than ten revolving stars, each of different design, were also set up here, and constantly changing in design and color, reappearing and disappearing, obtained a well-merited meed of success.

Over each entrance to the Mansion was set a star of deep blue lamps.

A marvellous effect, and one never yet essayed to add to the brilliancy of an illumination, was obtained by the introduction of the search-light. On the roof of the Washington Loan and Trust Company's Building were set four 24-inch General Electric Company's projectors built at Middletown, three facing the Capitol and one facing the Monument. During the evening the brilliant rays of light from these projectors shot the national colors on the clouds, or illuminated the surroundings of the city. The grandest effects were obtained, however, when the whole four were brought to bear on the Capitol or on the Monument. The nights being without moonlight, the back-ground was absolutely black, and when the lights were thrown on the Capitol it appeared as the magnificent white marble building it really is, but grandiose and awe-inspiring beyond conception, and many a veteran bears away with him an aspect of the Capitol which will live in his memory while he himself lives. The illuminated Monument was none the less effective. The white stone shaft springing up straight into the blackness of night, seemed like a supernatural finger pointing heavenward.

All this remarkable display was not obtained without great effort. Less than thirty days elapsed between the commencement of the work and the illumination. Poles had to be erected, and a whole three-wire system installed, drawing current from every available dynamo, public or private, in the city. In fact, not enough current could be procured.

Two G. A. R. badges, sixty-three corps badges, the same number of mottoes and names, special devices such as the anchor and stars had to be designed and executed. The streets had to be skilfully wired and socketed, the revolving wheels to be conceived and constructed. Projectors had to be brought from the factory and erected. It was a great undertaking brought to a satisfactory termination. Some idea of the work can be gained from the fact that over twenty-five thousand incandescent lamps were used in the illumination, as well as over one hundred arc lamps.

Credit for the success of the illumination is to be rendered to Mr. A. D. Page, to whom *carte blanche* had been given, and to Mr. F. H. Clarke, the Washington representative, who were materially assisted by Mr. Fanshawe and Mr. McAllister, both skilful designers and versed in lamp requirements. The search-lights were in charge of Mr. Gragg.

THE CLEVELAND CONVENTION.

The following is a copy of a circular just issued by Secretary Richardson of the American Street-Railway Association, which association will hold its 11th annual meeting in Cleveland, Ohio, October, 19, 20 and 21 next:

OFFICE OF THE AMERICAN STREET-RAILWAY ASSOCIATION,
CORNER ATLANTIC AND THIRD AVENUES,
BROOKLYN, N. Y., Sept. 19, 1892.

DEAR SIR: The Eleventh Regular (Annual) Meeting of The American Street Railway Association will be held at Association Hall, Cleveland, Ohio, the third Wednesday in October (the 19th), 1892, commencing at 10 o'clock A.M., and continuing three days.

The meeting will doubtless be much more largely attended than any preceding meeting. The following is a general

PROGRAMME OF THE MEETING.

FIRST.—*Reports of Special Committees.* Special committees will report on the following subjects: "A Model Electric Street-Railway Roadbed, and Underground Wiring;" "A Perfect Overhead Electric Construction;" "Economy of Machine-Shops for Electric Street Railways;" "Power-House Engines;" "Relative Cost of Operation of Horse, Cable and Electric Roads," and "Standards for Electric Street Railways." Notice has been received by the secretary that special papers will be read under the following titles: "Experiments on the Expansion of Continuous Rails," and "Is a Standard Rail-Head Possible?" Upon the request of the executive committee, Mr. D. F. Longstreet has consented to prepare, and will read a paper narrating the events which led up to the formation of the American Street-Railway Association.

SECOND.—*Exhibition of Street-Railway Supplies.* The local committee has secured ample accommodations for all who desire to exhibit their manufactures. Mr. H. J. Davies, secretary of the Brooklyn Street Railroad Company, of Cleveland, has special charge of this department.

THIRD.—*Local Entertainment.* The Cleveland Street-Railway Companies, supplemented by the Short Electric Railway Company, propose to entertain all who attend the meeting in a way to be remembered.

FOURTH.—*Reduced Rates of Fare.* The Boston Lines Committee, Central Traffic Association, New York and New England Passenger Lines Committee, Railway Association of Michigan, Southern Passenger Association and Trunk Line Association have united in granting the courtesy of the special rate of a fare and one-third for the round trip to all, including friends and members of the families of all in attendance at the convention, whether delegates, supply-men or others. The territory to which the concession applies is all of the United States, except the Western and Pacific Coast States included in the territory of the Trans-Continental Association and the Western Passenger Association. The latter association has, however, granted a fare and one-third rate from Peoria, via the C., R. I. & P., C., B. & Q. and J. S. E.—A. T. & S. F. railways only. All will, of course, avail themselves of the reduced rates where possible. The rules governing reduced rates, *strict conformity with which is required*, are given as follows:

First.—Each person must purchase (not more than *three* days prior to the date of the meeting) a first-class ticket (either unlimited or limited) to Cleveland, for which he must pay the regular tariff fare, and upon request the ticket agent will issue a certificate of such purchase, properly filled up and signed by the said ticket agent.

Second.—Where the journey is made over more than one line it may be necessary for the passenger to purchase separate local tickets, and procure certificates thereof for each of the lines over which he travels in going to Cleveland, as some lines do not honor the certificates of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase his ticket and secure a certificate filled in accordingly. In case a ticket on the certificate plan cannot be procured at the starting-point, the person should purchase to the nearest point where such a ticket can be obtained, and there repurchase through to Cleveland, requesting a certificate properly filled out by the agent at the point where the repurchase is made.

Third.—Tickets for the return journey will be sold by the ticket agent at Cleveland at one-third the highest limited fare to those only who hold certificates signed by the ticket agent at the point where through tickets to Cleveland were purchased, and countersigned by the clerk of the convention, certifying that the holder has been in attendance upon the convention. Mr. John J. Stanley, general manager of the Broadway and Newburgh Street Railway Company of Cleveland, has kindly consented to serve as clerk of the meeting for this exclusive purpose.

Fourth.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route by which the

ticket for the return journey should be sold, and without it *no reduction will be made*, as the rule of the association is: "No refund of fare will be made because of the failure of the person to obtain a certificate."

Fifth.—Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fare. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the convention. The certificates are *not transferable*, and the signature affixed at the starting-point, compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer. In order to guard against the misuse or transfer of either a certificate, or ticket procured through it, the association has been obliged to guarantee the redemption at full fare of any return ticket afterwards found to have been transferred or misused.

N. B.—Please read *carefully* the above instructions, and be particular to have the certificates properly filled out and certified by the railroad agent from whom you purchase your going ticket or tickets. *Tickets and certificates should be obtained at least* THIRTY MINUTES *before the departure of trains.*

A certificate is void if altered; if not presented within prescribed dates; if not signed by the clerk of the meeting, and viséd by the agent of the Central Traffic Association in attendance at the meeting at Cleveland; or if blank spaces on the *going* side are not filled out, signed and stamped by the agent of the line at the point from which the passenger started.

The secretary suggests to all who will attend the meeting, and who desire to transact business at any other city *en route*, to arrange to do so on the trip *to* Cleveland, as the going ticket will, of course, carry with it, in most cases, stop-over privileges, while the return ticket will not.

FIFTH.—*Attendance of Ladies.* The attendance of the wives and daughters of gentlemen attending the convention having become an established custom, grows more and more in popular favor every year. The pleasure of the society of ladies adds largely to the general interest of the meeting, and their participation in the excursions and banquet will be fully arranged for as heretofore.

SIXTH.—*The Banquet.* The annual dinner will take place on Thursday evening, the 22d prox., at the Hotel Hollenden. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each. In order to facilitate the executive and the local committees, will you please inform the secretary immediately upon the receipt of this notice of the number that will be present from your company, enclosing the additional amount covering the number in excess of the two to which the company is entitled, that definite arrangements as to the number that will attend the banquet may be promptly made.

SEVENTH.—*Hotel Accommodation.* The local committee of arrangements made the following agreement with the Cleveland hotel proprietors:

CLEVELAND, O., October 28, 1891.

We hereby agree with A. Everett, Frank De H. Robison, Horace Andrews, J. B. Hanna and H. J. Davies, a committee representing the street-railroad companies of Cleveland, that if the next annual meeting of the American Street-Railway Association shall be held in this city, beginning October 19, 1892, we will reserve for said committee rooms in our hotels to be occupied by delegates to the convention, and that we will charge the delegates for said rooms only our regular rates; that we will not permit any supply companies or their agents to exhibit their wares in our hotel, but will refer said companies or agents to said committee for information as to space for exhibits. Signed, the Weddell House, the Hollenden Hotel Co., the Stillman Hotel Co., the Forest City House, the Kennard Hotel, the American House, the Hawley House and the Wilmot.

There will be accommodation at Cleveland for all who attend the meeting, but the local committee proposes to provide *first* for the delegates The headquarters of the association will be at the Hollenden. The rates at the hotels are as follows:

The Hollenden, American plan, $3 to $5 per day; European plan, rooms, $1 to $2.50 per day; the Stillman, $4 per day with bath, $3.50 per day without bath; the Weddell, $3, $3.50, $4 and $5 per day; with bath, $4 and $5 per day; Forest City House, $3 and $3.50 with bath; $2.50 and $3 without bath; Kennard House, $2, $2.50 and $3 per day; with bath, $3.50; American House, $2 and $2.50 per day; Hawley House, $2 per day; the Wilmot, $2 per day.

Rooms will be assigned in the order of the applications received therefor, and, as far as possible, in accordance with the expressed wishes of the applicants. Those who expect to be present are urged to communicate with the committee at once, stating whether they will be accompanied by members of their families, and, if so, how many, in order that due provision may be made for the accommodation of all who may come. As orders for rooms will be taken subject to cancellation on or before October 16, it will be readily seen that no risk is taken by any one who, expecting to be present, engages a room at once. It is certain that immediate action in this respect can only be to the advantage of the applicant, for the hotel proprietors can readily dispose of any rooms that may have been engaged prior to the said date should their engagement for any reason be afterwards cancelled. In case a preference for rooms at any other hotel should be expressed the committee will undertake to secure such quarters as are desired, if notified in due time. Concerning hotel accommodations, please address all communications to Mr. Henry J. Davies, Secretary Local Committee, Cleveland, O.

A list of the present membership of the association, numbering 198 companies in the United States and Canada, is sent herewith. If your company is not already a member, it is cordially invited to join, and be represented at the meeting. Will you please acknowledge receipt of this letter as soon as possible, stating whether you expect to be present? On the enclosed delegate's card kindly fill in the names of those who will attend from your company, and return it with your letter of acknowledgment in the accompanying envelope.

Awaiting your *prompt* reply, I remain,

Sincerely yours, WM. J. RICHARDSON, *Secretary.*

EXHIBITORS AT THE CLEVELAND CONVENTION.

The following is a list of proposed exhibitors, with the nature of their exhibits, at the convention of the American Street Railway Association, to be held in Cleveland Oct. 19, 20 and 21 next.

International Register Co., Chicago, Ill., fare registers.
Johnson Electric Co., Cleveland, miscellaneous supplies.
Mitchell-Brant Copper Co, Erie, Pa., copper castings.
St. Louis Register Co., St. Louis, Mo., fare register.
Meaker Manufacturing Co., Chicago, fare register.
New Departure Bell Co., Bristol, Conn., gongs.
H. N. Loomis, Hightstown, N. J.
H. W. John's Manufacturing Co., New York, asbestos.
Davis & Cook, Watertown, N. Y., levels.
New York Car-Wheel Works, Buffalo, car wheels.
Baltimore Car-Wheel Works, Baltimore, car wheels.
Dorner & Dutton, Cleveland, trucks and wheels.
Cleveland Frog and Crossing Co., Cleveland, special rail work.
Duplex Street Railway Track Co., New York, rails.
Peckham Motor Truck and Wheel Co., Kingston, N. Y., wheels and trucks.
Fulton Foundry Co., Cleveland, trucks and wheels.
Robinson Machine Co., Altoona, Pa., trucks.
J. H. Graham, Boston, Mass., truck.
Barnes Brake Co., Cleveland, friction-brake.
Sperry Electric Railway Co., Chicago, electrical machinery.
Jewell Belting Co., Hartford, Conn., belts.
Bodifield Belting Co., Cleveland, belts.
General Electric Co., New York, electrical machinery.
Westinghouse Electric and Mfg. Co., Pittsburg, electrical machinery.
Pennsylvania Steel Co., Philadelphia, rails.
Wm. Wharton, Jr., & Co., Philadelphia, rails.
New Process Raw Hide Co., Syracuse, N. Y., gears and pinions.
Morton Safety Heating Co., Baltimore, Md., car-heater.
Washburn & Moen Manufacturing Co., Chicago, copper wire.
R. D. Nuttall Co., Allegheny, Pa., electric-railway supplies.
Chas. Scott Spring Co., Philadelphia, springs.
Billings & Spencer Co., Hartford, Conn., commutator-bars, etc.
Combination Car Co., Boston, model of street car.
Pittsburg Steel Hollow Ware Co., Allegheny, Pa., gongs.
Pomeroy & Fischer, New York, varnish, etc.
Rochester Car-Wheel Works, Rochester, N. Y., car wheels.

Griffin Wheel Co., Chicago, car wheels.
Taylor Truck Co., Troy, N. Y., trucks.
Johnson Company, Johnstown, Pa., rails.
Brownell Car Co., St. Louis, street car.
Reliable Manufacturing Co., Boston, miscellaneous supplies.
Hill Clutch Works, Cleveland, clutches.
Brooklyn Railway Supply Co., Stamford, Conn., Walkaway plow.
Walworth Manufacturing Co., Boston, poles.
Ford & Washburn Co., Cleveland, storage-battery motor.
Sterling Co., Chicago, model of Stirling boiler.
Schieren & Co., New York, belts.
Short Electric Railway Co., Cleveland, electrical machinery.
Detroit Electrical Works, Detroit, Mich., electrical machinery.
Lewis & Fowler, Brooklyn, N. Y., miscellaneous supplies.
J. G. Brill Co., Philadelphia, trucks and cars.
Western Electric Co., Chicago, miscellaneous supplies.
The E. S. Greeley & Co., New York, general electrical supplies.
Standard Railway Supply Co., Chicago, car registers, stoves, etc.
J. M. Jones' Sons, Agts., West Troy, N. Y., sand-box.
The Reliance Gauge Co., Cleveland, steam-gauges.
Terre Haute Car Manufacturing Co., St. Louis, car wheels.
Porter Tramway Switch Co., Cleveland, switch.
Safety Brake Shoe and Construction Co., Boston, safety brake shoe.
Technic Electrical Works, Philadelphia, electrical supplies.
Eureka Tempered Copper Co., North East, Pa., miscellaneous supplies.
Esmond Street Railway Co., New York, rails.
Mark & Sterling, Cleveland, rail-joints, chairs, etc.

THE TROLLEY IN NEW YORK CITY.

The Metropolitan Traction Company, of this city, received from the board of aldermen on Thursday, Sept. 29, nine franchises that virtually permit of its adopting electric power on all of its various lines. Before it can do so, however, the permission of the state railroad commissioners will have to be obtained. Through the concessions granted the company permitting the connection of the different lines it will be in a position to construct a direct trolley route from the Battery to 110th street, principally under the elevated railroads.

AN ELECTRICALLY COOKED BISCUIT.

We have to return our thanks to Mr. D. C. Dewar, assistant manager Bell Telephone Company, Ottawa, Can., for an electrically baked biscuit, baked in the Ahearn electric oven at the Central Canada Fair held in that city. The Ahearn electric oven is the only oven heated by electricity in the world, and is the invention of Mr. Ahearn, the well-known Canadian electrician. The biscuit sent us is all that could be desired and in every way equal to those baked in the ovens of ordinary coal stoves.

IN EDISON'S FAVOR.

The Court of Appeals of the U. S. Circuit Court on Oct. 4 handed down a decision in the case of Edison Electric Light Company against the United States Electric Lighting Company, affirming the decision of Judge Wallace in favor the first-named company.

ELECTRICAL SOCIETIES.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

A lecture will be given before the electrical department of this institute by J. H. Gerry, of New York, on October 7, at 8 P.M. His subject will be "Recent Improvements in Electrical Clocks."

THE CHICAGO ELECTRIC CLUB.

Steps are being taken to reorganize the Chicago Electric Club on a stock basis. The movement seems to meet with general approval.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The first meeting of the season of the American Institute of Electrical Engineers was held at 12 West 31st street, September 27. Mr. Charles P. Steinmetz read a paper entitled "On the Law of Hysteresis (Part II.) and other Phenomena of the Magnetic Circuit." The paper was a voluminous one, and a very complete record of Mr. Steinmetz's investigations.

The following is a list of the names of associate members elected at the meeting of Council, September 27 :

Albright, H. Fleetwood, Electrical Engineer, Western Electric Co., 227 So. Clinton st., Chicago, Ill.

Armstrong, Chas. G., Electrical Expert and Electrical Architect, 1301 Auditorium Tower, Chicago, Ill.

Callender, Romaine, Electrician, Brantford Electrical Laboratory, Brantford, Canada.

Crandall, Chester D., Assistant Treasurer, Western Electric Co., 227 South Clinton st., Chicago, Ill.

Fisher, George E., General Manager, Commercial Electric Co., 55–57 Gratiot ave., Detroit, Mich.

Flesch, Charles, Electrical Engineer, Melbourne, Australia.

Jackson, J. P., Assistant Professor of Electrical Engineering, Penn State College, State College, Pa.

Kinsman, Frank E., Electrical Engineer, Plainfield, N. J.

Magenis, James P., Editor the *Adams Freeman*, Adams, Mass.

MacFadden, Carl K., Chief Electric Light Inspector, Chicago & Northwestern Ry. Co., 22 Fifth ave., Chicago, Ill.

McBride, James, Superintendent, N. Y. & Boston Dye Wood Co., 146 Kent st., Brooklyn, N. Y.

Noll, Augustus, New York Insulated Wire Co., 15 Cortlandt st., New York city.

Ray, William D., Electrician of Local Line of Northern Pacific R. R. Co., at Chicago, 308 Home ave., Oak Park, Ill.

Rodgers, Howard S., Electrical Engineer, Thomson-Houston Electric Co., 624 Western ave., Lynn, Mass.

Ross, Robert A., Engineer in charge of Engineering Dept., Edison General Electric Co., Peterborough, Ont.

Smith, Frank Stuart, Supt. of Carbon Dept., Westinghouse Electric and Mfg. Co., Pittsburg, Pa.

ELECTRIC-LIGHT NOTES.

At a meeting of the directors of the Visalia Gas Light and Heat Company of Visalia, Cal., the president and secretary were authorized to make the necessary purchases for the completion of the company's plant to enable it to furnish lights for the streets of the city and to increase the incandescent plant.

The residents of Arcata, Cal., are desirous of having electric lights, and Mr. William V. Lockwood, of the

Pacific Electrical Storage Company, visited the town for the purpose of conferring with the people on the question of establishing an incandescent light plant. Mr. Lockwood also visited Ferndale, Fortuna and Rohnerville for the same purpose, but as yet no definite arrangements have been made, although the prospects are very promising.

HISTORY OF THE INCANDESCENT LAMP.

One of the most interesting books published is the "Evolution of the Incandescent Lamp," by F. L. Pope. There is no other work like it, and it is invaluable for reference, as it gives a history of the incandescent lamp from the time of the earliest experiments up to the present time. The book gives a chronological history of modern incandescent lighting; accounts of the early work of Edison, Sawyer and Man; commercial introduction of the incandescent lamp; the hydrocarbon treatment of incandescent lamp-carbons, and the commercial measurement of electric currents. It also contains much other matter of interest, including press comments on the new light during the early days of electric lighting. The price of this interesting work is $1.00, and it can be obtained at the office of the Electrical Age Publishing Co., World Building, New York.

NEW BOOKS.

QUESTIONS AND ANSWERS ABOUT ELECTRICITY. A first book for beginners. Edited by E. T. Bubier, 2d. 100 pp. and 31 illustrations. D. Van Nostrand Co., New York.

This book is a catechism of electricity, written by such well-known authorities as T. O'Conor Sloane, Caryl D. Haskins, A. E. Watson and Edward Trevert; arranged and edited by Edward T. Bubier, 2d. Its object is to serve as a primer upon electricity and magnetism for young students and amateurs. In view of the many and varied uses to which the electrical current is being constantly applied, and so strongly is the public mind being directed towards it that such a work as this should be incorporated in the curriculum of the common schools. It is absolutely necessary that the youth of the present day should be instructed in the elementary principles of electricity, and the above work is well suited for the purpose.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, October 1, 1892.

F. S. PAMPERON, of the Electric Manufacturing Company, Oconto, Wis., manufacturer of the "Brilliant" incandescent lamp, was in town during the week.

J. T. BRAY & Co., formerly of 55 Dey street, manufacturers of Gillette magnetos, etc., have moved to Keyport, N. J., where they have secured a big factory, and will manufacture on a larger scale.

THE PAN-AMERICAN ENGINEERING AND SUPPLY COMPANY, 136 Liberty street, is doing an extensive business in electrical supplies and engines for Mexico and Central America.

AN electric sign is a prominent feature at night in front of the Democratic headquarters on Fifth avenue. The names of the Democratic candidates for president and vice-president and an American eagle design are wrought in red, white and blue electric lamps.

TRUEX & VAIL, 136 Liberty street, are agents for the "Brilliant" incandescent lamps. They report that although only having the agency but a few days, a large number has been sold. This lamp is very highly spoken of; it does not blacken and is long-lived, some having, it is said, burned 1,800 hours.

THE work of erecting the handsome electric-light poles on Fifth avenue is progressing rapidly. On each pole is a cross-arm of artistic design on each end of which will hang an arc lamp to be operated on the Edison incandescent mains. These poles and lamps were fully described in the ELECTRICAL AGE a few issues ago.

THE PERKINS ELECTRIC LAMP COMPANY, manufacturer of incandescent lamps, will on October 1 remove its New York office from Room 110, first floor, to a suite of offices, Room 401, on the 4th floor of the Bennett Building, 97 Nassau street. This change was rendered necessary to meet the demands of its greatly increased business.

THE MATHER ELECTRIC COMPANY has found it necessary to secure larger quarters for its New York office in order to satisfactorily handle the immense increase in its business. A suite of offices has been secured on the 4th floor of the Bennett Building, 97 Nassau street, to which it will remove on October 1 from its present quarters in the same building.

Mr. W. R. BRIXEY has succeeded to the Days Kerite insulated wire and cable business, and will continue at the old address, 203 Broadway. Mr. Brixey was for fourteen years superintendent and general manager of the company, and has a thorough knowledge of the manufacture of Kerite wires and cables. He is prepared to supply wires, cables and tapes of the highest standard. We wish him all success.

THE United States Food Exposition, in commemoration of the discovery of America, was formally opened on Saturday evening, October 1, at Madison Square Garden. In a few instances incandescent lamps are used for decorative effects, but there is nothing remarkably unique. The Armour Packing Co.'s booth is tastily illuminated with electric lamps, and the St. Charles evaporated cream booth is surmounted by a sign made up of the words: "St. Charles Evaporated Cream—Unsweetened, Sterilized," in small incandescent lamps.

THE C. & C. ELECTRIC MOTOR CO., 402 and 404 Greenwich st., New York, has recently received an order from the chief of construction of the World's Columbian Exposition for two generators of 110 H. P. each, to be used to furnish current to the electric elevators that have been installed in the Administration Building of the Exposition grounds. These machines are to be in operation during the dedication ceremonies of the new buildings this month. In addition to these generators the company has also received orders for five more generators of 110 H. P. each, four of which are to furnish power to motors operated by exhibitors, and the fifth is to furnish lights.

N. S. CHESLEY & Co., 136 Liberty street, are agents for the Easton Electric Company, of Brooklyn, manufacturers of arc dynamos with automatic regulator, slow-speed incandescent dynamos (direct driven) and motors, and also buy, sell and repair second-hand apparatus. They report that their business has increased to such an extent as to necessitate the enlarging of their facilities. They have secured a large building at 24 Morris street, Jersey City, convenient to their New York office, which they have fitted up with improved machinery, necessary to repair all kinds of electrical apparatus—dynamos and motors especially. Mr. Elmer E. Warner, formerly connected with the Excelsior Electric Company, is their

superintendent, and is said to be a most competent electrician. They have ample power, and solicit business from the manufacturers of electrical appliances.

THE PIERCE AND MILLER ENGINEERING COMPANY, 42 Cortlandt street, agent for the McIntosh and Seymour engines, reports that the McIntosh and Seymour Company received an order from the General Electric Company for three 500 H. P. McIntosh and Seymour engines; also one 250 H. P., one 150 H. P. and one 100 H. P. compound engines. On September 27 an order was received by cable from Berlin, Germany, for three 500 H. P. compound engines. The Pierce and Miller Company has completed the installation of the steam plant for the Globe Electric Street-Railway Company, of Fall River, Mass. This plant consists of engines, boilers, etc., for 1,000 H. P., and has been running successfully for three weeks. They have also completed and run for two weeks the 800 H. P. steam plant for the Central Street-Railway Company, of Baltimore, Md., and another of 500 H. P. for the Rock Creek Electric Railway Company, of Washington, D. C.

J. JONES & SON, manufacturing electricians and dealers in electric-light, telephone, telegraph and general supplies, inform us that the report which has been in circulation, that they are about to close their business at 39 Vesey street, is entirely untrue, and that on the contrary they have added to their business quarters by acquiring the controlling interest in a large and well-equipped machine-shop at 60–62 Murray street, known as the J. M. Lambert Manufacturing Company, where their manufacturing will be carried on in the future. The removal of this part of the business has left on their hands at 39 Vesey street a well-fitted machine-shop for sale, and this no doubt has given rise to the rumor. Not only are they able to offer better facilities by this move to their customers in the mechanical line, but they have more room and time to enlarge the supply and construction department at their old quarters, a part of the business which they are vigorously and successfully pushing.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	86 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	199 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	87 00
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	10 000	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	115 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 75
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*105
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	101 00
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	12 75
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	112 50
General Electric Co., 5s	4,000,000		*104
General Electric pref.		100 00	118 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 00
Laclede Gas pref.	2,500,000	100 00	64 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	61 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	95 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	39 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	51 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The cholera scare, as it is termed by the press of New York, has caused already a loss to the country of not less than $100,000,000; but it seems to have had the effect of stopping the strikes, which should, as the old Farmer's Almanac used to predict, "come along about this time." The electrical community is wonderfully free from them, and nothing but reports of excessive activity reach us. The country is being filled with light and power rapidly, while heat in various forms is being applied from electrical sources. Money is still called for to carry out these enterprises, for the majority have passed through the valleys of experiment and test; all preliminary money has been expended, and that required now is substantially to fill orders and reap the reward. I could mention at least a baker's dozen where there is no possible doubt of a very large return for the amount invested, and these cover sums from $500 up to $600,000, including a wide field in the electrical art, so that if there is a desire to embark in any particular branch the opportunity exists. While it is conceded that the general principles of generating and applying electricity will not undergo any material change, the expense of production will be much reduced; yet the cost of ascertaining this is well invested and produces most satisfactory returns.

The constant improvements and additions are weekly shown in our list of patents granted. For all inventions, except such as are directly connected with the business of the few consolidated corporations, there is sure to be opportunities for the use of small sums of ready cash, in

return for which an interest in the patent will be given and a corresponding share of the profits. The customers include all the electric corporations and private parties not owned in part by the parent companies, and the profit on these goods is large, because there is no competition in the particular article. They include everything required or used in electrical construction, equipment, operating and maintenance. Hundreds of millions are already earning fair profit in this line to-day, and the scope increases continually. The application of electricity to heavy trains in connection with local service is taking a firm hold of capitalists and being heard from in many states. A road some fifteen miles long, straight-away, with a city at one end, half a dozen villages at the other, and scattered throughout its length half a dozen other villages, having to-day from 500 to 20,000 population, right of way secured, grade and most of the fencing, culverts, etc., complete, the flower of central New York state, farms, creameries, dairies, etc., for traffic and custom, calls to-day for electric assistance on bed-rock terms, to construct and equip, or clean sale. The elevated roads are seriously contemplating electric traction, and the Brooklyn bridge can't hold back much longer. Surely the expense there need not be over 60 % of the present cost of the cable system, and there will be no excuse for a breakdown short of an earthquake. It costs money to stop these cars during the rush hours; the public is clamoring for what belongs to it, a regular, reliable service, and it exists only in the dynamo.

A new question of great importance has been passed on this month in Albany, and one which, if the secretary of state is correct, needs the close attention of the Legislature this winter. It seems that the Municipal Gas Co., which operates in Albany and West Troy, recently absorbed the Albany Electric Light Company, and in due course offered its certificate for extension of business, capital, etc. The secretary refused to file the certificate giving the necessary powers, on the ground that a certificate of incorporation should only contain such business objects as are authorized under section 60 of the transportation corporation law, and further, that a corporation could not be organized under section 60 with the objects of furnishing both gas and electric light. There are a great many corporations doing this, and from a financial standpoint no small city will pay separate corporations interest on the investment if the business is not combined. That it is not so in the west is shown by a number of bond sales lately; one is $30,000, Maysville, O., Light and Water Co. at par, and $30,000 more of the same is in this market to-day, and will probably be taken up soon. There are a great many investments of this nature on the docket just now, and nearly all are safe.

The Westinghouse Company has listed on the New York Stock Exchange an additional issue of $522,700 of assenting stock, and also $261,800 of preferred. The Brooklyn Edison Electric Illuminating Company has listed its first mortgage five per cent. coupon gold bonds, payable 1940, $500,000, and its capital or common stock $1,500,000. Both of these securities are good, safe investments, and will increase in price rapidly.

ELEVEN HUNDRED HORSE-POWER TURBINES.

As an instance of both excellent service and good workmanship in construction of water-wheels, it may be mentioned that Warren Curtis, treasurer of the Hudson River Pulp and Paper Co., some time since wrote James Leffel & Co., Springfield, Ohio, that a pair of their James Leffel wheels had been running night and day for six years, stating that he believed in that time no one had been into the wheel-case since it started.

This wheel, or pair, is 44 inches in diameter, and is rated at something over 1,100 H. P., being a twin wheel on horizontal shaft. After a trial of this wheel, three more of the same kind were purchased, all of which are running equally well, the four wheels giving in the aggregate about 4,500 H. P., under 50 feet head.

The Hudson River Pulp and Paper Co. is using over twenty of these wheels. George West & Sons, Ballston Spa, are using twenty-two, and the Smith Paper Co., Lee, Mass., has purchased thirty-two. The Marinett & Menominee Co., Marinett, Wis., recently ordered twenty-one, and the Fox River Pulp and Paper Co. has ordered nine large wheels, which are not yet shipped. Many other companies could be mentioned, using each from four to twelve. At least 200 pulp and paper mills are using and operating James Leffel Turbine.

BALL ENGINES.

The Ball Engine Co., Erie, Pa., of which Mr. F. R. Chinnock, 18 Cortlandt street, is the New York representative, has issued a pamphlet illustrative and descriptive of its latest improved heavy-duty engines for electric railways. These engines are made in the following types: Simple, tandem-compound, cross-compound and triple-expansion.

It is easy to see that the Ball engines are exceedingly popular and give every satisfaction by referring to the list of street-railway companies using them, which will be found on the last pages of the pamphlet. In connection with electric lighting that company has issued an exceedingly interesting pamphlet, entitled "Electric Lights on a Coral Reef," illustrating and describing the erection and installation of a steam plant, designed by the company for an electric-light station at Key West, Fla.

TRADE NOTES.

The Pelton Water-Wheel Company, of San Francisco, has obtained the general agency for the Pacific Coast for the Smith "Success" Turbine. There are many magnificent water-powers of low heads on the Pacific Coast generally, *i.e.*, from 4′ to 5′ up to 30′, 40′ and 50′, and in order to develop them the company determined to obtain possession of some first-class turbine especially adapted for low heads. After considerable investigation it selected the Smith "Success" as being eminently suited to fulfil the requirements.

PERTH AMBOY TOWING LINE.

NEW YORK, N. Y.

MESSRS. FORREST SILVER BRONZE PACKING CO.,
115 LIBERTY ST., N. Y. CITY.

Gentlemen: I have had your Silver Bronze Packing for the last two years on several of our tug-boats. It is giving good satisfaction and exceeds any other packing we have ever used. In one place it was the only packing that would keep the box tight without heat. I am placing it on all of our engines as fast as possible.

(Signed) I. L. FISHER, agent.

NOTE.—The boats on this line do very heavy towing, running day and night, changing crews and never laying up.

W. H. BARTHOLOMEW, PHOTO-ENGRAVER,
18 Spruce Street,

NEW YORK, June 21, 1892.

ELECTRIC CONSTRUCTION AND SUPPLY CO.

Gentlemen: The focusing lamp which I purchased from you a few months ago is by far the best I have ever used. It has been in almost constant use since it has been in my shop and is giving satisfaction in every respect.

Yours truly,

W. H. BARTHOLOMEW.

EDDY ELECTRIC MOTOR.

"The Chances Are" is the title of a little pamphlet issued by the Eddy Electric Manufacturing Company, of Windsor, Conn., directing attention to the merits of its electrical machines, and the "Eddy" electric motor in particular.

It is cleverly gotten up, and bound to attract the attention of all into whose hands it may fall. No fear of its getting into the waste-basket before perusal.

PATENTS SUSTAINED.

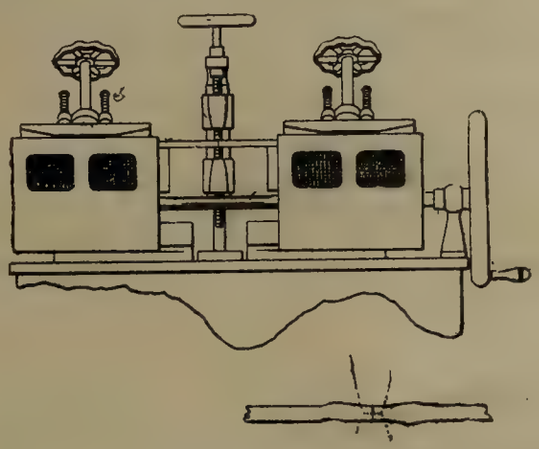
The Enamel Insulator Company, of Chicago, Ill., has issued a circular notice calling attention to the decision of the commissioner of patents upholding the Morford patents owned and controlled by the company. These patents cover enamel rheostats, cooking apparatus, and all other electrical apparatus with conductors embedded in enamel. The company will commence proceedings against any infringements.

The Electrical Age's Illustrated Patent Record.

Issued September 27, 1892.

483,124. Electric Heater. Thomas Ahearn, Ottawa, Canada. Filed April 4, 1892.

483,162. Automatic Coin-Actuated Telephone. Franz Müller, Berlin, Germany. Filed Aug. 25, 1891. Patented in Germany, in Switzerland and in Italy.

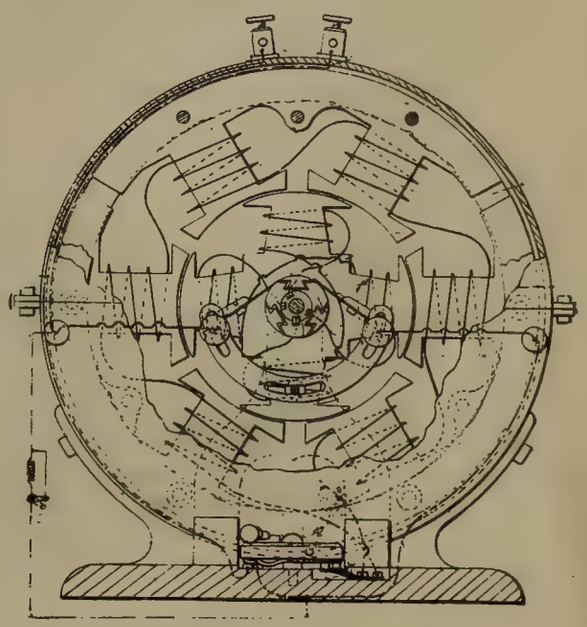


483,423.—PROCESS OF ELECTRIC WELDING.

483,168. Method of Measuring the Strength of Magnets. Charles H. Rudd, Evanston, assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 6, 1891.

483,175. Test System for Multiple Switchboards. Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 5, 1891.

483,189. Electric Meter. Addison G. Waterhouse, Hartford, Conn. Filed Jan. 4, 1892.



483,431.—ELECTRIC MOTOR.

483,202. Guard for Railway Cars. Patrick Barron, Pittsburg, Pa. Filed Sept. 28, 1891.

483,204. Electric Locomotive. Norman C. Bassett,

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HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 1, 1891.

483,231. Circuit-Closer for Railroad-Crossing Signal Mechanisms. Irvin W. Loy and Richard O'Toole, Mechanicstown, Md. Filed Nov. 6, 1891.

483,235. Electric Cut-Out and Switch-Box. Llewellyn D. McMunn, Cromwell, N. D., assignor of one-half to Milton R. Utley, Minneapolis, Minn. Filed April 5, 1892.

483,272. Means for Controlling the Operation of Mechanisms. Henry E Vineing, Roseville, N. J., assignor of one-half to Robert S. Walker, New York, N. Y. Filed Feb. 27, 1892.

483,285. Electric Cable. Theodore Guilleaume, Cologne, Germany. Filed May 5, 1892.

483,308. Watchman's Electric Time-Recorder. Nelson H. Raymond, Buffalo, N. Y., assignor of one-half to Charles M. Proctor, same place. Filed Aug. 17, 1891.

483,309. Electric Bell. Nelson H. Raymond, Buffalo, N. Y., assignor to Charles M. Proctor, same place. Filed Aug. 29, 1891.

483,310. Electrical Annunciator. Nelson H. Raymond, Buffalo, N. Y., assignor to Charles M. Proctor, some place. Filed Sept. 26, 1891.

483,316. Electric Snap-Switch. Seth F. Alden, New Bedford, Mass. Filed Feb. 1, 1892.

483,327. Coupling for Underground Wires. John J. Purcell, Washington, D. C., assignor of one-half to William H. Allen, same place. Filed Feb. 16, 1892.

483,339. Thermostat. Ira F. Beers and Frederic C. Beers, Elmira, New York. Filed March 17, 1891.

483,366. Electric-Railway System. Andrew L. Riker, New York, N. Y. Filed Dec. 22, 1891.

483,388. Trolley-Track Hanger for Electric Railways. William Q. Prewitt, Lexington, Ky. Filed Oct. 17, 1891.

483,423. Process of Electric Welding. Charles L. Coffin, Detroit, Mich. Filed Dec. 11, 1891.

483,424. Electric Metal-Working Device. Charles L. Coffin, Detroit, Mich. Filed Dec. 11, 1891.

483,425. Process of Electric Metal-Welding. Charles L. Coffin, Detroit, Mich. Filed Jan. 21, 1892.

483,426. Process of Electric Metal-Heating. Charles L. Coffin, Detroit, Mich. Filed Jan. 26, 1892.

483,427. Electric Metal-Working. Charles L. Coffin, Detroit, Mich. Filed Feb. 6, 1892.

483,428. Process of Electric Metal-Working. Charles L. Coffin, Detroit, Mich. Filed Feb. 8, 1892.

483,431. Electric Motor. William M. Dresskell, Brainerd, Minn. Filed June 23, 1891.

483,494. Electric-Railway Conductor. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed Sept. 23, 1886. Divided and this application filed March 23, 1889.

483,506. Test System for Multiple Switchboards. Oro A. Bell, New York, N. Y., assignor to the Western Electric Company, of Chicago, Ill. Filed Sept. 30, 1891.

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ELECTRICAL AGE

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THE CLEVELAND CONVENTION.

Next week, Wednesday the American Street Railway Association will meet in Cleveland in annual convention, and there is every indication that the meeting will be a most successful one. The development of street railways occupy the greater part of the attention of electricians nowadays, and there will likely be a large attendance of electrical people. The exhibition will be a feature of great magnitude and importance, and the latest development in everything pertaining to street railways—electric, horse, cable and otherwise—will be exemplified on this occasion. All of our friends will be welcome at our headquarters at the Hollenden Hotel.

THE EDISON LAMP DECISION.

In our last issue we made a brief announcement to the effect that the Edison lamp case had been decided in favor of the Edison company. This decision, a full abstract of which we give elsewhere, is of vast importance and involves a vast sum of money. It also gives the Edison company the absolute monopoly in the manufacture of incandescent lamps, and places it in a position where it can dictate any terms it pleases to those who wish to continue the manufacture of incandescent lamps. There are several concerns engaged in this work throughout the country, and what will be the practical result of the decision it is too early to say. The Edison company is now unquestionably master of the situation, but we think it would be to its advantage to permit the other companies to continue the manufacture of lamps under license. It will be extremely interesting to note the course of the Edison company in the premises.

WESTINGHOUSE NEW INCANDESCENT LAMP.

Closely following the decision in the Edison lamp case comes an announcement of great importance and interest from George Westinghouse, Jr., to the effect that after December 1 next the Westinghouse Electric and Manufacturing Co., of which he is president, will put upon the market a new incandescent lamp radically different to that known as the Edison lamp. It does not infringe the Edison patents and is itself covered by patents. In a circular issued by Mr. Westinghouse that gentleman states that the new lamp requires no platinum, and is made in separable parts, so that the incandescent burner can be renewed and the bulb and other parts of the lamp used over and over. It is also stated that by means of an important discovery the efficiency of the lamp is increased and its life prolonged, and that by the re-use of the bulbs a saving of from 30 to 50 per cent. will be given to consumers in the cost of lamps.

In view of the vast magnitude of incandescent lighting this announcement possesses an importance that it would be difficult to appreciate. Hitherto the Edison lamp and its relatives, which are practically the same in construction, have held the incandescent field undisputed and uncontested, but it looks now as if it would have a formidable rival to contend with for patronage. If the Westinghouse lamp is capable of fulfilling all the claims made for it, it certainly will find no difficulty in getting a large share of the vast business it is to contend for. Its features, as set forth in the circular and above referred to, are very important ones, and if the lamp proves to be all that is claimed for it the Edison lamp will likely suffer from comparison. Such a lamp as this Westinghouse lamp has been the dream of inventors and electric light men for years, and that the practical solution of the problems involved should have been met at this juncture, when the courts have awarded to Edison all rights touching the incandescent lamp as we know it, is full of the greatest importance. If the Westinghouse company realizes its hopes in regard to this lamp it will be placed on a foundation that will be well nigh impregnable, and we may expect to see a battle of giants in the incandescent lamp field. Matters look extremely interesting, and the advent of this new lamp will be watched for with the greatest concern.

ELECTRIC RECIPROCATING TOOL.

One of the latest applications of electricity to useful purposes is that described and illustrated below. The device is an electric stone-carver, constructed on the reciprocating principle. It is known to the trade as the "Electrical Reciprocating Tool," and was invented by Mr. Wm. P. Carstaphen, Jr., of Denver, Col. It is provided with a reciprocating plunger located and moving within tubular spools of the coils of insulated copper wire, through which an electric current is alternately passed. The current is automatically switched from one coil to the other, and the magnetic force thus produced operates the plunger. The carving tool is attached to the end of the plunger and the rapidity of the strokes is regulated by a button placed on the side of the tool. The stroke can be varied from one-eighth of an inch to one inch and the speed from 300 to 600 strokes per minute. It requires a current of from 4 to 6 volts to operate it, and is therefore perfectly harmless to handle.



ELECTRIC STONE CARVING.

The tool can be used by workmen on scaffolds and elsewhere away from the workshop by obtaining the current from a portable storage battery. These batteries can be made large enough to supply sufficient power for a day's work. With this tool the carver or sculptor, instead of dividing a portion of his attention to striking his chisel, can devote his entire attention to the lines which he is following, thus producing more accurate and rapid work. It is estimated that the machine will produce work in one-fourth the time of hand-work, and therefore a material reduction in the cost will be secured.

The principle of this device can be adapted to an endless variety of uses, and tools of this class can be made to do the most delicate carving or heavy drilling and mine work.

It is an ingenious device, and no doubt will find an extensive use in the art of stone-carving.

Mr. Wm. M. Crane, Park Avenue Hotel, New York city, is the general agent for the company which makes this tool.

THE "SUCCESS" ARC LAMP.

The lamp illustrated and described herewith was designed by Mr. S. L. Phillips, of 120 Liberty street, New York. It is called the "Success" arc lamp, and is the result of efforts on the part of Mr. Phillips to satisfy the demand for an arc lamp more pleasing to the eye than that at present in vogue, particularly where it is to be employed for inside illumination, and at the same time to be equally as efficient and cheap.

The "Success" arc lamp has been especially designed for use on incandescent circuits. It is of compact form, highly efficient, and through the medium of an ingenious device the single 8-hour lamp can be converted into a double or 14-hour lamp. This is accomplished by having the lower carbon-holder hollow and provided with a bayonet tripod cap. As the carbon burns away it is forced upward by a spiral spring beneath it.

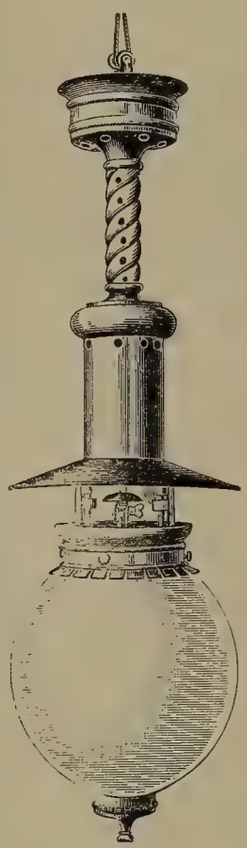


FIG. 1.

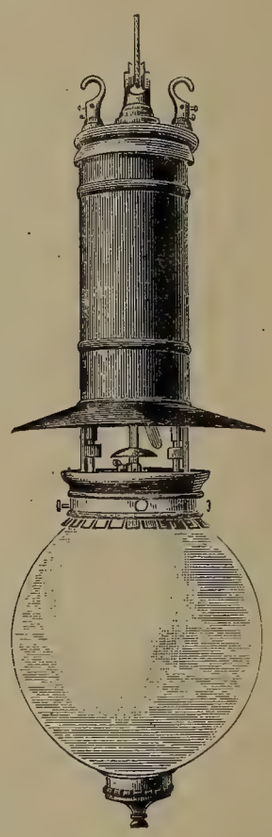


FIG. 2.

The simplicity of the mechanism and absence of compensating springs, weights or dash-pots, are special features of the lamp.

Fig. 1 shows the style of lamp employed for interior lighting, the ordinary length of which is 36 inches; but if desired it can be shortened to 22 inches, without interfering with the time limit of burning—8 hours. Fig. 2 represents the lamp used for outside lighting, and in Fig. 3 will be seen the mechanism.

A simple clock train feeds the carbon-rack, which is raised or lowered by the difference in pull of the main and shunt coils. These coils are arranged one above the other, the carbon-rack passing through the centre of them and the solenoid core. The weight of the solenoid core keeps the carbons apart, and when the current is turned on the shunt coil raises this core—on the lower end of which is a pawl that engages the teeth of the pinion and raises the rack—releases the pinion, and the carbons come together. The main coil instantly divides them and strikes the arc.

These lamps can be wound for any ampèrage, but are nominally wound for 7 to 8 ampères and 45 volts.

They can be operated from the outside wires of an Edison 3-wire circuit singly, two in series, five in series, or ten in series, as desired.

Ordinarily the lamp is wound with its proper resistance, but when it is to be used in connection with isolated plants or electric railway circuits, where there is likely to be a variation in the potential, an extra resistance, equal to the resistance of the arc, is provided, which is automatically cut in to save the shunt coil from being burned out in case the lamp should become extinguished.

Being wound for the voltage at which it is to be used, and entirely differential, it is impossible for the lamp to get out of adjustment. The value of this will be greatly appreciated, as it does away with all necessity for regulation, and as a matter of course, saves the lamp from being damaged by unskilled attendants.

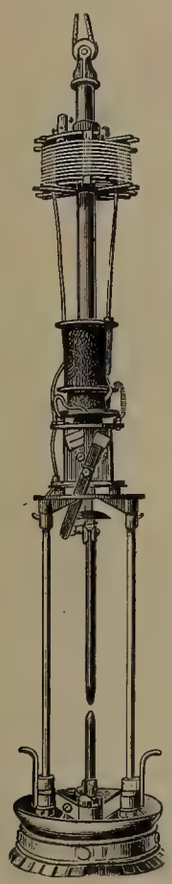


FIG. 3.

Great care has been exercised to have the lamp thoroughly insulated, so as to insure immunity from the handling of exposed parts, and due provision is made to have it protected from grounds. A specially designed and patented snap-switch is provided with each lamp.

Taking everything into consideration the "Success" arc lamp bids fair to become very popular and prove a success in more than name only.

ELECTRICITY, LIGHT AND FIRE.

This is the title of a paper read by Mr. C. C. Haskins, of Chicago, before the meeting of the Fire Underwriters of the Northwest, which was held in Chicago, September 27 and 28 last.

The following is an abstract from his paper:

"There was a time within the memory of man when any old barn, woodshed or cow-house was plenty good enough for an electric-light plant. A wheezy, rickety engine was hunted up somewhere, patched up and put in service. Two, possibly three, boys were set to run the machine, and ten chances to one the whole outfit soon went up in smoke, or down through the sheriff's hands to the unhappy creditors. Is it any wonder that underwriters were chary of electric-light plants, and property through which wires were run helter-skelter by men who knew little of electrical laws, to be inspected by those who knew less? No wonder that the smoke from electric fires blackened the eyes of electrical enterprise and made the underwriter wince with dread. The novices, the schemers, the speculators who crowded the ranks, the half-baked electrician who talked of computators and presented you his business card with 'Electrical Engineer' engraved upon it; these are nearly all gone, and the business has fallen into legitimate, competent hands. Station-houses are better built, wires are more carefully selected, greater pains are taken in construction, the entire enterprise is settling down to business and scientific bases, and in all the larger cities careful supervision of plants has been inaugurated by the underwriters or by municipal authority, or both.

"This examination is far from perfection. The underwriters should join hands and purposes throughout the land, from Bedloe's Island to the Golden Gate, and from New Brunswick to the mouth of the Rio Grande, and demand a proper installation, or refuse a risk on property wherever the hum or the light of electricity is known.

"I have before suggested, and I now repeat, that the underwriter and the fire department should work together for the general good. In every district there should be within easy reach some competent person to whom the electrical inspection of an installation might be confided. It makes a wonderful difference when a plant is in prospect whether an inspection is to follow the installation or not."

DECISION IN THE EDISON LAMP CASE IN FAVOR OF EDISON.

In the United States Circuit Court of Appeals on October 4, Judges Lacombe and Shipman, a decision was rendered in the now famous lamp case of the Edison Electric Light Co. against the United States Electric Lighting Co., which was an appeal from the decision of Judge Wallace, of the Circuit Court, Southern District of New York. The decision was rendered by Judge Lacombe, and is in favor of the Edison Company as was Judge Wallace's decision. It is somewhat voluminous, and we will give only its main points, as much of the ground was gone over in the decision of Judge Wallace.

On Jan. 27, 1880, under an application filed Nov. 4, 1879, letters patent No. 223,898 were issued to Thomas A. Edison, and by subsequent assignments passed to the complainant. The four clauses of the patent are as follows:

1. An electric lamp for giving light by incandesence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires as set forth.

2. The combination of carbon filaments with a receiver made entirely of glass, and conductors passing through the glass, and from which receiver the air is exhausted for the purpose set forth.

3. A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors should be exposed for radiating light as set forth.

4. The method herein described of securing the platina contact wires to the carbon filament and carbonizing of the whole in a closed chamber substantially as set forth.

In the lamp made by the defendant the carbon con-

ductor is not coiled as indicated in the third claim, nor is it secured as indicated in the fourth, nor does complainant contend that either of these clauses is infringed. The Circuit Court holds that the first claim was by its phraseology limited to lamps, in which (among other things) the leading-in wires are secured to the filament according to the method of the patent; that is, by cement carbonized *in situ*, and that as defendant used clamps for this purpose it does not infringe. This construction of the first claim has been acquiesced in by the complainant, which has not appealed from the decision. There remains for consideration only the second claim.

The defendant's burner is of carbon so small in cross-section that by the ordinary usage of common speech it may be fairly called a "filament;" the receiver which contains the burner is made entirely of glass; the conductors which connect with the burner pass through the glass; and from the receiver the air is exhausted. Defendant contends, however, that the specifications of the patent and the prior state of the art require that this second be so limited in construction that defendant's apparatus will not fall within its terms, and that unless so limited such claim is directly anticipated or untenable as not involving patentable novelty.

Lamps devised to give light by means of the electric current are broadly divided into two groups, the arc and the incandescent. In the former two conductors or electrodes are so arranged that when in operation they are slightly separated with their axes in the same vertical line. The current leaps across the intervening space, tearing off and partially vaporizing particles from the opposite ends of the electrodes and developing heat and light in the ends of the electrodes and in the finer particles between them. In order to provide a current that shall be as effective as possible at the place where it develops light, not only the conductors, which bring it from the source of supply, but also the electrodes themselves forming part of the conducting circuit are devised to present but small resistance to the passage of the current. The effective resistance begins when the break in the circuit is reached. In an incandescent lamp there is no break in the circuit, but there is introduced into it a piece of poorly conducting material, which is so arranged that its resistance to the passage of the current will develop heat sufficient to bring it to the state of incandescence. The wires which conduct the current to the place where it is thus developed by resistance are so devised as to present but small resistance to its passage. The effective resistance begins where the piece of poorly conducting material (the burner or illuminant) is placed, and the lamp expires when the burner is consumed, breaks or wears away. The longer the life of the burner the longer the life of the lamp and the more available it becomes for practical electric lighting.

The selection of materials for the various parts of the circuit thus formed, their manipulation, arrangement and operation have for many years occupied the attention of experimenters, and the result of their labors made public from time to time constitute the state of the art of incandescent electric lighting.

The patent sets forth that "The object of the invention is to produce electric lamps giving light by incandescence, which lamps have high resistance so as to allow of the practical sub-division of the electric light." By the phrase "sub-division of the electric light" is meant such a sub-division of the electric current that at several alternating foci supplied from the same source of electricity there shall be developed lines of moderate intensity—comparable to those given out by ordinary gas jets, and the problem to be solved required a system and apparatus which would admit of the development of these moderate lights in sufficient number and at so low a cost as to be commercially useful.

The decision then refers to the state of the art prior to 1879, and to Edison's French patent, and continues:

"In his invention as described in the French patent Edison departed from the existing idea of burners of low resistance, declaring the commercial and scientific necessity of burners of high resistance, although they must be slender and presumably fragile, and attempted to find a method of protecting them from the effects of heat and of the atmospheres. It is said that the theretofore known laws of electricity should have taught every one that an electric incandescent lamp must have a burner of small cross sections and small radiating surfaces. The electric laws have been known and have been recognized, but they did not tell how to protect the materials which would make efficient burners from the destructive effects of other sources than electricity to which they must be subjected; in other words, they did not tell how to construct a lamp. Edison, in his French specification, followed the principle of high resistance to an extreme, made platinum burners with a resistance of 200 to 300 ohms and described the method by which they were to be prevented from speedy deterioration 'by destroying or intercepting the atmospheric action; he freed them from occluded gases by subjecting them to a high degree of electrical heat in a vacuum and subsequently sealed them also in a vacuum.' The platinum lamp did not achieve success. Inasmuch as carbon has a specific resistance from 200 to 400 times that of platinum (hard, dense carbon having a lower resistance than porous carbon), is practicably infusible, had been long before suggested as a translating device and used as such in many of the lamps devised by the prior art, it might be supposed that when one skilled in that art was seeking a substitute for the platinum wire, something which would by reason of high resistance and small radiating suface apply the philosophy disclosed in the French patent, and then admit of operation at a higher temperature without melting, he would have turned to carbon; but the record in this case clearly established the converse of this proposition. Carbon when exposed to the air at a temperature sufficient to produce incandescence undergoes combustion. To remedy this difficulty, earlier experimenters suggested enclosing the carbon-burner in a glass globe from which the air and moisture were to be excluded. These globes were separable, to allow of replacement of the interior parts. We do not find the words 'suitably sealed,' used in the King patent (British, 1845, No. 10,919) to describe a modification of his lamp for use under water, sufficient warrant for the contention that its structure was to be so radically changed as to substitute a light and compact all-glass globe with irremovable burner for the cumbrous apparatus with its column of mercury which he describes in detail.

"Neither the enclosing chamber of Crookes, nor the Geissler tubes, though being all glass with wiring sealed in they would not leak, were used by the prior art to protect incandescent burners. By reason, in part, that that mode of construction with a separable chamber, the vacua which the earlier experimenters sought to secure could not be maintained. Though subsequent improvements in exhaust pumps might give their apparatus a high initial vacuum, it would rapidly disappear in the leaking globe. It was against the oxygen or other carbon-consuming gases that all prior inventors sought to protect the burner, and later inventors tried to accomplish the same result by filling the chamber with nitrogen or some other gas which was inert, *i.e.*, did not combine with the carbon; the carbons themselves were also subjected to processes for making them harder, more tenacious, and series of carbons were arranged to be brought in operation successively without opening the chamber; but one and all of these devices failed to secure stability in the carbon. An operation variously de-

scribed as a 'disintegration,' 'a wearing away,' 'a kind of evaporation,' was soon fatal to the life of the burner. The record abundantly establishes the proposition that so far from turning to carbon for his first burner, which was to have so high a ratio of resistance to radiating surface, one skilled in the art would have been led by the teachings of that art to suppose that this instability would prove fatal to its use irrespective of the size of the burner. Especially is it true that the use of small carbons in the attenuated or filamentary form which Edison had indicated in the platinum patent would not have been thought of. Nor do we find any suggestions of Lane Fox either in his patents (British, Nos. 3,988, 4,043, 4,626, of 1878, 1,122, of 1879), or his other publications, any such appreciation of the cause of the disintegration of carbon or any such supposed method of preventing it as to controvert the conclusion that the art was looking elsewhere than to carbon for the burner, which should have a future. Certainly Lane Fox himself seems to have looked for success rather to his metallic alloys and his compounds operated in nitrogen or other suitable gas than to carbon in a perfect vacuum. The literature of the art fully sustains the statement of Mr. Schwendlar quoted in the *Telegraphic Journal* 1879 that 'we can scarcely expect that the principle of incandescence will be made use of for practicable illumination,' unless there be discovered a conductor without the defects of platinum, and 'which does not combine at high temperature with oxygen.'

"In June, 1878, and January, 1879 (United States patents 205,144 and 211,262), Sawyer-Man indicated one of the causes which operated to produce this disintegration of the carbon, viz., 'that some oxygen or other element for compounds remained in the lamp.' The carbon 'occluding sufficient air or oxygen to render its consumption a mere question of time,' as 'the least quantity of oxygen in a sealed lamp is sufficient to combust an indefinite quantity of carbon.'

"This they sought to remedy by heating the carbon pencils immersed in a hydrocarbon liquid to an extremely high temperature, thus producing a hard and dense carbon and one whose specific resistance was lowered by that very process. They also, while the globe was on the pump and nitrogen flowing into and out of it, heated the 'carbon to incandescence, thus driving out all the impurities and occluded gases which are carried out of the glass by the current of nitrogen.' Believing that the deterioration of the carbon-burner was due to the presence of occluded oxygen which escaped into a sealed chamber and 'promoted combustion,' they sought to secure stability by substituting for the oxygen they had forced out by heating on the pump an atmosphere of nitrogen; that done they sealed their chamber, which seems to have been a separable one.

"Edison had experimented with carbon before he devised the platinum lamp of his French patent. Subsequently to the date of that patent, apparently because that lamp did not seem to promise the success he hoped for, he again turned to carbon. In the course of his investigations he made a discovery as to the causes of 'disintegration,' of which he availed himself to devise a lamp, in which carbon, even in the filamentary form required for a burner, which ratio of resistance to radiating surface was such as to apply the philosophy pointed out in his French patent, could be maintained for a sufficient length of time and become a commercial success.

"At the date of the application for the French patent he had apparently reached only the point that 'pencils (not filaments) of carbon can also be freed from air in this manner and be brought to such a temperature that the carbon becomes pasty, and if it is then allowed to cool it is very homogeneous and hard.' The knowledge that practical stability can be given to a carbon filament was not gained until October, 1879."

The patent in suit is next gone over in detail, and after brief reference to the testimony of experts for the defendant the decision goes on:

"The second claim of the patent is broad enough in its phraseology to cover the invention above set forth—at least when the burner is a carbon *filament*. This last word is not specifically defined in the patent, though therein it appears for the first time in the art. It was a common English word with a meaning sufficiently plain to indicate that the cross section of any article which it was used to qualify must be so small as to be threadlike; and we think a sufficient indication of what that size is would be afforded by an examination of the ordinary threads in common use.

"An examination of the patent, however, indicates its dimensions with more exactness. It is to be fragile, so small in cross sections that, with earlier carbon-rods, its use is a 'reversal of former practice.' One of the substances suggested in the patent to be used as a burner is to be reduced to .007 of an inch in diameter. Ordinary cotton thread, also suggested in the patent, has varying diameters, the largest commonly used being $\frac{1}{64}$ of an inch in diameter; the Patent Office model has a diameter of about $\frac{1}{66}$ of an inch. The evidence fails to satisfy us that the prior art furnished any burners less than twice this size.

"In contradistinction to these earlier burners Edison called his burner a *filament*. The term is apt, and we do not think he was required to specify by thousandths of an inch its precise maximum and minimum. Surely no one could doubt that burners nearly approaching in size the examples of his filament shown in the patent would be filaments, nor that burners nearly approaching in size the earlier of the rod-burners would be rods.

* * * * * * *

"All the experts and all the counsel agree that the words 'carbon filaments,' because the combination of the patent contemplated only the incandescence of a single filament in each lamp. This is correct, but the words thus altered found their place in the claim through no mere clerical error. Maps, though they may be to describe the individual concrete combinations, which were to be protected against infringement, they are illuminative of the efforts of the draughtsman to secure his exhausted all glass-receivers in combination with carbon filaments of all kinds, and he used the plural, omitting the phrases 'of high resistance' and 'made as described,' used in the first claim in order to make sure that he should not, as to this second claim, be confined by construction to any one variety of filament. For this reason the future limitations, which defendant seeks to read into his claim, viz.: That the filament must be one of high specific resistance, or of, at least, 100 ohms resistance, cannot be accepted.

"The second claim may be thus paraphrased.

"The combination of carbon, filamentary or thread-like in size and properly carbonized, used as an illuminant in an incandescent electric lamp with a receiver made entirely of glass and conductors passing through the glass, and from which receivers the air has been exhausted to such an extent that disintegration of the carbon, due to the air washing action of surrounding gases or to any other cause is so far reduced as to leave the carbon practically stable.

"Defendant's lamps are plainly infringements of second claim as thus construed.

"Defendant further contends that the patent is invalid because it does not so describe the lamps as to enable a person skilled in the art at the date of the patent to make a practically useful structure. The evidence of

the witness Howell seems to us a conclusive answer to this contention. He made, as he testified, according to the directions of the patent, and using only processes known to the art before its date, incandescent lamps such as the patent describes, which lasted 600 hours. Defendant criticises this evidence because the witness subjected the filaments made by him to the action of the electric current during the process of exhaustion. But the patent repeatedly directs that the vacuum shall be high and nearly perfect. Sawyer and Man had, prior to the date of the patent, shown that there were occluded in the carbon itself, and in the various internal parts of lamp-chambers, gases and impurities, which are set free by the passage of the current. Manifestly, if they were not removed before sealing, the nearly perfect vacuum would soon disappear. Edison's French patent also details a process for forcing them out of platinum and removing them while exhausting is going on, and a person, who was sufficiently skilled in the art to know of these earlier publications, and was carefully solicitous to conform to the directions of the patent would naturally have resorted, as Howell did, to this method to secure a vacuum free, so far as might be, from the intrusion of such occluded gases. It is contended, however, that this process 'electric heating on the pumps' in effect produces a carbonization of the filament, that it is now used as part of the process of carbonization, and that, therefore, because the patent simply directs that the filaments be 'properly carbonized,' because electrical heating is now used with the understood object of supplementing the work of the carbonizing furnace, because Edison has always thus heated his filaments, and because such additional carbonization is necessary to make a practical lamp under his patent; therefore, he has either purposely suppressed an essential element of his process, or has failed to give the full, clear and exact description of it which the statute calls for. To this proposition we cannot consent. It is immaterial that the philosophy of electric heating on the pumps is better understood today than it was in 1879, so long as the requirements of the patent would not be complied with by one skilled in the art, unless he did in fact so heat the filaments. Whether he heated to carbonize or to secure a nearly perfect vacuum, the result would be the same—an operative lamp produced by following the directions of the patent with the ordinary skill of the art, and that is all the patentee was required to show."

The other defences interposed by the defendant are then briefly noticed, and the decision concludes as follows:

"We do not find in the various contracts introduced in evidence sufficient warrant for holding that the complainant was without such interest in the subject of the controversy as to enable it to maintain the bill in its own name without joining other parties, nor do the facts make out such a case that injunction should be revised on any of the laches or equitable estoppel by reason of undue delay in bringing suit, all acquiescence under infringement.

"The decree of the court is, therefore, affirmed with costs."

DECISION IN FAVOR OF THE BRUSH COMPANY.

In the United States Circuit Court of Appeals, on October 4, a decision was rendered in the case of the Brush-Swan Electric Light Co., of New England, against the Brush Electric Co., in favor of the defendant and appellant, the decree of the United States Circuit Court being reversed.

This suit was brought to enforce a contract by which the Brush-Swan Electric Company acted as exclusive agents of the Brush Electric Company in certain territory.

On May 21, 1878, the Telegraph Supply Company, now known by the name of the Brush Electric Company, the defendant in the case, entered into a contract with Rowley & Montgomery, to whose rights the complainant, the Brush-Swan Electric Light Company, of New England, succeeded. It was accepted as a contracting party, in the place of its predecessor, by the Brush Electric Company on July 12, 1882.

By virtue of the contract of May 23, 1878, and its amendments of June 21, 1880, and February 23, 1882, the Brush-Swan company became the exclusive licensee to sell the Brush Electric company's machines and apparatus within a specified territory. Its business was to furnish local electric companies or manufacturers or individuals who required an extensive plant for electric lighting, with the electrical machinery, apparatus, engines, iron and equipment which they respectively needed, and with the labor necessary to put the same in position, and, as a rule, under a single contract for an entire plant. It bought from the Brush Electric company its machines at a discount from the price which was fixed by the manufacturer of at least twenty per cent., and was to accept drafts therefor payable in seventy-five days from delivery of the machinery at Cleveland and to pay the drafts at maturity. The agreement was to continue for seventeen years from April 24, 1877, unless sooner abrogated by mutual agreement or by the decision of arbitrators. The 9th article provided as follows:

"Ninth. If at any time the pecuniary responsibility of the party of the second part become so impaired as not to be sufficient to enable the party of the first part to safely transact their business in said territory through them, then this contract may be abrogated, provided that the question of the aforesaid pecuniary responsibility of the party of the second part must first be determined by the board of arbitration hereinafter named."

If the Brush Electric company sold its machinery within the specified territory, it was to pay the Brush-Swan company the stipulated discount or commission thereon, which thus became, as a rule, the exclusive purchaser from the manufacturer of its apparatus for use within such territory. It and the manufacturer had the exclusive right to sell, and it could be therefore styled an agent, but it was not an agent upon a *del credere* commission; its contracts with its customers were contracts to furnish an entire plant, and it bought like any other purchaser from the Brush Electric company upon its own credit.

On October 27, 1887, the Brush Electric Company declared the contract abrogated and annulled, and refused to deliver apparatus to the Brush-Swan company, or to fill its orders. To compel a specific performance of the contracts this suit was thereafter instituted by the Brush-Swan company.

In the decision the court says:

"The decision as to the propriety of the defendant's act in annulling the contract turns upon questions of fact, which relate to the extent of a modification of the conditions of the original agreement in regard to the time of payment. If these conditions were substantially unmodified, they were not complied with by the Brush-Swan company, and its part of the contract was persistently left not performed, but if they were modified so that the complainant was not required to pay for its purchases until it collected from its own customers, it did not violate its contract, and was not guilty of any substantial breach, so far as is disclosed by the testimony. The Circuit Court was of opinion that the contract was modified to the extent and in the particulars which have been indicated. This is the crucial point in the case."

The financial prospects of the Brush-Swan company at its inception, and the resulting friction between the two companies on account of these expectations not being realized are then considered at length. Finally an arbitration was called for by the Brush Electric company, in technical compliance with the conditions of the ninth article of the contract. The complainant made no reply in regard to arbitration, and on October 27 the Brush Electric company declared the contract abrogated, and thereafter refused to fill orders sent by the Brush-Swan company.

"The fact that the call for an arbitration was placed by the Brush Electric company upon the refusal of the other party to furnish security," continues the decision, "is criticised by the complainant upon the ground that the contract did not compel the complainant to give security for the performance of its undertaking. This criticism would be a just one if the conduct of the Brush-Swan company in the violation of its agreement had not been such as to fully justify the Brush Electric Company in declaring the contract at an end.

* * * * * * * * * *

"In our view of the testimony, the complainant is asking a court of equity to compel the specific performance of a contract which it has not kept, which it cannot truthfully assert that it will keep, and which apparently it cannot help violating, and desires to compel the defendant to furnish it with merchandise which it cannot pay for, and the ultimate payment for which it cannot attempt to secure.

"The decree of the Circuit Court is reversed, and the bill is directed to be dismissed, with costs in the Circuit Court and in this court."

The decision was rendered by Judge Shipman.

DECISION IN THE BRUSH STORAGE-BATTERY CASE.

Judge Shipman, in the United States Circuit Court of Appeals for the Second District, on October 4 handed down a decision in the case of the Electrical Accumulator Co. and others, appellants and defendants, against the Brush Electric Co., appellee and complainant.

This was an appeal from the decision of the Circuit Court for the Southern District of New York, which enjoined the Electrical Accumulator Co. from infringing on certain specified patents owned by Brush, relating to secondary batteries.

Patent No. 337,299 is considered by the court as the one having the greatest bearing on the case. It relates to an improvement upon the Planté battery and upon no other.

Brush's secondary battery is Planté's secondary battery improved, says the decision, and his language is to be read in the light of that fact and the fact that he was speaking only of a current-storing device. It, therefore, serves no useful purpose to show that the Brush patent was anticipated, because some pre-existing scientist had described a battery which corresponds with the general phraseology of the claims, provided their language should be so construed as to include the class of batteries which has been mentioned, a construction which is forbidden by the history of the invention and a disinterested examination of the patent.

Regarding patent No. 266,090, the court holds that the broadening of the scope of the patent by the insertion of new matter while the patent was pending in the patent office, should not have been allowed by the latter, and hence it takes a narrower view than that held by Judge Coxe, of the lower court, who found an infringement by the defendants of two claims only. As construed by this court there is no infringement of patent No. 266,090.

The decree of the Circuit Court is modified in accordance with the directions contained in the decision, with costs to the appellants. In other respects the decree of the lower court is affirmed.

GROUNDING THE NEUTRAL WIRE.

On the 10th of March last, at a special meeting of the New York Board of Fire Underwriters, resolutions were passed to the effect that (1) all electric companies furnishing current for power and light to parties holding certificates of approval of electric equipments from the board, shall make regular weekly reports of the tests of their circuits, as called for in the requirements of the board; (2) that the intentional grounding of any portion of the equipments on the part of electric companies is a violation of the rules of the board, and requesting that such practice be discontinued, and (3) that electric companies should remove existing grounds on or before October 1, 1892.

The board further directed the superintendent of the survey department to decline to grant certificates or make inspections of equipments supplied with current by any company who disregarded these rules.

The Edison Electric Illuminating Company did not remove the ground from the neutral wire, holding that it was not a dangerous practice, notwithstanding the decree of the Board of Fire Underwriters to the contrary, and have not made the weekly reports of tests required by the resolutions of the board, on the ground that it was impracticable for it to do so.

Therefore, when the board's order regarding the grounding of wires went into effect on October 1, the Edison company still continued the practice of grounding the neutral wire. Since then holders of policies who use the Edison currents began to feel anxious about the validity of their insurance. The matter was finally brought to a head by a large retail dry-goods house asking its insurance broker on October 3 if its contemplated electric-light displays on the outside of the building during the Columbus celebration would invalidate its insurance policy. The reply was to the effect that the survey department of the Board of Fire Underwriters would hereafter "decline to make any inspections of equipments made by the Edison Illuminating Company until that company notifies the board that it has complied with the rules of safety." This reply revealed a somewhat alarming state of affairs, and the result was that on October 4 a conference was held between President Johnson, of the Edison Company, D. O. Mills, a director of the same company, and William A. Anderson, superintendent of surveys of the Board of Fire Underwriters, and Professor Henry Morton, of Stevens Institute, who is the board's expert.

The conference was of an amicable character, and at its close Mr. Johnson expressed the opinion that it was possible for the Edison company to make a proposition to the underwriters which would be acceptable to them immediately.

President Kennedy, of the Board of Fire Underwriters, was very hopeful of an amicable settlement of the difficulty.

"The previous arrangement," he said, "will hold good until a final settlement is effected. The disposition of the board is to afford every possible accommodation to the property owners using the electric system of the Edison company, and the board will extend the time during which it will continue to inspect and approve the Edison equipment to such time as the present negotiations are completed."

The matter now stands where it has stood for the past

year, and there is no cause for alarm or a suspension of illumination arrangements.

In an interview by a representative of the ELECTRICAL AGE with Mr. James W. Pryor, the secretary of the Edison company, regarding the situation, that gentleman said that the Board of Fire Underwriters did not fully appreciate the electrical conditions involved. In the opinion of the practical men in the company and its experts the removal of the ground was undesirable. Large experience and the theory of many electricians proved that the grounding of the neutral wire was altogether desirable. It was not reasonable to suppose, he said, that a company that had invested millions of dollars in its plant was going to adopt a course of action that would cause injury to itself and to those who depended upon it for its products. He thought that the vast experience of the company combined with theoretical considerations outweighed the mere theory of the Board of Fire Underwriters. In England, he said, although the grounding of wires was forbidden, the electric-light business has increased to such an extent that the companies were seriously considering the advisability of adopting the practice. In Berlin the Edison company had recently adopted the grounding of the neutral wire, and in the New England states the insurance authorities approve of the practice. "Statistics," he said, "do not support the position taken by the Board of Underwriters. And they do not assert that our system of wires is the cause of a large proportion of fires. On the contrary, our percentage of fires is very small. Our statistics are made up from the reports of the fire marshal for 1890 and 1891. In 1890 there were thirty-seven fires in buildings in which there were electrical installations. The loss amounted to $126,310, including the fire in the Western Union Telegraph Building, where the loss was $65,000, and caused undoubtedly by overcharged telegraph wires. Nine of these buildings were illuminated by this company, but high-tension companies also had wires in two of these buildings. In 1891 there were fifty-nine fires in buildings where there were electrical installations. The total loss was $70,116. Our wires were in six of these buildings, where the loss was $6,000. High-tension illuminating companies also had wires in two of these buildings.

"In view of these facts, theory should not play much of a part; we want practical workings. We claim that this ruling is a hardship, and that it is a practical impossibility for us to remove our ground. Our company has a vast system, and supplies four great districts: the office district down-town, the dry-goods district, the retail district and the best part of the residence district. Our clients are business men, and the officers of this company are practical business men. It is not likely, therefore, that they would pursue a course that would injuriously affect their interests."

Regarding the requirement of the board that weekly reports of insulation tests of circuits shall be made, Mr. Pryor said that his company had no circuits, and therefore the report must cover the whole street system if at all. The company had been hard at work for five months on a report and it was not completed yet.

The Edison Electric Illuminating Company now has 180 miles of ducts and 500 miles of conductors in use.

RECEPTION OF FIRE CHIEFS.

The New Gaynor Electric Co., of Louisville, Ky., gave a reception to the visiting fire chiefs in that city at its exhibition hall, 521 to 527 Third street, on Wednesday, Oct. 5. The company got up a neat aluminum medal in commemoration of the 20th annual convention of the N. A. F. E., which was held in Louisville, Ky., Oct. 4, 5 and 6 last. The officers of the company are: H. F. Donigan, president; Jo Meyrick, secretary; and J. W. Dawson, superintendent.

ELECTRICITY VS. STEAM ON RAILROADS.

The modern passenger locomotive, for high-speed trains, says George Westinghouse, Jr., in the *Railroad Gazette*, must be capable of developing at least 1,200 H. P., and it costs about $10,000; that is, the engine, boiler, feed-pumps, steam piping and everything necessary to produce motion cost about $8 per horse-power. For the operation of a train by electricity, in place of one steam locomotive there would be required the following principal items, costing, according to present prices of electrical apparatus, approximately the figures set opposite:

A stationary steam-boiler, 1,600 H. P.	$16,000
A stationary engine, 1,600 H. P.	18,000
An electric generator, 1,600 H. P.	25,000
Motor for locomotive, 1,400 H. P.	22,000
	$81,000

In addition to the above there would have to be added the proportionate cost of the buildings and outside electrical construction for the transmission of the electricity from the generator to the locomotive.

There are innumerable places where electrical power will profitably supplant the steam-engine, but I feel confident that the above figures, or any modification that may reasonably be expected, will be a most serious obstacle to the utilization of electricity for moving standard railroad trains, even provided all of the mechanical details necessary for the transfer of electrical energy of 1,200 H. P. from a stationary to a moving object shall be satisfactorily worked out.

LEGAL.

MECHANICS' LIENS.

In the recent case of the Badger Lumber Co. *vs.* the Marion Water Supply Co., the Supreme Court of Kansas held that an electric-light company having a franchise to occupy the streets is not so distinctively public in its nature and operations as to exempt its property from the application of a statute relating to mechanics' liens. The court said: "The general rule is that the public property of a municipal corporation is not subject to seizure and sale, and it is generally held that a mechanic's lien cannot be enforced against property which is not subject to sale on execution. The reason for this exemption is that such corporations are instrumentalities of the government itself, and the seizure and sale of the public property would interrupt and suspend the functions of government, and also that other provisions have been made by law for the collection and payment of public obligations. Corporations, however, such as the one claiming exemption here, although they serve the public convenience to some extent, are not organized merely for public advantage, but are operated largely for the private benefit of the incorporators. In this state such corporations may mortgage or sell their property, and the general rule is that property of a corporation which may be sold under a mortgage or specific lien given by the owner may be subjected to a mechanic's lien. If a corporation may, by its voluntary act in creating a specific lien, subject its property to seizure and sale, it is difficult to find any substantial objection in allowing and enforcing the claim of a laborer or material man against the same property under the mechanics' lien law."

Transformers should never be placed against metal, such as tin roofs or metal-shingled walls, as there is always danger of a "ground" on one side of the line, and consequent trouble.

ELECTRIC CRANE.

The value and utility of electric cranes in machine-shops where heavy machinery and castings are handled are becoming more and more recognized, and in all first-class works these valuable machines will be found.

We give herewith an illustration of an electric travelling crane in the recently completed erecting-shop of the E. W. Bliss Co., Ltd., 17 Adams street, Brooklyn, N. Y. This crane is operated by three electric motors, which are manipulated by one man by means of a wheel for each. The operator stands on the platform shown at the left-hand end of the crane, where the three wheels used in operating the motors may also be seen.

The span of the crane is 48 feet and the limit of its longitudinal travel is 96 feet. The machine has a lifting and carrying capacity up to 25 tons, and the motors can be used simultaneously, so that the lifting, and the transverse and longitudinal movements can be accomplished at the same time. This arrangement renders it a matter of great facility to pick up castings and machines at any one point in the shop and carry them to any other point, and the work is, besides, done with great speed and accuracy.



ELECTRIC CRANE IN ERECTING-SHOP OF THE E. W. BLISS CO., LTD.

This machine was designed by the Morgan Engineering Co., Alliance, Ohio, and is said to be giving the best of satisfaction in its operation.

The E. W. Bliss Co. is well known in the trade as manufacturer of presses, dies and special machinery. It also operates the works of the Stiles & Parker Press Co.

NEW BOOKS.

RECENT PROGRESS IN ELECTRIC RAILWAYS, by Carl Hering. W. J. Johnston Co., Ltd., New York. Price, $1.00.

This book gives a summary of current periodical literature relating to electric-railway construction, operation, systems, machinery, appliances, etc.

The electric-railway industry is one that is undergoing constant and rapid improvement and constant change, consequently progress in this direction can only be recorded in periodical literature and not in books.

This work is a compilation of such articles and brings the subject down to date. The book has twelve chapters, 389 pages and 104 illustrations. Many valuable statistics are given concerning electric railways, and the merits and demerits of the overhead, conduit, surface conductor and storage-battery systems are quite completely considered. The various underground tunnel systems and high-speed interurban railroads are described, and altogether the book will be of great value to all interested in electric railways, as it gives a good deal of groundwork for calculations touching future projects. It gives the latest facts and figures that are available—in fact, it crystallizes into one little volume the vast amount of literature that has in the recent past been published on the subject in the many but scattered electrical periodicals. It will be found a valuable book for reference.

HOW ELECTRICITY IS MEASURED.*

BY HERBERT LAWS WEBB.

In the various, or one might say multifarious, methods devised for the execution of electrical measurements of different kinds, use is made of the three effects of electricity described above—electro magnetism, electrolysis, and heat. The primogenitor of all electro-magnetic measuring instruments is the galvanometer. In its simplest form the galvanometer consists of a coil of insulated wire in the centre of which is pivoted a magnetized needle. To the spindle which carries the needle is attached above the coil a light metallic pointer which moves over a graduated scale. The more delicate the balance of the needle and the greater the number of turns of wire in the coil the more sensitive the galvanometer. The most sensitive type of galvanometer is that invented by Sir William Thomson, in which the needle is very small and is attached to a tiny mirror about the size of a dime ; the mirror and needle are suspended within the coil of wire by a single silk fibre, and a spot of light, reflected by the mirror from a lamp back to a paper scale placed about three feet from the instrument, serves as the pointer. The slightest movement of the needle is accompanied by a very appreciable deflection of the spot of light on the scale. This instrument was designed originally for transmitting signals through the Atlantic cable, and it was used on all long cables for many years, until the siphon recorder, which marks the signals on a continuous strip of paper, replaced it.

The galvanometer is used in making electrical measurements both by comparison and directly. For instance, in measuring the resistance of a wire a current is sent through the wire to be measured and through a set of standard resistance coils whose resistance is known and can be adjusted at will. The current has two paths open to it, one along the conductor whose resistance is to be determined and the other through the coils whose resistance is known. The galvanometer is so connected that it will show by the deflection of its needle which path absorbs the most current. As we have seen already, the flow of current is proportional always to the resistance of the circuit, so that what must be done is to vary the resistance of the adjustable coils until the galvanometer needle remains stationary. That will indicate that the current flowing through the two paths is equal ; therefore the resistance of those two paths must be equal, and as the resistance of the adjustable coils is known, the resistance of the conductor is found by reading off the number of ohms in circuit when the balance is obtained. This is one of the simplest of electrical measurements and can be performed with extraordinary accuracy, the resistance of conductors being determined down to one ten-thousandth of an ohm. The method of carrying it out can be compared to the simple act of weighing. The balance takes the place of the circuit having two branches, the pointer being the galvanometer at their junction ; the material to be weighed is the unknown resistance and the weights the adjustable coils whose value is known, the attraction of gravity supplying the place of the current which permits the comparison to be made. The weights are adjusted until the pointer shows equality (just as the coils are adjusted until the galvanometer needle remains at zero), and the weight of the substance is then known by the value of the weights used in obtaining a balance.

In many cases electrical measurements are made by comparison with standard values, as in the example just given, the galvanometer being the indicator which serves as a means for establishing the comparison. In measuring electrical pressures, for instance, comparison is made with a standard cell whose pressure or electromotive force is known. Direct methods of measurement are also available, and of course for the commercial measurement of electricity it is obviously necessary to employ instruments which shall give direct indications. The relations between the volt, the ohm, and the ampére being fixed and immutable, it is plain that, any two of the three values being known, the other can be determined. If of any circuit in which a current is glowing we know the resistance (in ohms) and the pressure at the source of electricity (in volts), we can arrive at the current strength in ampéres by dividing the volts by the ohms. Similarly, if we know the resistance and the current strength, we get the pressure by multiplying them together. There is an almost endless variety of laboratory methods for measuring electrical pressure, current strength, and resistance, all employing a galvanometer of some kind and a standard of comparison by which to establish the values of the unknown quantities.

Coming to the commercial measurement of electricity, it is obviously necessary, as has just been said, to provide instruments which shall indicate directly the values required to be known without manipulation or recourse to standards of comparison. In a central station those in charge must be able to know at any time what is the pressure on the circuits and how much current is being consumed by the lamps or motors. In most systems of distribution an unchanging pressure is maintained and the current varies according to the number of lamps or motors that are connected to the circuit. In other systems exactly the reverse takes place, the current being the constant element and the pressure the variable one. The power drawn from the station is in any case equal to the product of the two factors, and it varies continually as consumers turn their lamps and motors on and off. Consequently, in order to know what their machinery is doing, the attendants at the central station must have direct-reading voltmeters and ampéremeters, which will indicate at any moment the pressure on the circuits and the amount of current flowing into them.

At the consumer's house or office a meter is required which will indicate the amount of electrical power supplied to his lamps or motors during any given period of time. This meter, unlike the central station measuring instruments, which can be arranged so as to be switched in and out of circuit at will, must be connected permanently in the circuit so that it will record continuously the power that is supplied to the group of lamps under its surveillance. These electric meters, when designed for use on circuits where the pressure is kept constant, as for instance in the low-tension system of electric lighting, simply register the amount of current consumed by the lamps; the pressure being known, the amount of power consumed is readily arrived at. If on a 110-volt circuit a consumer has used 2,000 ampéres of current in a month, the amount of power used is 220,000 watts, or 220 kilowatts.

In the design of direct-reading or recording electrical measuring instruments the various effects of the electric current have been utilized in many different manners. The larger proportion of commercial measuring instruments, however, depend on electro-magnetic mechanism for their action; that is, on the effect of the current on a coil placed within the influence of a permanent magnet, or *vice versa*. In other words, the family of electro-magnetic voltmeters and ammeters are descendants of the galvanometer previously described. The construction of these instruments is comparatively complicated and involves a high degree of mechanical and electrical knowledge and skill and the most scrupulous use of the best material obtainable. Every instrument turned out is most carefully tested and calibrated by standards kept in the laboratory, and their readings, which are given by a pointer moving over a dial or curved scale, are generally accurate to within a fraction of 1 per cent.

* Abstract from *Engineering Magazine* for October, 1892.

ANNUAL MEETING OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The second annual meeting of the American Electro-Therapeutic Association was held at the New York Academy of Medicine, 17 West 43d street, on October 4, 5 and 6, and was in every respect an unqualified success. The attendance was large and included many well-known electrical people, and the social features of the convention were notable events. Manufacturers and dealers in electrical apparatus had quite large exhibits of their goods, and this feature was a marked success.

The meeting was called to order at 10 A. M., Tuesday, President Dr. W. J. Morton in the chair.

President Morton's address dwelt particularly on the growing importance and use of electricity as a curative agent.

At the conclusion of the address the committees on standard coils, standard meters, and of arrangements, made their reports, after which a paper was read by Dr. A. D. Rockwell, of New York, on "The Use and Abuse of Electricity in Medicine." This was followed by two other papers, viz.: "New Contributions of the Electrical Treatment (both Faradic and Galvanic) to the Diagnosis in Gynæcology," by Dr. G. Apostoli, and "A New Treatment of Prostatic Hypertrophy," by D. G. Betton Massey, of Philadelphia.

At the afternoon session the subject of "Electric Cataphoresis and its Practical Application as a Therapeutic Measure" was discussed in its various phases. Mr. A. E. Kennelly, chief electrician of the Edison laboratory, and Prof. E. J. Houston, of Philadelphia, in papers discussed the Physics of Cataphoresis; Dr. W. J. Morton considered its uses in General Medicine; Dr. Augustin H. Goelet, of New York, took for his portion of the discussion "Its Uses in Gynæcology," and "Its Uses in Nervous Diseases" was considered by Dr. Fred'k Peterson, of New York.

At the close of the discussion two papers were read, one on "Stable Electrodes—Old Materials Newly Arranged," by Dr. R. J. Nunn, of Savannah, Ga., and the other by Dr. C. Eugene Riggs, of St. Paul, Minn., on "The Value of Voltaic Alternatives in Optic Nerve Atrophy."

At the evening session the following papers were read: "The Present Status of Electrolysis in the Treatment of Strictures," by Dr. Robert Newman, of New York; "Some Phases of Neurasthenia and their Treatment," by Dr. W. F. Robinson, of Albany, N. Y.; "Rotary Transformers for Medical Use," by Dr. R. L. Watkins, of New York, and "A Contribution to the Electrical Treatment of Cystic Goitre and Hydrocele." Also "A Note on Psoriasis," by Dr. Chas. R. Dickson, of Toronto, Canada.

After the adjournment the doctors went to the Electric Club, where a reception was tendered them. There was a large and brilliant attendance, and a supper was served. The affair was a most pleasant one, and the doctors were delighted with their reception.

On Wednesday the doctors were ready for business promptly on time, and at the morning session they listened to papers from two shining lights in the electrical firmament—John J. Carty, electrician of the American Telegraph and Telephone Co., New York, and Mr. A. E. Kennelly, chief electrician at the Edison laboratory. The following papers were read at the morning session: "The Need of Greater Simplicity and Uniformity in Electro-Therapeutic Apparatus," by Dr. W. J. Herdman, of Ann Arbor, Mich.; "Medical Electricity from an Electrician's Standpoint," by John J. Carty, vice-president New York Electrical Society; "Anæsthetical Electricity," by Dr. Wm. F. Hutchinson, of Providence, R. I.; "Some Physiological Experiments with Magnetism at the Edison Laboratory," by Dr. Frederick Peterson, of New York, and A. E. Kennelly, of the Edison laboratory, and "The Effect of Electrolytic Action in the Removal of Certain Neoplasms," by Dr. D. S. Campbell, of Detroit, Mich.

In his paper Mr. Carty thought that doctors would agree with him that it was desirable for the advancement of the science of electro-therapeutics that there should be a thorough understanding between electricians and physicians. The understanding should be in the matter of terms used to designate different electrical effects.

There were Faradic, Galvanic and Franklinic currents all in the electro-medical vocabulary, of which distinctions were not accepted by practical electricians. The word Faradism was undoubtedly based on Faraday's discovery of the generation of an electric current by plunging a magnet into a coil of wire. This was the fundamental principle of the dynamo and motor, also the telephone. The term Faradic current was not used in connection with these apparatus.

He discussed the use, or rather the misuse, of the words Galvanism and Franklinism in like manner, and said that these terms and Faradism related to difference of degree only.

Prof. Houston's paper was an interesting one. Cataphoresis, he said, was the introduction of drugs or medicaments into the body by means of electric currents. He then explained the various applications of this principle, and deeply interested his hearers.

At the afternoon session on Wednesday a discussion took place on the "Relative Fœticidal Value of the Galvanic and Faradic Currents in Ectopic Gestation;" after which papers were read on "The Treatment of Salpingitis by Depletion and Drainage Secured by Electricity," by Dr. Augustin H. Goelet, of New York, and "The Negative Pole of the Galvanic Current an Aid to Uterine Development, with Cases," by Dr. Charles G. Canaday, of Roanoke, Va.

On Wednesday night a very interesting lecture was given by Dr. J. Mount Bleyer, of New York, on "The Phonograph and Micro-Phonograph," with illustrations, and later the members attended a reception given by the resident members of the city of New York. This was an extremely pleasant affair and all enjoyed themselves.

On Thursday at nine o'clock the members, on invitation, visited the Telephone Exchange, and at ten o'clock they convened for business. Three papers were read in the morning on subjects of deep interest to the doctors, but of no interest whatever to the general reader; and at the evening session two papers of similar character were read.

In the afternoon many of the members availed themselves of the invitation to visit Mr. Edison's laboratory in Orange, N. J., and those who went felt amply repaid for the journey. They were well received and shown everything of interest in that celebrated building.

On Friday a lawn party was given by Dr. Chavoir, at his sanitarium, Stamford, Conn. The members of the party were deeply interested in this celebrated establishment.

The following is the list of officers elected for the ensuing year: President, Dr. Augustin H. Goelet, New York; first vice-president, Dr. W. F. Hutchinson, Providence, R. I.; second vice-president, Dr. W. J. Herdman, Ann Arbor, Mich.; secretary, Dr. M. A. Cleaves, New York; treasurer, Dr. R. J. Nunn, Savannah, Ga. Executive committee: Doctors W. J. Morton, New York; G. Belton Massey, Philadelphia; Robert Newman, New York; Charles J. Dickson, Toronto, Can.; J H. Kellogg, Battle Creek, Mich. Committees on arrangements, standard coils, standard meters, static machines, constant-current generators and controllers, and on electrodes, were appointed.

Philadelphia was selected as the place for the next meeting, which will be held on the Tuesday following the meeting of the Pan-American Congress.

EXHIBITS AT THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION CONVENTION.

A very fine display of electro-medical apparatus was made in the room adjoining that in which the meetings of the American Electro-Therapeutic Association were held last week.

J. H. Bunnell & Co., 76 Cortlandt street, New York, was represented by Mr. Hubert J. Kelly and a full line of new style, No. 4, "double-decker" Home electro-medical apparatus. These outfits have a cell of dry battery for their operation, are very simple, compact, efficient, and always ready for use.

The McIntosh Battery and Optical Company, 141 and 143 Wabash avenue, Chicago, had an extensive display of electrodes and cabinet batteries. A large Töppler-Holtz static machine was operated by an electric motor, and produced a spark over an inch in length. Two devices for using Edison currents for cautery and electrolytic work were also exhibited. It is said that this company is the largest manufacturer of electro-medical apparatus in the country. The exhibit was in charge of Mr. C. S. Neiswanger. Mr. C. Alfred Smith, the secretary of the company, was also present. Oelschlager Bros., 42 East 23d street, New York, are the New York representatives of this concern.

The Jerome Kidder Mfg. Co., 820 Broadway New, York, had an attractive display of cabinet and faradic stand outfits of different styles and various instruments. Among the latter were keyboards, high-tension coils, instruments for application, milliammeters, electro-cauteries, etc. The company was represented by T. F. Livingston and C. M. Aitkins.

The Edison Manufacturing Co., 110 East 23d street, New York, had a large and attractive exhibit, including an Edison galvanic cabinet for office work with 50 cells type C Edison-Lalande battery, a new cautery outfit, cautery instruments, one of the new Edison fan-motors, a time-switch for controlling the operation of electric lamps or other electrical apparatus, and a new cautery rheostat. The new cautery outfit is of very low price. One charge of the batteries will last one year without any attention whatever. It is claimed to be the most complete, economical and efficient cautery battery on the market. Mr. E. M. Smiles was in charge. Mr. J. W. Gladstone was also present on the opening day.

The Ozone Mfg. Co., 47 and 49 Liberty street, New York, showed one of its ozone machines in practical operation. Mr. A. Roloson explained the operation of the apparatus.

J. C. Vetter & Co., 104 East 23d street, New York, had a very attractive display of their well-known electro-medical apparatus. One interesting piece of apparatus shown was the incandescent lamp tapper. This device is, as its name implies, a "tapper." An incandescent circuit can be tapped and the current taken wherever needed, by means of ordinary conducting cord. It can be attached to any lamp socket, and binding-posts are provided for the insertion of the wires of the tap circuit. The display also included carbon current-controllers, dry battery cells, complete medical outfits, new portable dry-battery outfits, each operated by one of the firm's well-known dry cells "M. B." storage batteries, a photophore outfit, etc., etc. The range of application of the carbon current-controller was shown in connection with an incandescent lamp, which could be set at any desired degree of luminosity. The exhibit was in charge of Mr. A. F. Vetter.

Waite & Bartlett Mfg. Co., 143 East 23d st., New York, showed two static machines and a cabinet outfit.

The W. F. Ford Surgical Instrument Co., 315 5th ave., New York, occupied a prominent position in the centre of the room and had a very full display of its goods Among the many things seen were storage-battery medical outfits, a bullet probe, electric saw, portable electric and motor outfit, cautery electrodes and various styles of portable battery outfits. The exhibit also included a motor-dynamo, made by the C. & C. Electric Motor Co., of this city, which is used for the production of current for cautery work, drilling, etc. Mr. H. H. Shrope was kept busy explaining the various devices.

The Galvano-Faradic Mfg. Co., 300 4th ave., New York, was represented by a large line of its standard electrical apparatus for medical use. The battery outfits of this company are very compact, and they are complete and efficient. They include combined galvanic and faradic batteries, upright cabinet batteries and wall cabinet batteries. The exhibit was a complete one.

The Law Battery Co., 85 John street, New York, exhibited a Law cabinet electro-therapeutical outfit, under the charge of Mr. W. G. Peaslee.

O. Flemming, 1,009 Arch st., Philadelphia, had a large display of electro-medical apparatus, including combination galvanic and faradic outfits, galvanic current controllers, milliammeters, portable faradic batteries with different secondary coils, electrodes, etc. Mr. Flemming's interests were looked after by Mr. J. Beuter.

A NEW INCANDESCENT LAMP.

The following important announcement has just been made by the Westinghouse Electric and Manufacturing Company:

OFFICE OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.,

PITTSBURG, PA., Oct. 6, 1892.

TO USERS OF INCANDESCENT ELECTRIC LAMPS:

In order that no one may be misled by the statements of the owners of the Edison patents with regard to the effect of the recent decision of the United States Circuit Court of Appeals for the Southern District of New York, sustaining the second claim of Mr. Edison's incandescent lamp patent (the other three claims having been held by the Court not to be infringed), we beg to announce to our customers and to users of incandescent electric lamps generally, that we are prepared to receive orders for the delivery in quantities, after December 1, of our new incandescent lamps, the manufacture of which has been established at our Pittsburg factory.

These lamps not only do not infringe the Edison patent above referred to nor any of the patents of other companies, but they are fully covered by patents of our own.

The new lamp differs radically from those now in use. It requires no platinum and is made in separable parts so that the incandescent burner can be renewed and the bulb and other parts of the lamp used over and over. Furthermore, by means of an important discovery, the burner is rendered stable, its efficiency increased, its life prolonged, and its normal candle power maintained.

The manufacture of these lamps will be carried on almost entirely by machinery, and the first cost thereby considerably reduced, so that, with the advantages obtained from the re-use of the bulbs, a saving of from 30 to 50 per cent. to consumers in the cost of incandescent lamps for a given service will be effected.

These lamps are in appearance a decided improvement over those now in use, and when used with a new socket designed for the purpose, a further reduction in the cost of lamp renewals will be effected, as no base attachment is required to make the connection with the socket.

We are prepared to make advantageous time contracts

with the users of incandescent lamps, with important allowances for the return of the bulbs to our factory.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. By GEORGE WESTINGHOUSE, Jr., President.

There is no ambiguity about this announcement. It is a disclosure of an invention quite as important at this time as was that of the Edison incandescent lamp at the time of its birth. This announcement is doubly important just now, coming as it does right on top of the decision of the lamp suit in favor of the Edison company, and as the Edison and Westinghouse interests are widely different, it does not require any great stretch of imagination to foresee the result of this turn of events.

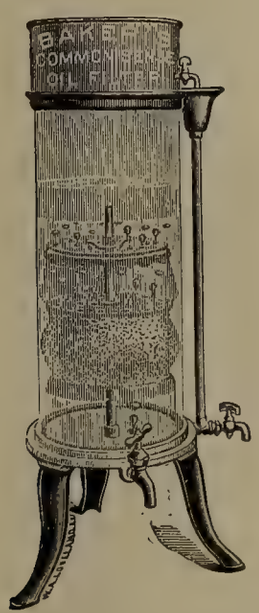
BAKER "COMMON-SENSE" OIL-FILTER.

While every one using oil freely realizes the great saving instituted by an oil-filter, many filters are a long way from giving satisfaction. Either they become clogged and refuse to filter or else the dirt comes through with the oil.

Although the Baker "Common Sense" filter shown in the accompanying illustration is simple and inexpensive, it will thoroughly clean oil for any length of time. Its users speak highly of its simplicity, the small amount of care it requires, and the extreme amount of saving it effects in oil.

More than 3,000 of these filters are now in use among the best firms in the land.

The filtering medium is all submerged in water and occupies the upper portion of two bell-shaped glasses.



"COMMON-SENSE" OIL-FILTER.

The oil to be filtered is put into the tank on top of filter, and is fed down through the side pipe, entering the filter at the bottom near the centre. Oil being lighter than water, immediately rises through the water, and accumulates beneath the filtering material, being enclosed by the bell. By capillary attraction and its gentle pressure upward from its lighter gravity, the oil gradually goes up through the filtering material in the lower glass bell, and is caught and required to pass through the upper one in the same manner, the clean oil accumulating on top of the water, and is drawn off at the front faucet, which communicates with the central pipe.

The side faucet is to draw off the water.

By means of the water the gravity of the oil is reversed and diminished to less than one-tenth. Hence it has only a very slight tendency to rise.

The iron and babbitt, and most other impurities found in the oil are heavier than water, and hence have a tendency to fall; but this tendency is greatly diminished by the water, whose gravity is subtracted from that of those substances, thus their inclination to drop is very moderate. As a result of these two modifications of gravity there is a very gentle but certain tendency to separate, and in this condition only is it possible to filter oil successfully for any length of time. The filtering material used is such as has been proven by most thorough experiment and constant use to be the very best. With all these advantages the filter is made of glass, so that the operation is visible. No filter, filtering up through the liquid, it is said, can be made successful without visible operation.

Mr. F. H. Alling, 136 Liberty street, New York, is the agent for these filters.

MAKING OZONE BY ELECTRICITY.

At the exhibition of electro-medical apparatus at the convention of the American Electro-Therapeutic Association which was held in this city last week, an apparatus for the production of ozone by means of electricity was exhibited by the Ozone Manufacturing Co., 47 Liberty street, New York, and attracted considerable attention.

The ozonizing of atmospheric air by this machine is accomplished by employing a small motor, driving a blower, which forces the air through the apparatus, the current for operating the motor being taken from any available electric plant. The air, first passed through a drying tube to eliminate any moisture present, is conveyed to the ozone generator, a cluster of tubes, of which each tube consists of two concentric thin glass tubes, the inner one being nearly filled with water, into which dips one electrode. A glass vessel, also containing water, serves to receive the generator, and in it is also placed the other electrode. A silent discharge of electricity, derived by special device from the current driving the motor and allowed to pass through a specially wound transformer to the generator, takes place through the space intervening between the thin walls of the glass tubes and ozonizes the air flowing through to the outlet of the apparatus, where it is distributed or made use of as required.

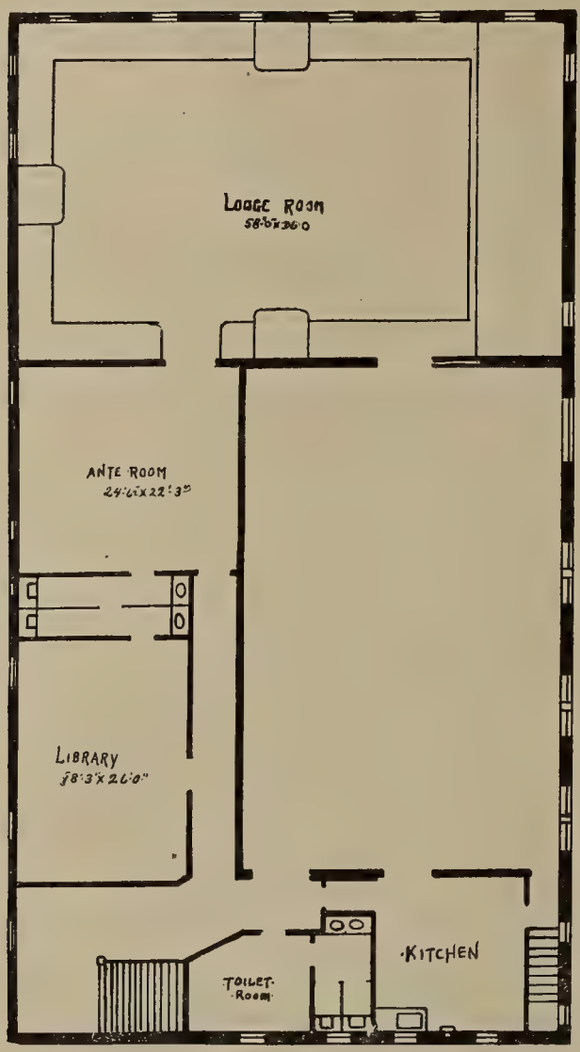
The machine occupies only a small space, but it will speedily ozonize the air of a large room or hall.

The apparatus would be specially valuable for use in hospitals for disinfecting purposes and also for the treatment, by inhalation, of affections of the respiratory organs.

The Ozone Manufacturing Co. employs the ozone generated by the large ozone plant at its works in the manufacture of remedies containing ozone, the therapeutic value of which is attracting the attention of the medical profession.

INTERLOCKING SIGNALS.

The Pennsylvania Railroad Co. will soon begin work on the erection of a power-house near Holmesburg Junction, near Philadelphia, to supply power for the operation of a new system of interlocking signals, which the company will put in between the Broad street station and Holmesburg Junction. This system of signalling is to be automatic, and will be operated by the wheels of the locomotive as it passes over a given point on the rail. Along each rail there will be two wires, which will be connected with the signals, and as soon as the wheel of an engine touches them a current will set the signal. The system will be somewhat similar to that now in use between Pittsburg and Wall station.



SECOND FLOOR.

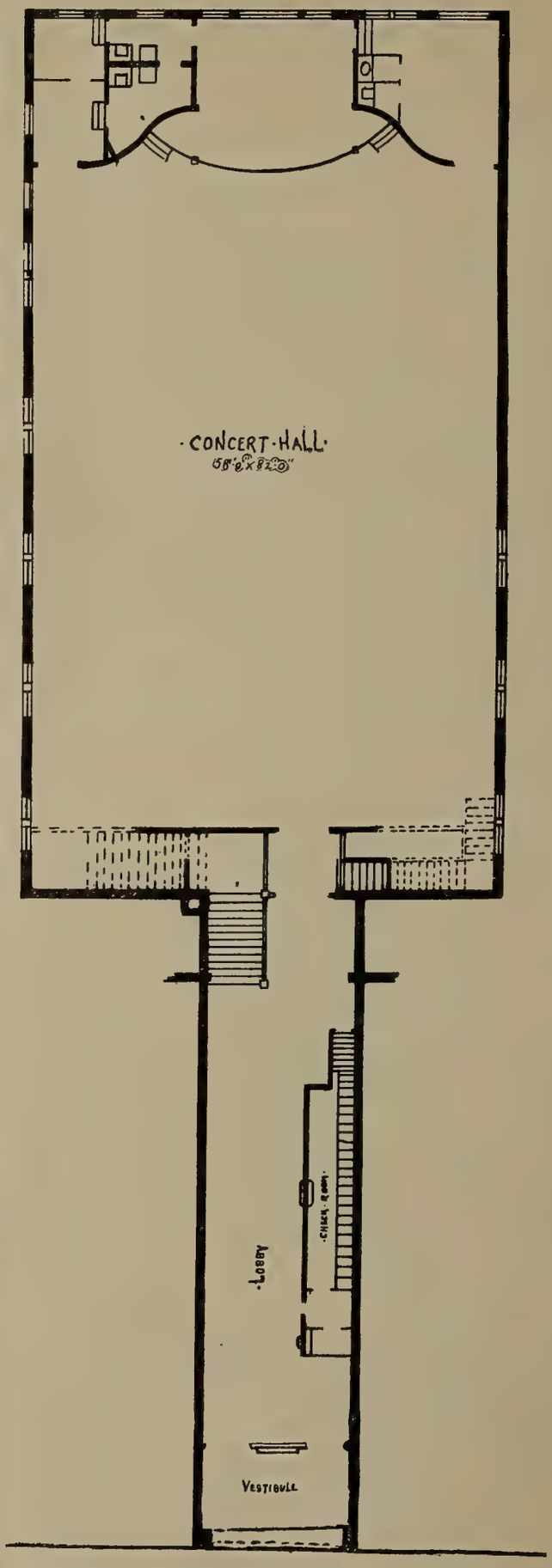
THE EXHIBITION HALL AT CLEVELAND.

We give herewith a plan of the hall which will be used for the display of exhibits at the Cleveland convention of the American Street Railway Association next week. The building in which it is located is on Superior street, nearly opposite the Hollenden Hotel, the headquarters of the association. It is known as the Army and Navy Hall, and affords abundance of room. But as the exhibition promises to be of huge proportions, the second floor of the building, a plan of which is also given, will be utilized as well, and in addition to this vast space a building is being erected on the adjoining vacant lot for exhibition purposes. The size of this latter structure is 66 feet front by 145 feet deep; altogether there will be plenty of room.

The location of the exhibition is very convenient to headquarters, and this fact will insure a very large attendance and interest.

The size of the main exhibition hall, shown on the ground plan of the building, is 58 by 82 feet. The committee having the exhibition in charge has worked with great energy to make the display a success in every respect, and the wisdom and good judgment displayed in the discharge of their onerous duties command the admiration of all interested.

The large room on the second floor is the banquet hall. This, with all the smaller rooms on the same floor, will be given up to exhibition uses.



FIRST FLOOR.

Mr. H. J. Davies, secretary of the Brooklyn Street Railroad Company, is chairman of this committee, and his uniform courtesy to all has won for him many friends.

CORCORAN SCIENTIFIC SCHOOL.

The Corcoran Scientific school, Columbian University, Washington, D. C., has issued its conspectus of courses leading to the degree of electrical engineer for the term 1892–3. Prof. Francis R. Fava, Jr., is the professor of engineering.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, October 8, 1892.

W. S. CHESLEY & Co., electrical engineers and contractors, Electrical Exchange Building, desire some live salesmen. They offer good inducements and prefer young men who have finished college or an engineering course.

J. P. MCQUAIDE, of the National Conduit Mfg. Co., of this city, has just returned from Omaha, where he has completed a system of underground conduits. He is highly pleased with the success of the subways and the growing demand for his system.

M. C. SULLIVAN, general manager of the Sullivan Mineral Insulation Co., Electrical Exchange, city, reports that the future trade is very promising. He is doing well, although his company is comparatively new in the field. Mr. Sullivan knows as much about slate switchboards as any one.

"INVENTIVE PROGRESS: BENEFITS OF THE AMERICAN PATENT SYSTEM" is the title of a very attractive pamphlet just put out by Mr. Wm. A. Rosenbaum, the well-known electrical expert and patent solicitor, Times Building. The pamphlet contains reading-matter of exceeding interest and value, also illustrations made from photographs of nine commissioners of patents and of prominent inventors, besides many others of various subjects. It is really a neat piece of work.

THE CLARK ELECTRIC COMPANY, 192 Broadway, illuminated its offices with its fine system of arc lighting during the Columbus parade on Wednesday night. The light could be seen as far down Broadway as Trinity Church and Wall street, and the entire length of Dey street. Since last Friday the company has displayed one of the finest American flags on Broadway from the front window of the office. This company has established a very high reputation for its arc-lighting system, which embraces all branches. It is stated as a fact that its apparatus invariably gives perfect satisfaction to the purchaser. It claims to be leading all others in New York with its handsome arc lamps for interior lighting from incandescent current, two in series.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	203 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	93 00
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	160 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N. B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	116 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	2,650,000		*107
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	105 00
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Edwards Railroad Elec. Lt. Co., O.	1,500,000	100 00	30 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	46 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	119 75
General Electric Co., 5s	4,000,000		*106
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 00
Laclede Gas pref.	2,500,000	100 00	66 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	61 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	13 00
Postal Telegraph	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*96
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s, Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	9 00
The Wells & French Co., Ill.	600,000	100 00	par
T.-H Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	96 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	37 75
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The most important feature on the electrical financial horizon this month, and which will affect more investors than any other probable incident, is the decision of the United States Circuit Appellate Court sustaining the Edison incandescent lamp patent, in the suit of the Edison Company against the United States Company. The decision has had a marked effect on the stock of both corporations, in Boston as well as in New York. The General Electric went up three points, resting at $117.50, within half a point of the highest quotation. On the 19th of August it reached $118, and has glided between that and $108 ever since. The Edison General reached

as high as $120 at the time the consolidation with the Thomson-Houston was perfected. There is every reason to expect that the General Electric will go to $130 before March 1 next, and to $200 within five years, as I have predicted form the day of the consolidation. On the other hand, Westinghouse preferred, which pays seven per cent.—and pays it, too—fell off from $50.75 (the par of this stock is $50) to $48.50 asked, with no bid. The common stock fell from $38.50 to $37.50 asked, with $37.25 bid. The local illuminating companies do not show so much change, but will fall into line in the course of a few days. The exception to this, perhaps, was the New York City Company, which closed at $104 bid, $105 asked, on the day the decision was handed down. The Brooklyn Edison company has also improved rapidly of late, and will, now that the stock is listed on the New York Stock Exchange, soon reach par. The regular quarterly dividend of 1 per cent. has been declared, and will be paid on Nov. 1. The New York and New Jersey Telephone Company also has declared its regular quarterly dividend of 1½ per cent. payable Oct. 15.

Coupons of the first mortgage bonds of the Brooklyn City Railway Company are payable at the Central Trust Company on presentation, also the regular quarterly dividend on the stock of 2 %. The dividends paid in New York for Oct. 1 are estimated at $32,000,000. I do not look for a very large or well-distributed business on the Stock Exchange until after the election excitement is over. It is so much easier to speculate on one's favorite candidate than the rise and fall of shares, but there will be from four to six weeks of plunging, that will furnish holiday expenses for the brokers who have been cooling their toes over the electric fans all summer. New inventions and securities are not rushing the market for the moment, but occasionally a little diamond turns up that is always in demand. Such is the case with a little burglar alarm I met this week, the invention of Mr. C. H. Burnap. It is not larger than an ordinary pocket-book, and can be carried as comfortably in the pocket; it is electric and everlasting, can be fastened on to the door-knob or key, with a string leading to the fanlight; costs complete only $2.50, and is a sure preventive against any one entering, or more than attempting to enter, your house or apartment. It is only one point in efficiency below the farmer's trap-gun ; it does not kill the brute, and is harmless to the members of the family or friends.

Electric construction companies demand and receive 15 % as commission on their outlays, and the money is turned over sometimes daily, the profits compounded. I think the investor who puts his money into electrics can amuse himself shortly by taking a flyer or two in gold mines. Few people seem to see that a million in sight in a gold mine may require two millions to reach the mint with it. Electrics are different in this, that a valid contract to pay is part of the business.

A GOOD TEST.

The following interesting data serves to show what the Short Electric Railway Company's apparatus is capable of doing in emergencies. The road on which this occurred is the Collins Park and Belt Line R'y Co., of Atlanta, Ga.:

THE SHORT ELECTRIC RAILWAY COMPANY.

Dear Sirs : The E. T. B. & G. R. R. delivered our generator at the W. & A. R. R. through an error. The W. & A. carried her out to the new water-works, 10 miles from the city. Hunting her up and getting her back to the G. P. yards delayed me in setting her up. Took her out to the power-station last Friday evening. Unloaded her and set the base on Saturday. Put her together on Sunday. Wired her up on Monday, and started her on Tuesday. The company here did not have an engine, and it would have been very costly for me to haul the generator to the power-station by wagon. Besides, some parts of the road would have had to be fixed up. In all I believe it would have cost $40 or $50 to haul her four or five miles to the plant. Therefore, I hitched an electric car to the flat car containing the generator and started for the plant. It made a heavy load, but I got there safely. On the steepest grade we went along faster than a man could walk, and, you know, we have some pretty stiff grades on the road, fully 6½ % I think. The motors got pretty warm, but not more so than I have seen them during heavy traffic. The work done by them is remarkable and is the talk of the town.

(Signed) R. L. CALDWELL,
Expert in Charge.

Data concerning the trip is as follows :

Pennsylvania Railway Company car No. 5653, weight	23,150 lbs.
1 Short 150-H. P. generator, weight	24,000 "
Total weight	47,150 "

Between the Georgia and Pacific R. R. Co. and the power-station of the Collins Park and Belt Railway Company there is one grade of 5 % and another of 6½ %. The distance between the two points is 4½ miles. The motive-power was one 16 ft. open car-body, equipped with two 20-H. P. single-reduction Short railway motors.

TRADE NOTES.

J. BRADFORD SARGENT, of 620 Atlantic avenue, Boston, New England agent for the Stirling boiler, and the Cooper Corliss compound-condensing engines, is a very busy man these days. Mr. Sargent has lately installed a 300-H. P. Stirling boiler with the Hull Electric Light and Power Company, of Hull, Mass., and has in course of erection, among others, a 300-H. P. Stirling boiler and a 200-H. P. Cooper Corliss engine, in Chas. Heap's woollen mills, Williamstown, Mass. In the works of Armour & Co., of Chicago and Kansas City, the Stirling Co. has recently placed in one, two, three, four and five orders—5,000 H. P. The Stirling boiler is being recognized as the best and most economical boiler on the market. It may be interesting to note that during the month of August boilers aggregating over 8,000-H. P. capacity were sold.

FISHER ELECTRIC COMPANY,
DETROIT, MICH., June 27, 1892.

ELECTRIC CONSTRUCTION AND SUPPLY CO.,
NEW YORK, N. Y.

Gentlemen : We have used the Ward Arc Lamp exclusively during the last two years for combination plants, and have had the very best success in using them. We find they are accurately made and carefully adjusted, and our customers are thoroughly satisfied with their operation.

Very truly yours,
FISHER ELECTRIC CO.

NEW YORK, LAKE ERIE & WESTERN R. R. COMPANY,
OFFICE OF THE GENERAL ROADMASTER,
JERSEY CITY, N. J.

MESSRS. FORREST SILVER BRONZE PACKING CO.,
NO 115 LIBERTY STREET, N. Y. CITY.

Gentlemen : In answering your favor relating to the Silver Bronze Packing on the double-ended screw ferry-boat "John G. McCullough," of the N. Y., L. E. & W. R. R. Co., I am pleased to say that it has given full and complete satisfaction.

Your packing holds water and steam under high pressure without requiring any soft packing to help it out and without the usual severe friction of other metallic packings under high steam. In my opinion one of the best features of your packing is its automatic action, for

since it requires no attention or adjustment, the liability of its being screwed up too tight is entirely removed, and the danger, common to other metallic packings with which I am familiar, of melting them out or heating the rods is avoided.

I always take pleasure in recommending your Silver Bronze Packing because I believe it to be the most reliable and economical, also the best packing in every respect in the market. I take great pride in showing it in working on my engine to all who are in a position to appreciate a good packing, and shall be glad to have you send any one aboard of the "McCullough" whom you wish to have see it working.

Yours very truly,
(Signed) WM. MACDONALD,
Engr. of the "J. G. McCullough."

The Electrical Age's Illustrated Patent Record.

Issued October 4, 1892.

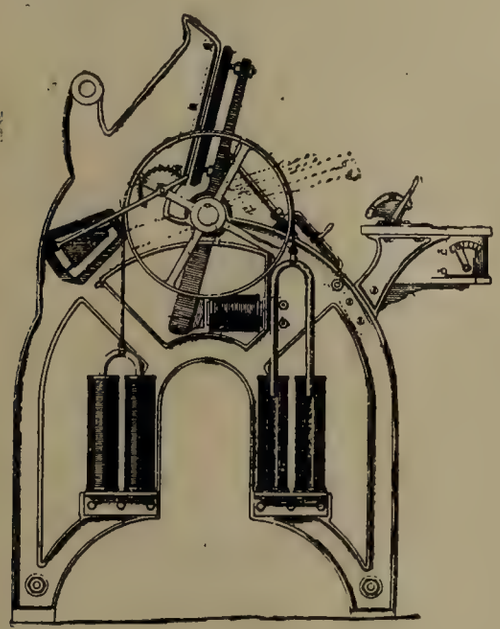
483,545. Electric Fan. Elisha B. Cutten, New York, N. Y. Filed May 22, 1891.

483,556. Adjustable Electric-Light Hanger. Herbert L. Holt, Ellsworth, Me. Filed Feb. 5, 1892.

483,562. Storage-Battery. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

483,563. Storage-Battery. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

483,564. Electric-Magnetic Mechanism for Operating Printing Presses. Ernst H. Korsmeyer, Kansas City, Mo. Filed Sept. 5, 1891.



483,564.—ELECTRIC-MAGNETIC MECHANISM FOR OPERATING PRINTING PRESSES.

483,582. Motor-Mounting for Electrically Driven Fans. Andrew L. Riker, New York, N. Y. Filed Dec. 22, 1891.

483,625. Electric Burglar-Alarm. Homer T. Wilson, Louisville, Ky. Filed June 9, 1892.

483,653. Molding Mica Forms for Electrical Insulators. Charles W. Jefferson, Schenectady, assignor to Eugene Munsell & Co., New York, N. Y. Filed June 1, 1892.

483,654. Galvanic-Battery. Harry T. Johnson, New York, N. Y. Filed Dec. 10, 1891.

483,689. Trolley-Catcher. John J. Hoppes, Springfield, Ohio, assignor, by mesne assignments, to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 24, 1891.

483,692. Electrolytic Diaphragm. Anton J. Lehman, New York, N. Y. Filed July 6, 1891.

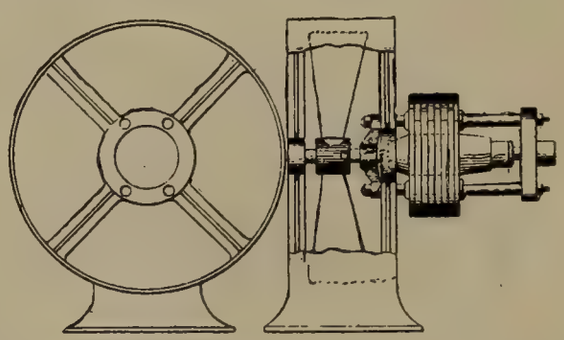
483,700. Armature for Dynamos and Motors. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 2, 1891.

483,704. Electric Switch. David H. Armstrong, Long Island City, N. Y. Filed June 11, 1892.

483,708. Armature for Motors and Generators. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 27, 1891.

483,712. Electric Switch. Axel Ekström, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 10, 1890.

483,713. Electric Snap-Switch. Axel Ekström, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 7, 1891.



483,582.—MOTOR-MOUNTING FOR ELECTRICALLY DRIVEN FANS.

483,718. Telephone-Receiver. Ferdinand Gross, Montreal, Canada. Filed Jan. 18, 1892. Patented in Canada.

483,728, Electric Burglar-Alarm. Alfred Stromberg, Chicago, Ill., assignor of one-half to Mark Simons, same place. Filed March 15, 1892.

483,729. Armature Winding for Dynamo-Electric Machines. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 30, 1889.

483,732. Commutator for Electric Machines. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 26, 1891.

483,739. Door-Lock Switch for Electric Lights. Charles Green, Toronto, Canada. Filed April 8, 1892.

483,745. Electro-Therapeutical Instrument. James W. Molière, San Francisco, Cal. Filed Sept. 14, 1891.

483,758. Electrical Heater. Arthur E. Appleyard, Boston, Mass. Filed Sept. 14, 1891.

PATENTS.—Continued.

483,759. Electrical Heater. Arthur E. Appleyard, Boston, Mass. Filed Dec. 28, 1891.

483,761. Closed Conduit for Electric Railways. William G. Creighton, Norwood Park, Ill. Filed Feb. 6, 1892.

483,768. Police-Telegraph System. Charles A. Rolfe, Chicago, Ill. Filed May 6, 1892.

483,771. Insulator. Albert P. Seymour, Syracuse, N.Y. Filed March 5, 1892.

483,782. Thermo-Electric Battery. Paul Giraud, Chantilly, France. Filed Aug. 1, 1891. Patented in France.

483,806. Insulated Rivet. William S. Hull, Sheffield, Ala. Filed May 2, 1892.

483,816. Alternating-Current Motor. William Stanley, Jr., and John F. Kelly. Pittsfield, Mass. Filed March 10, 1892.

483,822. Electric Locomotive. Thomas L. Willson, Brooklyn, N. Y. Filed Aug. 25, 1891.

483,844. Burglar-Alarm Contact. Nevil M. Hopkins, Washington, D. C. Filed May 9, 1892.

483,856. Electric Railway. William G. Murphy, Jr. Marysville, Cal. Filed Sept. 30, 1891.

483,862. Electric Switch. Harry T. Paiste, West Chester, Pa. Filed May 14, 1891.

483,940. Electric Heater. Fred. B. Perkins and Charles S. Jones, Toledo, Ohio, assignors, by direct and mesne assignments, to the Toledo Electric Heating Company, same place. Filed April 1, 1892.

483,974. Holder for Incandescent Lamps. Edwin P. Allam, Romford, assignor of one-half to Ernest Richard Dolby, London, England. Filed Oct. 27, 1891. Patented in England.

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ELECTRICAL AGE

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LIGHT ON THE COLUMBUS FESTIVITIES.

The sun by day and electric light by night vied with each other during the Columbus festivities last week in their efforts to produce the most brilliant effects. They were both at their best and completely successful in pleasing everybody.

THE OLDEST ELECTRICAL SOCIETY.

All members of the electrical fraternity in New York city should encourage the New York Electrical Society in its good work. The new officers of the society are making its success a personal matter, and are working hard to bring it up into a higher plane of usefulness and interest. We publish on another page a list of the lectures for the coming season which certainly could not be improved on. The season's work is well planned, and the authors of the various lectures are men of recognized high standing in their respective branches. Their names alone will insure a large attendance at the lectures, but what the society needs most of all is new and active members. The lectures this season will be worth ten times more than one year's dues. Just consider this matter!

THE CLEVELAND CONVENTION.

By the time this issue of the ELECTRICAL AGE reaches the hands of its readers the convention in Cleveland of the American Street Railway Association will be in progress. There is every prospect that it will be the most interesting and profitable meeting the association has ever held. What we mean by "profitable" is not profit in a pecuniary sense but in the acquisition of new ideas. Each attendant will return home with one or more new ideas and a resolution to put them to a practical test. In doing this the experimenter will develop other new things which he, in turn, will describe to his fellow-delegates at the next meeting, if he does not do so before. Thus experience grows and forms the groundwork for the vast and important and rapidly-growing interest—the electric street railroad.

In glancing over the programme of the meeting it is found that horse-car roads are not mentioned, except in the case where the cost of their operation is compared with that of electric and cable roads. The poor horse is practically dead as far as street-car roads are concerned, and he is simply out of the calculation altogether. Coal takes the place of oats, and iron replaces horseflesh; it is a step in the evolution of the perfect street railroad, that is all it is.

From all reports at the present writing the exhibition of electric street-car apparatus and appliances will be of unusually large proportions. Very naturally it should be, when we think of the rapid development in the various departments of the electric-railway industry. New things are being constantly produced to meet new conditions, and old things are always undergoing the refining process. Therefore it is in the very nature of things that the exhibition should be a large and interesting one.

The ELECTRICAL AGE and its young and vigorous brother, STREET RAILWAY NEWS, will be represented at the convention by a large staff from the home office. We will have our convention headquarters at the Hollenden Hotel, where we will be pleased to meet all of our friends. All should give us a call, as we will have a unique and handsome souvenir to distribute.

In our next issue we will give a very full report of the proceedings, and an account of the exhibits, together with much other matter of interest.

In this connection we wish to say to those of our readers who do not receive STREET RAILWAY NEWS regularly that they should not fail to secure a copy of the issue of October 22—the convention number. It is probably the handsomest paper ever published on a special occasion. It is four times its usual size, and gotten up in a way that is an everlasting credit to the printers' and engravers' art—and, we may modestly add, the publishers' enterprise.

THE BALTIMORE CENTRAL RAILWAY CO.'S ELECTRIC LINE.

The system of the Central Railway Company, of Baltimore, Md., has been entirely reconstructed and equipped with electric power in the place of horses. The

The cars are equipped with 20 H. P. Thomson-Houston single-reduction motors, and in the power-station are 3 Thomson-Houston 200-kilowatt multipolar generators. These are driven by 3 McIntosh & Seymour engines of 250 H. P. each, and the steam-generating plant consists of Campbell & Zell's safety boilers, made by the Campbell & Zell Co., Baltimore, Md.

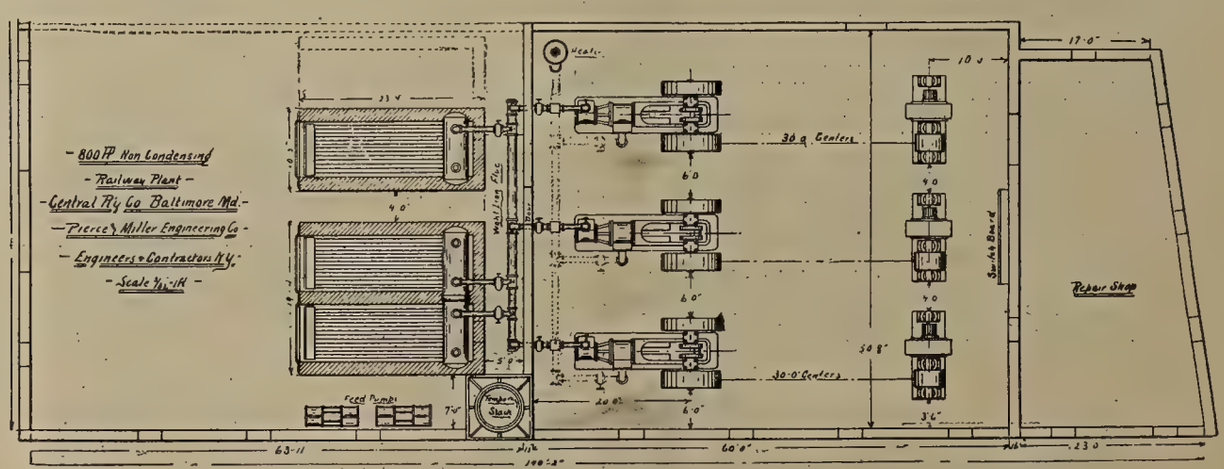


VIEW OF WORK ON OVERHEAD CONSTRUCTION, BALTIMORE.

residents of the city have for a long time past recognized the necessity of and been clamoring for increased rapid-transit facilities. The electric road will go a long way toward fulfilling their wishes and they are proportionately happy. The cars have been put into regular

The type of engines used in this installation are McIntosh & Seymour's compound-tandem non-condensing, special for railway work.

The entire power-plant exclusive of the boilers, was installed by the Pierce & Miller Engineering Company, of



PLAN OF RAILWAY PLANT CENTRAL RAILWAY CO., BALTIMORE.

operation, and are the first electric ones to pass through any portion of the thickly populated parts of Baltimore.

The road consists of six miles of double track newly laid by Thomas Murray & Co., with 7-inch Johnson girder-rail, 80 lbs. to the yard, manufactured by the Johnson Company, of Johnstown, Pa., and the work throughout is unusually good.

42 Cortlandt street, New York city, under contract, and it is to the credit of this company that load was put on to the engines six hours after starting up, and they have since run continuously under load without the slightest trouble of any kind.

It is proposed in the near future to increase the power-plant as the requirements of the road demand, and the

plant, as regards piping and general lay out, is arranged with this in view.

The piping of this plant is made throughout with flanged joints, and each boiler and engine branch-pipe is controlled by a shut-off valve, so that the entire plant can work together as one unit, or any unit of boiler or engine can be cut out at the will of the engineer.

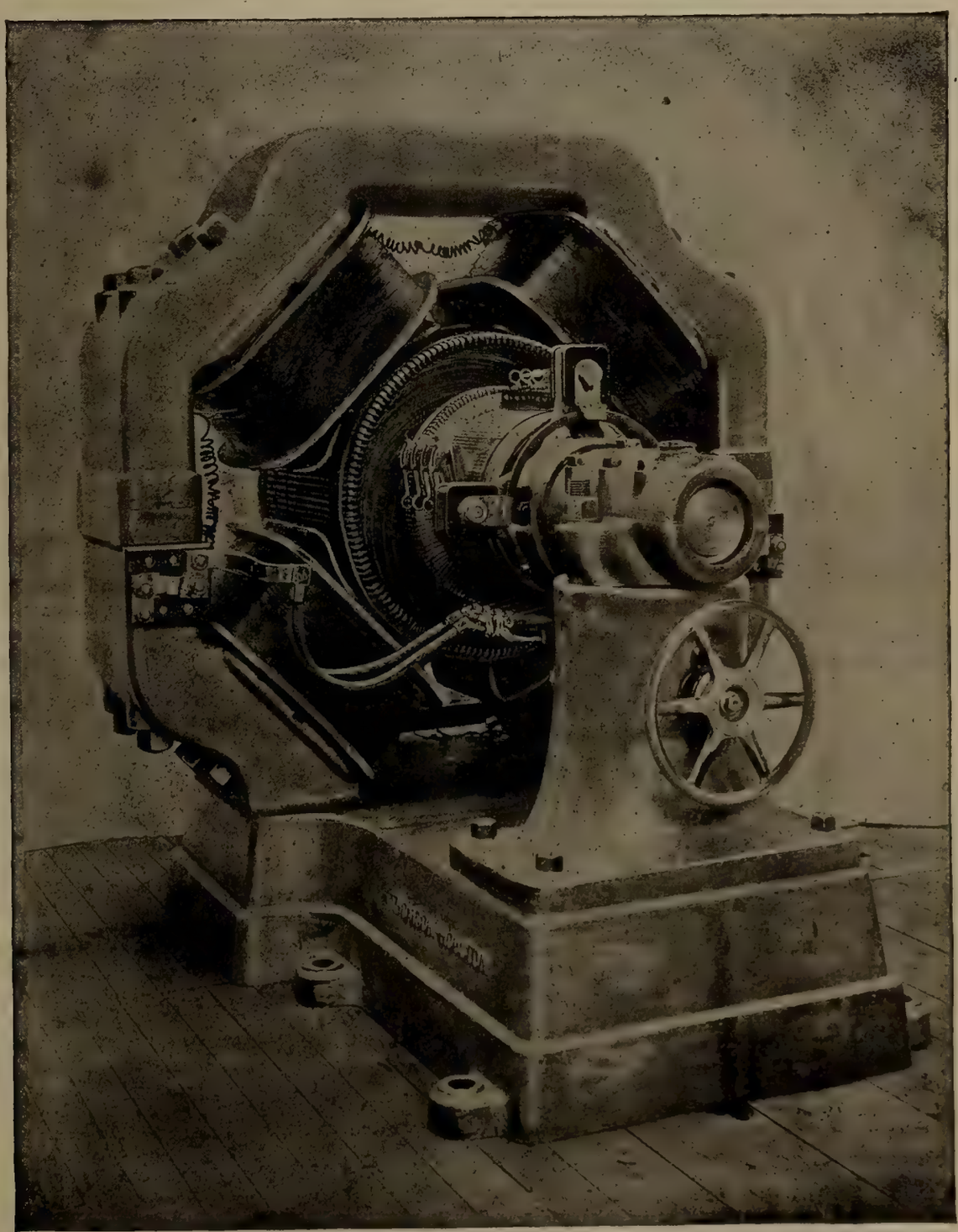
All live steam-pipes are equipped with Chapman special valves for heavy pressure.

gards live steam and exhaust, for convenience in making repairs.

The main exhaust runs through the feed-water heater and out of the building.

The plant is equipped with two Worthington Duplex Boiler Feed Pumps, each of ample capacity to feed the entire battery of boilers, leaving one extra pump.

An iron smoke-stack is installed with the present plant in a position to permit of connecting the present battery



THOMSON-HOUSTON RAILWAY GENERATOR.

The steam main and live steam cylinder jackets are automatically drained by a Blake Combination Pump and Receiver which forces the water of condensation directly into the boilers.

The main exhaust of each engine is fitted with a shut-off valve at its junction with the main header, so that each engine can be entirely cut out of the system, as re-

of boilers into a brick chimney, which it is proposed to build when the increase is made. This chimney to be of ample size to take the draught from a plant double the capacity of the present installation.

In the laying out of this plant by the Pierce & Miller Engineering Company, their usual practice was followed of making each boiler and engine unit of the proper size

to run each electrical unit with the greatest economy. These are arranged one directly behind the other, thus giving the most direct and shortest travel for the steam between the boilers and engines to save condensation.

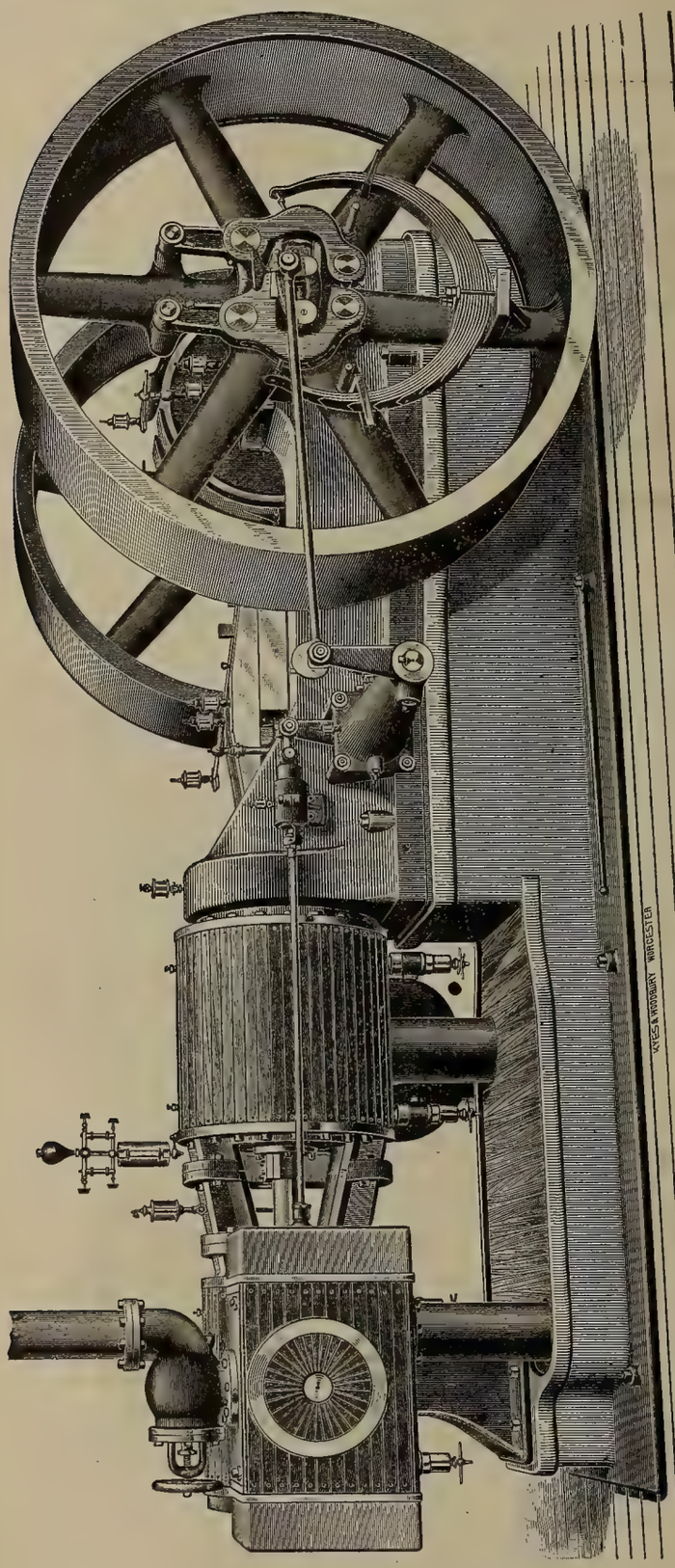
Mr. George Blakistone, president of the Central Railway Company, expresses himself as perfectly satisfied with the plant in every particular, and compliments the Pierce & Miller Engineering Co. on the perfect and workmanlike manner in which they have installed the plant.

Several illustrations accompany this article, including a view of the line-construction gangs of J. G. White & Co., of New York, who had the contract for the overhead equipment. The force shown in the picture is only a small portion employed by Mr. White on this work.

J. G. White & Co. have at present under contract in Baltimore some 85 miles of overhead construction and about 35 miles of track-laying, in addition to grading, paving and other constructional details.

Other views show the type of McIntosh & Seymour engine used in the power-house; a plan of the power-house; Thomson-Houston generator; Thomson-Houston motor fitted to the axle all ready to be placed under the car, and a cross sectional view of the 7-inch, 80 lbs. Johnson girder-rail which is used in the track construction.

Mr. George Blakistone has recently been elected president of the road, and it is to his enterprise that the remodelling of this road is mainly due.



McINTOSH & SEYMOUR COMPOUND TANDEM SPECIAL RAILWAY ENGINE.

CARE OF GAS-ENGINES.

Since gas-engines are coming into extensive use for small isolated electric-lighting plants, the following points as to their care, which we find in the *Engineering Record*, of this city, will be of interest and value. These hints have been taken from a variety of sources, and relate to tube-ignition engines alone. In this type the tube itself should be carefully looked after, since several charges may be drawn into the cylinder without any explosion, if it is in bad condition. Sometimes an engine refuses to start, and in such a case it will often be found that the tube is enlarged and covered with scale. It should be carefully removed as soon as it is seen to be in this state, care being taken that none of the scale get into the passages leading to the cylinder. There is no necessity for heating these tubes to anything near a white heat, and they are apt to cause much trouble at such a temperature. If the tube will not heat, the trouble may be due to the Bunsen burner or to draughts. Tubes of a special alloy are being put on the market by the Otto Gas-Engine Works, which will not deteriorate rapidly (their lifetime exceeding one year), and thus avoid many of the troubles mentioned.

Most engineers are accustomed to at once attribute loss in compression to the valves, but this can be easily determined by turning the fly-wheel. If very little compression is felt, the trouble is probably due to dust and grit getting between the valve and its seat or to the sticking of the valve-spindle in its gland. In the first case the grit can be removed by turning the valve around a few times, so as to grind the dust away. If the valves stick, a little coal-oil is to be poured on the spindle, which is to be worked sharply back and forth until the springs will bring it down on its seat in the proper manner.

The springs are also apt to become weak, and should then be at once replaced. A small loss in compression is quite important, since the power developed by the explosion depends considerably on the density of the mixture, and it has been found that the lower the amount of compression the richer must be the mixture in order to have good ignition.

After an engine has been knocked down for removal or repairs, and is then again set up, care should be taken that the cams working the valves are set in the place they formerly had. If the teeth on the wheel of the crank-shaft are set forward on the wheel keyed to the cam-shaft, the exhaust valve will be opened too soon and part of the force of the explosion be allowed to waste up the exhaust-pipe shaft. If the wheels are set a tooth or two backward the explosive mixture will be forced into the air-box, with results that may be extremely unpleasant in some style of engines.

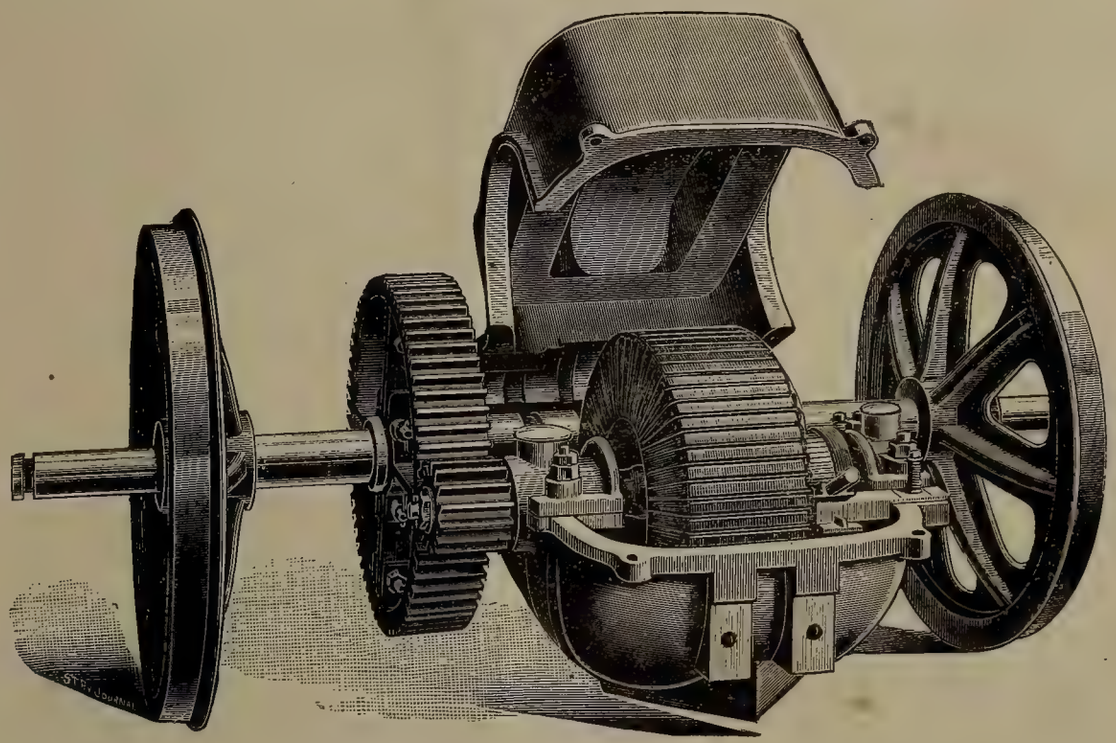
Joints and packings in gas-engines should give no trouble when the right material is used. They will give out and need replacing only when cooling water is not turned on for considerable length of time. For all joints exposed to the inner heat of engine, especially near the exhaust valve, asbestos board is used, and between the cylinder-head and cylinder the same material, but of slight thickness, will answer. Any attempts to use rubber packing will result in failure after a short run. Rubber packing may be used only on outer joints against water, where water-jackets are castings independent of the cylinder. Leaks of inner joints are generally detected by an accumulation of water over night inside of the cylinder. There is no trouble in detecting leaks outside of the cylinder, and there is no loss of power from such source.

PACKARD DYNAMOS AND MOTORS.

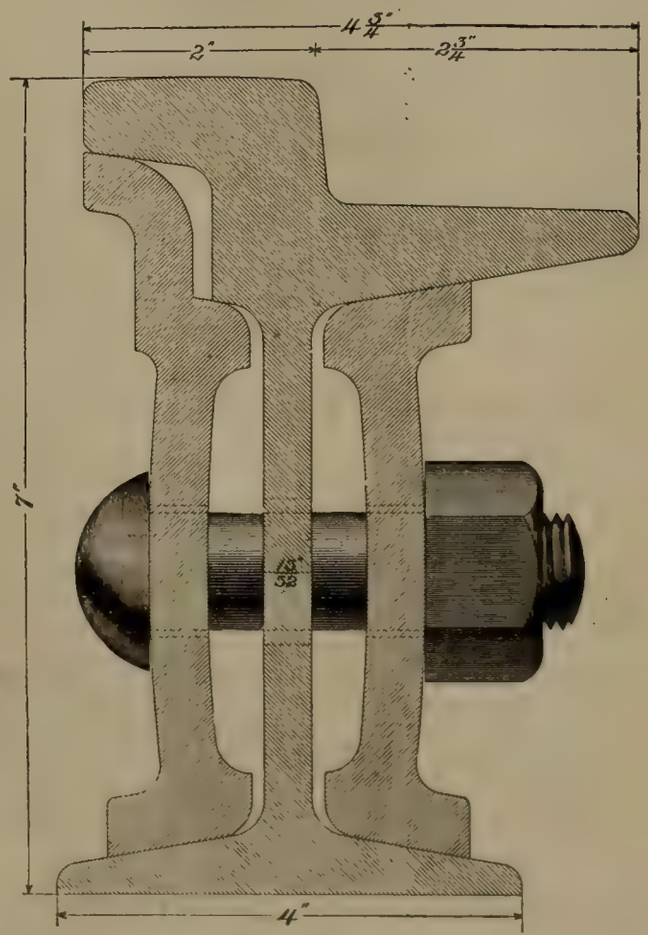
Of all the various types of dynamos and motors manufactured for light and power purposes those of the Packard Electric Company, of Warren, Ohio, enjoy an enviable reputation.

These machines are of a special form, and are designed for the distribution of electric-light power in small units. For small power it is well known that an electric motor is cheaper than any other form of power, while it possesses many advantages over them all, such as absence of skilled attendance, cleanliness, direct application to its work, economy of space, etc. The Packard machines are strictly first-class and made of the very best material.

The field is so constructed of wrought-iron bars held in place by a coating of soft cast-iron that a tremendously strong magnetic field is secured by the expenditure of but very few watts of electrical energy. There is but one field-coil, so arranged that it can be easily removed and replaced. As they are made to gauge, there is no difficulty in duplicating. By the substitution of the



THOMSON-HOUSTON STREET RAILWAY MOTOR.

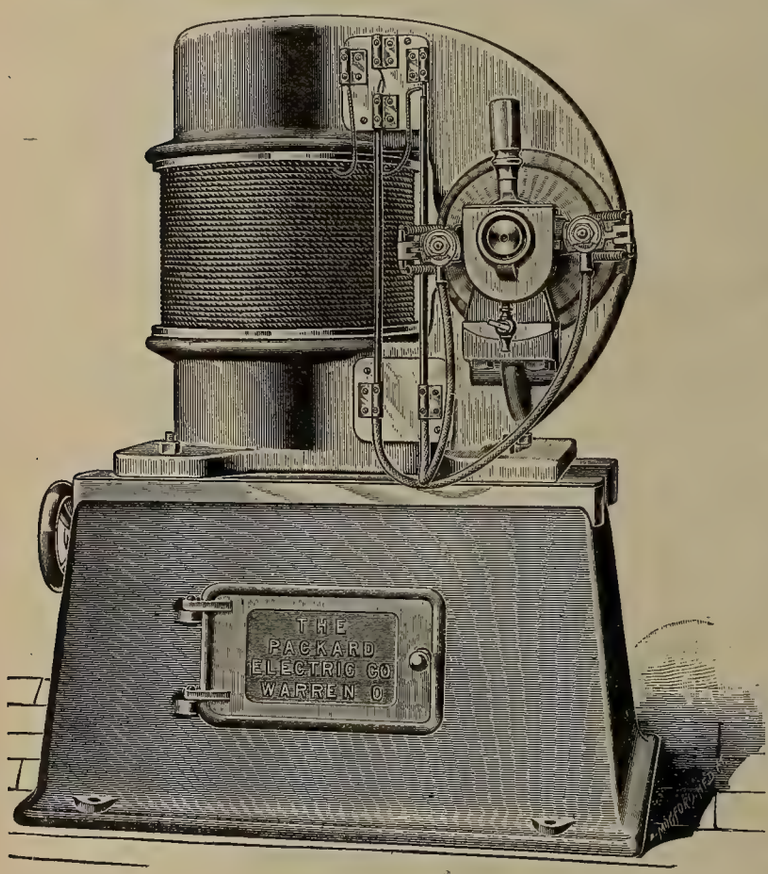


SEVEN-INCH JOHNSON GIRDER RAIL.

proper field-coil and armature the machine can, in a very few minutes, be charged to 110, 220 or 500 volts. This is one of the most important features of the Packard machines.

The armature is of the drum type built up of thin discs and securely fastened to a shaft made of the best grade of machinery steel of greatest diameter in its central part. A modification of the Siemens method is employed in the winding, and the proportion of the armature is such that there is but very little idle wire over the ends. Great care is exercised in the winding, so that there shall be no danger of short circuiting or burning out.

Pure hard copper, insulated throughout with mica, is used in the construction of the commutator, and it has



PACKARD DYNAMO.

sufficient face to insure the best results and reduce the wear to a minimum.

A special feature of these machines is the freedom from sparking at the commutator, and after the brushes have been once set at the non-sparking point they need never be changed under extreme changes in load.

The relative magnetism of the field and armature is so strongly developed that the lines of force do not become distorted, and hence the line of communication remains unchanged regardless of changes of load.

All motors and dynamos have self-oiling boxes and are provided with interchangeable bearing-sleeves of hard composition turned true to gauge.

These machines are of very high efficiency, are self-contained and regulated. Their design and construction is such as to make them extremely durable and with liability to derangement reduced to a minimum.

THE NEW YORK ELECTRICAL SOCIETY.

The following notice and programme for the season 1892–93, has been issued by Mr. Geo. H. Guy, secretary of this society:

This institution, founded in 1881, is the oldest existing electrical society in this country, and its usefulness is extending from year to year. The object for which the society was established was to afford all who are interested in electricity, whether as a science or as an art, an opportunity of coming together for interchange of ideas and to increase their knowledge by annual courses of lectures, which have been a feature of the society's work since its inception.

Following its usual custom the society proposes this year to continue its course of lectures, which will comprise fifteen in all, embracing the following subjects, and with the names of the lecturers, where their services thus far have been provided for:

1. The Arc Light (with experiments). By Mr. R. S. Dobbie.
2. The Telephone (experimental). By Mr. J. J. Carty, electrician Metropolitan Telephone Co., New York city, and Mr. F. A. Pickernell, engineer American Tel. and Tel. Co. (Long Distance Co.).
3. How to Lay Out and Wire an Isolated Lighting Plant, and How to Operate It. By Mr. Aug. Noll, superintendent New York Electric Equipment Company.
4. Primary Batteries (with exhibit of various batteries). By Mr. G. d'Infreville, late electrician West. Union Tel. Co.
5. Electricity in Medicine (experimental). By Dr. William J. Morton.
6. The Progress of the Year. By Mr. Joseph Wetzler.
7. What Europe is Doing in Electricity. By Prof. F. B. Crocker.
8. The Magnetic Field. By Prof. E. J. Houston.
9. Insulation and Surface Leakage (with experiments). By Dr. J. B. Williams.
10. Electric Heating (with experiments).
11. The Storage Battery.
12. The Continuous-Current Motor (with experiments).
13. The Alternating-Current Motor (with exhibit).
14. Electric Railways.
15. The Incandescent Light.

In order to attain the full measure of its usefulness, and to encourage beginners to associate themselves with it, the society makes no distinction whatever in the grade of its membership, to which any person interested in its work is eligible without examination of any kind as to his knowledge of the subject.

An invitation is extended to all amateurs, students, artisans, manufacturers and others interested in the progress of electricity to join the society and aid it in its work.

The dates and meeting-place for the lectures will be announced in due season. Admission, which is free, can only be gained by non-transferable tickets, which can be had on application to the secretary. The annual dues to the society are $3.00, and the secretary will furnish blank forms of application for membership on request.

For further information address the secretary, room 812, Mail and Express Building, 203 Broadway, New York city.

The 146th meeting of the society will take place at Columbia College on Wednesday, October 19, at 8 P.M.

Prof. F. B. Crocker will deliver an address, entitled "What Europe is Doing in Electricity," in which he will describe the numerous electrical establishments visited by him during a recent trip abroad. Prof. Crocker will point out specially the differences between our methods and those in vogue abroad, illustrating his remarks by photographs which will be exhibited.

The Postal Telegraph Company has decided to put into its new and magnificent building, now in the course of erection on the corner of Broadway and Murray street, New York city, six electric elevators made by Sprague, Duncan & Hutchinson, of 15 Wall street, city. Four of them will be "way" elevators and two "express," not stopping between the ground floor and the tenth story.

ELECTRIC DISPLAYS DURING THE COLUMBIAN FESTIVITIES.

Without the aid of electricity the magnificent night parade on October 12, which formed a part of the programme of the Columbian festivities in New York, would have been robbed of much of its glory. Electric lights were everywhere, and search-lights beamed upon the grand spectacle like the orb of day.

The great feature of the night pageant and the one everybody wanted to see, was the car "Electra" typifying electricity. It was over 20 feet high, and was surmounted by a figure of the globe from which sparkled the rays of countless tiny colored electric lamps. In all there were 3,000 electric lamps used on this magnificent chariot, and electricity was personified in the goddess



COLUMBIAN PAGEANT—FLOAT "ELECTRA."

"Electra," who held the reins of the hydra-headed monster that formed the front part of the float. The monster symbolized lightning, and from its eyes darted beams of electric light, while its teeth were made of rows of tiny electric lights. On the throne sat with "Electra" 30 girls clad in robes of metal. At the rear of the car, on another beautiful throne, sat another goddess encircled by a blaze of electric glory. This car was beautiful in the extreme and received more attention and applause from the thousands of spectators than any other.

The electrical decorations throughout the city were on a magnificent scale, and far surpassed any previous effort in this direction.

Nearly every building that contained electric lights on the line of march had some of them strung on the outside wall, intermingled with bunting and flags.

Among the electric displays which attracted particular attention, we may mention that of Messrs. Ehrich Bros., Sixth avenue and Twenty-third street, which consisted of a huge lion supporting a standard, on which were the initials "E. B.," studded with vari-colored incandescent lamps. A number of streamers extending from the roof to this standard were also studded with lamps, presenting a most beautiful spectacle.

We may also mention Messrs. Bloomingdale Bros., Fifty-ninth street and Third avenue, whose windows and building were most beautifully dressed. In the windows were scenes of Columbus before Isabella, wrought in wax; above the second floor to the left were the numbers 1492, and on the right 1892, and in the centre was the name Columbus. All of these three were nearly six feet high and constructed entirely of incandescent lamps. The three-days' festivities, which were on a stupendous scale, were a remarkable success in every way. Everything was favorable; the weather could not have been better, and everybody was in good humor.

The accompanying illustration gives a view of the Edison car, which was the centre of attraction in the night parade of October 12. No less than 3,000 lamps were used in the illumination of this car. They were run by a current of 100 ampéres at 85 volts for three and one-half hours. The current was obtained from Union storage batteries which were carried on the float and which were charged by the dynamos in the Edison building on Broad street. The other floats were illuminated by reflectors carried on the arms of the men who walked on each side of the float. Each reflector had a 75 or 100 C. P. lamp, which was fed by a current taken from the storage batteries on the Edison float and conveyed to the lamps by flexible cords.

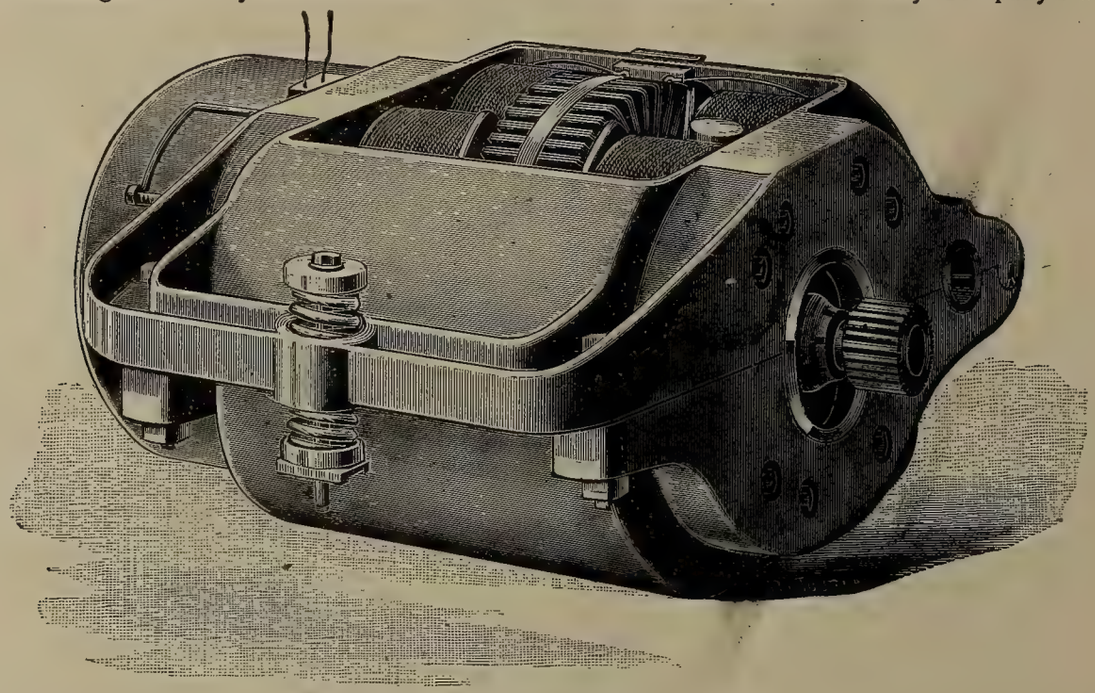
Fletcher & Fletcher Electric Co., the well-known electrical manufacturing house, of Cleveland, has moved to the main floor of No. 9 South Water street. The house has a fine display window and carries a good line of electric appliances for medical use, electric belts, batteries, bells, annunciator wire, etc., etc.

AT THE WORKS OF THE SHORT ELECTRIC RAILWAY COMPANY.

One of the foremost of Cleveland's great industrial concerns is the Short Electric Railway Company. The name "Short" is as familiar to all street-railway people as is that of Washington to the youth of the land.

The Short Company gets its great reputation of course from the electric motors it manufactures for street cars. These machines are found all over the country, indeed we may say the world. America is not a big enough field for the company to labor in; at the present time Mr. E. Higgins, the general manager, is in Europe in search of more conquests for his company.

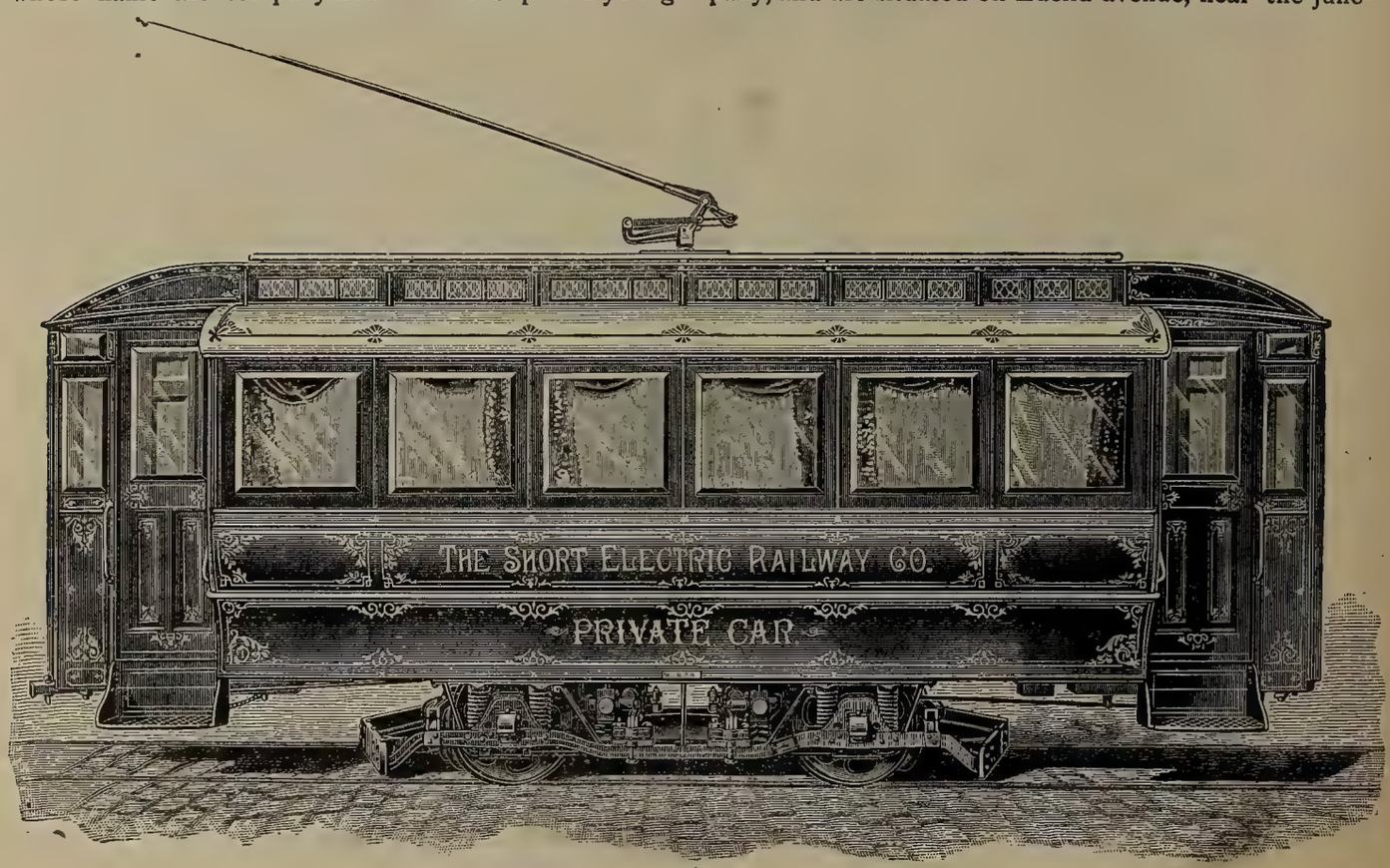
The Short Electric Railway Company's works are in



SHORT 20 H. P. SINGLE-REDUCTION MOTOR.

The head of this vast concern is Mr. Sidney H. Short, whose name the company bears. He is quite a young man, being born in 1858, in Columbus, Ohio. He is a thorough scholar and electrician, and is full of that personal quality known in America as "sand" or "grit."

the same buildings as those of the Brush Electric Company, and are situated on Euclid avenue, near the junction of the Cleveland and Pittsburg Railroad with that thoroughfare. They are thoroughly equipped with modern machinery, and in every respect are models of



SHORT COMPANY'S PRIVATE CAR.

industrial development. The main machine-shop is a maze of belting and shafting, and the floor space is almost entirely covered with lathes and other machines, and parts of motors, generators, etc., in all stages of manufacture. There are many machines in this shop designed for special work, each of which would form an interesting subject itself for an article ; but limited space forbids any more than a general reference to the vastness of this section of the works.

In the works the motors are designed, patterned, made and finished ready for placing in position on the cars. Each part of the motor receives especial attention in its own department, and it is an extremely interesting sight to visit this vast beehive of industry, and watch the various operations of manufacture.

Having made a general reference to the works of the Short Company, we will now consider its products—these are really what interest the members of the Street Railway Association most.



INTERIOR OF SHORT PRIVATE CAR.

THE "GEARLESS" MOTOR.

The first electric street-car motor was a machine with high-speed armature geared down through a long train of gears to the car-axle. Later on, the double-reduction motor came into general use, but it was afterwards found that two gears were the source of great expense in service. This however has been largely decreased by the introduction of the single-reduction gear motor by most of the well-known street-railway electric-motor manufacturers. While this type of motor is still successful and to a great degree considered the standard, the Short Company, on the ground that a motor with no gears at all would be the ideal street-car motor, produced the now well-known "Gearless" motor which has met with much success. The armatures of these motors run at a speed not to exceed 105 to 150 revolutions a minute, and in every way this type of machine is said to be a success. The first 10 Gearless motors made are known as the "Pittsburg" type for the reason that they were seen in operation in Pittsburg during the American Street Railway Association convention a year ago. These motors are now in regular service in St. Louis, Mo., Houston, Tex., Beatrice, Neb., and Grand Rapids, Mich. The diameter of the armature of these motors is 24 inches and they make 94 revolutions a minute with a 36-inch wheel, which gives a speed of 10 miles an hour. This design was not altogether satisfactory, however, and it was materially improved on, so that the field-magnets are presented to the face of the armature ring.

The latest style Gearless motor manufactured by the Short Electric Railway Company is a six-pole machine, weighing complete 2,300 pounds. The frame of this motor is cast from steel and is made in two halves, the upper half being supported by the truck; the lower half being hinged to the upper half, so that it may be easily swung down when the car is over a pit, so that inspection becomes easy. The lower half of the frame is cast without any opening up to the level of the centre of the axle, so that the motor can be run through water and slush, without in any way getting into or injuring it. It is therefore practically a water-proof motor. The armature is 21″ in diameter, is iron-clad and runs at a speed of 120 revolutions when delivering 20 H. P. The armature contains 92 bobbins, with 16 turns of wire in each bobbin. The ends of these bobbins are directly connected to the adjacent bars on the commutator, therefore making 184 bars in the commutator. The commutator is so

cross-connected that one-half of the bobbins on the armature are in series and the two halves of the armature are in parallel, so that only two brushes are used and they are placed horizontally and diametrically opposite each other on the commutator, easy of access, and the commutator can be easily cleaned from the trap-doors, while the car is in operation. There are three magnet spools in the machine, or three wound magnet poles and three consequent poles. The armature is carried on a hollow shaft, which has an internal diameter of 6″. Through this shaft passes a 4″ axle. There is an annular space of 1″ left around the axle. The end of this hollow shaft is placed in a flexible driving connection with the axle, which permits the motor to ride upon its supporting springs and at the same time transmit its power to the car-axle. The motor has an efficiency of over 80 % from 10 H. P. to 20 H. P. This new Gearless motor is arranged to be used in connection with 30″ wheels with a clearance of 3″ between the bottom of the motor and the truck. Two of these motors placed on a car will exert a horizontal effort in the starting of the car of about 1,500 pounds, 80 ampères, and would make a speed of about 20 miles an hour with an ordinarily well-loaded car, and a consumption of from 18 to 20 ampères.

SHORT SINGLE-REDUCTION MOTOR.

This machine is so well known that a detailed description is hardly necessary at this time. A few brief references to it will, however, be of interest.

The cores and pole-shoes of the field-magnets are cast in one solid piece and afterwards carefully annealed, giving the iron very high magnetic qualities. The coils are wound with No. 6 wire B. & S. gauge, and they are carefully insulated by a composite insulation nearly a quarter of an inch in thickness. The four coils in each set are connected in series and the two sets in parallel.

The armature core is 18½ inches in diameter and is of the ring type. The bobbins, of which there are 48, are wound with flat wire, which renders them strong and stiff mechanically, and they are carefully insulated. Any one or more of the bobbins can be rewound without disturbing the others. The commutator is 12½ inches in diameter and is composed of 144 bars of hard-drawn copper, the insulation being of mica. The brush-holder holds the carbon brush with an even, light pressure square upon the commutator. The electrical connections are of heavy insulated Clark cable enclosed in garden-hose, and are brought in at two places.

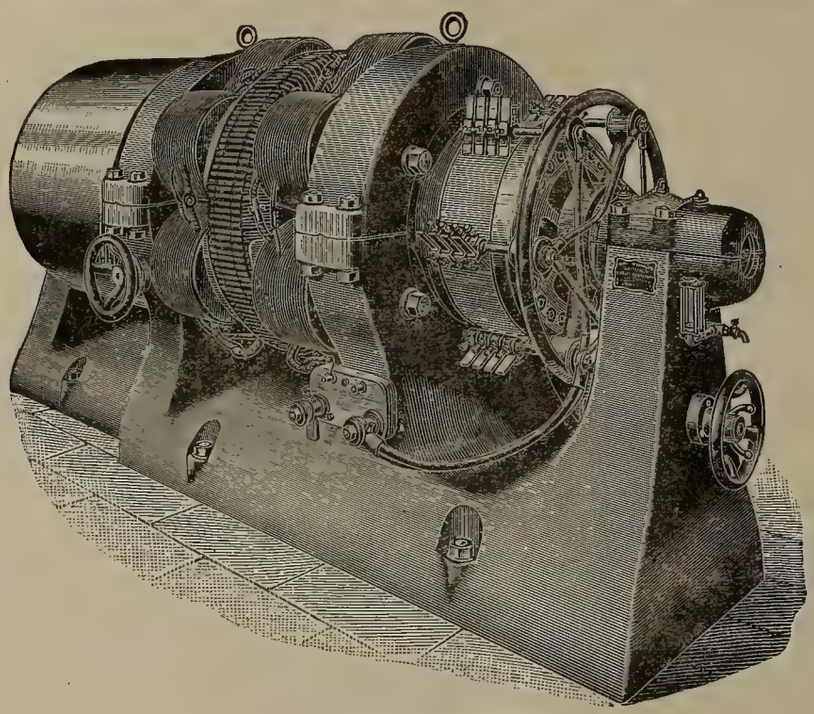
Brass bushings are used for the journal bearings. The motor frame is of cast-iron, practically waterproof and proof against mechanical injury. It is provided with two axle bearings 6 inches in length, and is hinged as shown in the illustration, so that it can be readily opened for inspection.

The gear teeth are of the involute type and have great strength. The pinion is cut from the best hammered steel and the split or axle gear from steel castings carefully selected.

The special features of the single-reduction motor are: first, thorough mechanical protection; second, thorough ventilation; third, sparkless running at the commutator; fourth, accessibility of all parts, and fifth, quiet running and high average efficiency.

SHORT SLOW-SPEED RAILWAY GENERATORS.

The Short Company has now brought out five of the series of electric-railway generators, the first of which was announced about two years ago. The machines, beginning with the 66 and ending with the 500 H. P. generator, are massive in form yet simple in construction. The 50,000 watt (66 H. P.) generator has four field-magnets and a ring armature wound with 60 bobbins; any one of the bobbins can be rewound without disturbing the others. The commutator is 10 inches in diameter and contains 120 bars made of hard-drawn copper rods and insulated from one another by mica. To this 2-pole type of generator belong the 66, 100 and 133 H. P. machines, which perfectly meet the demands of electric railways operating from 4 to 10 motor cars.



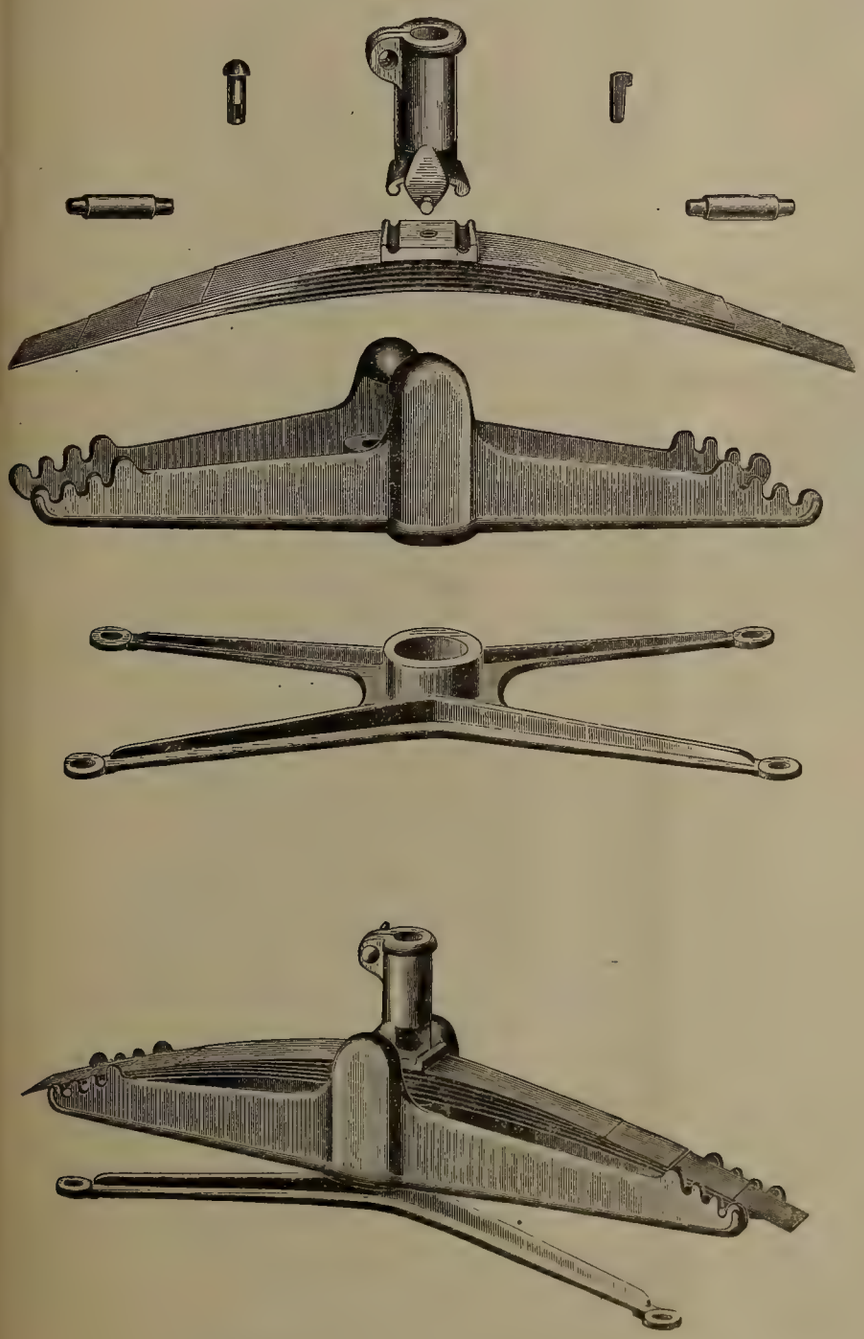
NEW SHORT GENERATOR.

The 200 kilowatt or 280 H. P. generator is of the 4-pole type. The field-magnet frame is one of the largest and most perfect single castings ever made for electric work, and weighs over 8,000 lbs. To this frame 8 field-magnets are bolted, arranged 4 on each side of the armature and carrying shunt and series coils. The pole-pieces are arranged for side presentation to the armature and make a powerful and uniform field of force. A prominent feature of the machine is the large diameter of the armature—39 inches. The armature shaft runs in two large self-oiling bearings, and the lubrication is

accomplished by rings on the shaft which draw the oil from a reservoir in the usual way. The commutator is of unusually large diameter, being 20 inches. It has 200 bars, and there is no sparking. Four sets of tangent carbon brushes are used which give a large contact surface.

THE PHILADELPHIA TROLLEY.

A trolley which has some new features has just been brought out in Philadelphia by the Technic Electrical Works. It is named the Philadelphia Trolley and has been designed to fill the need of the electric-railway superintendent and engineer. It embodies simplicity, being made up of only nine parts, and can be dismantled in seven seconds and assembled in twenty-two seconds, all without a wrench.



SEPARATE PARTS OF THE PHILADELPHIA TROLLEY.

Not a single nut, bolt, screw or washer is used in its construction, and there are no chains, coil-springs or small parts to rust or break with cold, ice or snow; neither are oil or grease required.

The Philadelphia Trolley embodies substantial mechanical design with lightness and durability of parts. All parts are interlocking and interchangeable, which means minimum cost of maintenance and repairs. It has side motion; besides being pivoted and free to turn. The design of the cam against the leaf-spring gives it equal tension against the trolley wire from vertical to horizontal positions, and the degree of tension may be adjusted through a wide range.

There is great need for a reliable trolley, and such a one as this, that can be taken apart and put together again in a few seconds, will be greatly appreciated by all, especially those roads which have experienced loss of revenue for hours on account of some trifling trolley trouble.

Agencies for this trolley will be placed in all parts of the United States and Canada.

THE GENERAL ELECTRIC COMPANY AT THE CLEVELAND CONVENTION.

The exhibit which the General Electric Company will make at the Street-Railway Convention promises to be of especial interest to street-railway men. Among other things it will exhibit a magnificent new special car, which is probably the finest equipped street car that has ever yet been constructed. This car will have a single truck equipped with two 15 horse-power W. P. 30 motors, regulated by the latest type series parallel controller. It will also exhibit a fine long car mounted on double trucks, equipped with W. P. double 25 horse-power motors, with both forms of control. The car will be equipped with measuring instruments, so that the economy of each method of control can be compared. These cars will be run upon the lines of the East Cleveland Railway Company, and the General Electric Company will furnish tickets to interested visitors.

At the hall will be shown a truck equipped with two 15 horse-power W. P. motors connected with the series parallel controller so that the operation of the motors can be clearly inspected. A dissected W. P. 30 motor will constitute part of the exhibit, clearly showing its great simplicity. Motors of the S. R. G., S. R. F. and Edison No. 16 types will also be shown. In addition a complete line of the new overhead parts introduced by the General Electric Company will be displayed, showing many new features.

Magnificent decorations of incandescent lamps will be made, not only around the hall, but also at the Hollenden Hotel, while a beautiful souvenir handbook, containing very valuable information on the general operation of electric railways, as well as covering the important features of the General Electric Company's apparatus, will be taken away by all the street-railway men there.

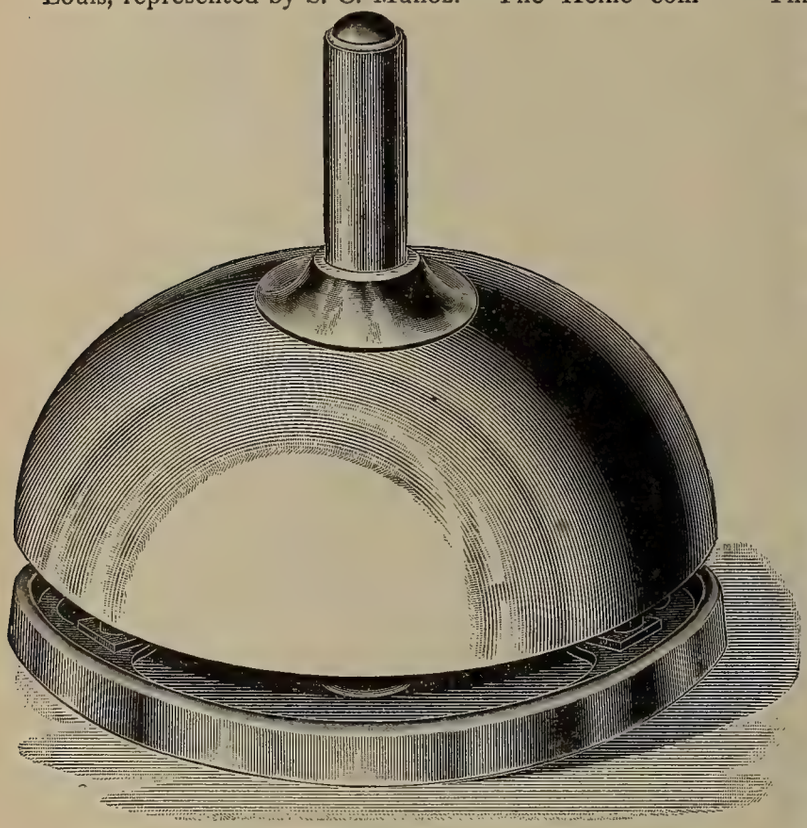
A LARGE CONTRACT.

The Brush Electric Company, of Cleveland, Ohio, through its agents, S. W. Trawick, of Atlanta, Ga., and A. D. Dorman, of New York, has just closed a contract with the Mutual Light and Power Company, of Montgomery, Ala., for a complete central-station plant, the consideration being considerably in excess of $100,000.

The capacity of plant is to be as follows: 300 arc

lights, 2,500 16 candle-power incandescent lights, 70 horse-power electric generators, 700 horse-power Hamilton Corliss Engines, 700 horse-power Heine Safety Water-tube boilers, and all necessary shafting, friction-clutch pulleys, couplings, etc., as well as all construction work for arc, incandescent and power circuits.

The contract for the complete steam-power plant was awarded to the Heine Safety Boiler Company, of St. Louis, represented by S. C. Munoz. The Heine company has sublet the engine portion of the contract to the Hamilton Corliss Engine Company, represented by J. A. Vail, of St. Louis.



MOSHER FIRE-ALARM BELL.

The complete plant must be installed and in operation by January 1, 1893.

Mr. Dorman has just closed a contract with T. S. McLachlin, of Whitehall, N. Y., for a 90 arc-light plant of the Brush system.

MOSHER FIRE-ALARM BELL.

The accompanying illustration shows a bell which has some novel features and which will find a valuable application. It is known as the Mosher Fire-Alarm Bell, and is made by the Mosher Fire-Alarm Bell Co., of Birmingham, Conn.

In external appearance it resembles a table call-bell, except that it has a long projecting cap from the centre of the gong, where the finger-tap is usually placed. In this projecting cap is an important piece of apparatus. Before describing it, however, it will be necessary to explain the operation of ringing the bell. It is rung by a spring within the gong which is wound up in the manner of a clock spring. The ringing of the bell is accomplished by a slight pressure on the pin which projects through the gong from within and into the projecting cap above referred to. The pin, however, is not accessible to the finger. The projecting cap, being screwed on to the gong over it covers it up. Within the cap is a plunger and spring, and when the spring is free to act it forces the plunger against the pin and the bell rings.

The plunger in its normal position, however, is held away from the pin by being forced into the interior of the cap against the spring, the plunger and spring being held in this state of tension by a solid composition which is put into the tube. This composition melts at a temperature of 110°, and when it does the spring, being thus released, forces the plunger against the pin and the bell rings.

This bell is a reliable fire-alarm, and it can be placed in any convenient place. Should the temperature in a room or hall rise to 110°, which is an abnormal heat, the alarm is sounded, calling attention to the danger.

This bell can be connected by electric wires so that when it acts by reason of high temperature the fact can be indicated on an annunciator, in a hotel for instance, and by distributing bells throughout the building and connecting each with the annunciator the location of any one ringing bell can be determined at once, and the trouble attended to. Mr. G. D. Mosher, Birmingham, Conn., is the inventor of this bell.

REPORTED ASSIGNMENT.

A despatch from Scranton, Pa., announces the assignment of the Wightman Electric Motor Co. Inability to collect money due is said to be the cause of the difficulty. It is reported, however, that the concern may be reorganized; it has an extensive plant in Scranton.

PAMPHLETS.

"The Tariff: Its Bearing upon the Industries and Politics of the United States," is the title of a pamphlet by Henry V. Poor, of H. V. & H. W. Poor, 70 Wall street, New York. It contains timely and interesting reading, and those engaged in electrical industries, including electric railways and electric lighting, will find it profitable reading.

"A Ready Reference for Engineers and Steam-Users" is the title of a pamphlet gotten up by Jame B. Stanwood, M.E., and published by Houston, Stanwood & Gamble, Cincinnati, O. It has 48 pages and is brimful of very useful facts and information, and of great value to engineers and those having steam plants in charge. The information given is worth many times the price.

SWAN LAMP MANUFACTURING CO.

Mr. E. P. Roberts, general manager of the Swan Lamp Manufacturing Company, Cleveland, Ohio, sole manufacturer of Swan incandescent electric lamps, has courteously arranged to have the company's works thrown open during the convention for the inspection of those who wish to see how incandescent lamps are made.

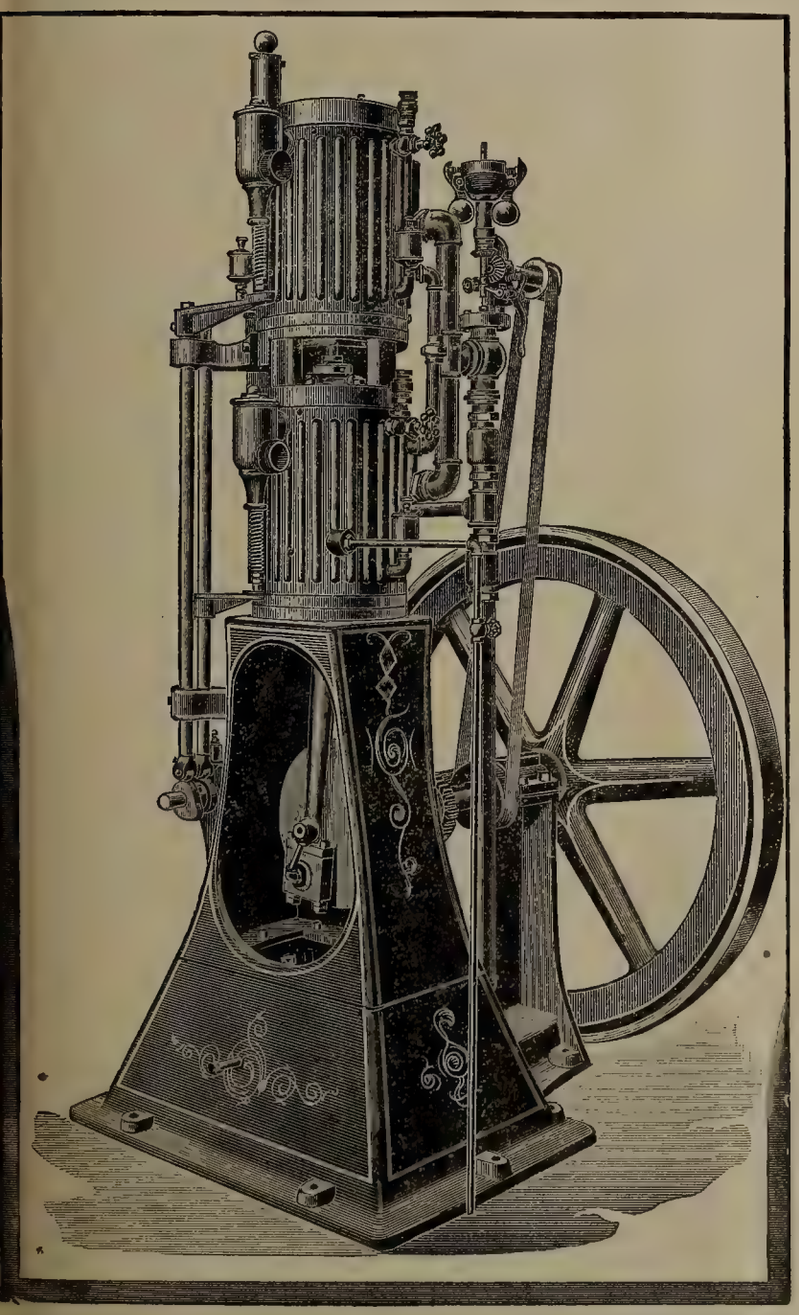
KILLED BY ELECTRIC SHOCKS.

Joseph F. Toliver, an employé of the Indianapolis Electric Company, Indianapolis, Ind., was killed by a 2,000-volt shock on October 10, which he received by accidentally taking hold of a "live" wire.

A lineman for the United Electric Light Co., of Springfield, Mass., met his death on October 6 by grasping both ends of a wire carrying a 2,000-volt current.

HICKS GAS-ENGINE.

The employment of gas-engines for small-power purposes, and especially for the operation of isolated electric-light plants, is very extensive. Since the time of introduction but few improvements have been made. The attention of Mr. John B. Hicks, the well-known inventor and manufacturer of steam-engines, having been directed to the subject, he set about to devise an engine which should contain many new and superior features. The result of his efforts is shown in the accompanying illustration of the Hicks gas-engine, manufactured by the Hicks Gas-Engine Works, of Cleveland, Ohio.



HICKS GAS-ENGINE.

In the old style gas-engines but one effective stroke of the piston was obtained for each two revolutions of the crank-shaft, one revolution being devoted to filling the cylinder with the explosive compound, and compressing it, and another to igniting and expanding the gases behind the piston, and then forcing them out preparatory to drawing in a fresh charge.

In the Hicks engine two cylinders working alternately are employed, their pistons being on one piston-rod. The power is thus doubled and the weight of the engine only increased by the weight of one cylinder and piston, a very small item when compared with the extra power secured.

In construction the engine is extremely simple yet highly efficient. It has fewer parts than the old style, can be bought for less money, is one-half the weight, and occupies one-half the space required for an equivalent H. P. of any other make. These with many other advantages make the Hicks engine a very desirable one in every respect, and certainly open up a very bright future for it.

GRAVES LOW-TENSION ARC LAMP.

The Graves low-tension arc lamp, manufactured by the W. D. Graves Electrical and Mfg. Co., Cleveland, O., is very well known in the West, and no less than 30 of them will be used for lighting the exhibition hall during the street-railway convention. A large number of them are used on the East Cleveland railway and they are reported to be giving the best of satisfaction.



GRAVES LAMP.

The lamp, of which we give an illustration, is noiseless in its operation, and gives a constant and brilliant light. It can be run in series or singly as desired, and consume any desired amount of current to make a highly efficient light. It is constructed on an entirely new principle. The upper carbon is separated from the lower one by a simple mechanical device, and the feed is produced by a pair of magnets connected in shunt with the arc.

The light is steady and free from hissing or flickering. These lamps can be used on any direct-current system of incandescent lighting and on circuits of from 70 to 220 volts. They are giving excellent satisfaction on street-railway circuits of 500 volts, where 6 or 8 of them are run in series. These lamps are made with single and double carbons, and there are no clock-works or dash-pots to complicate their operation.

CLEVELAND'S ELECTRICAL INTERESTS.

The Short Electric Railway Company's exhibit will comprise one 30 H. P. and one 20 H. P. single-reduction motors; one 15 H. P. Standard motor; one 20 H. P. Gearless (Pittsburg) 1890 type; one 20 H. P. Gearless motor of the 1891 type; one 25 H. P. Gearless motor of the 1892 type; a series-multiple switch with controlling apparatus; a 66 H. P. generator, and a 280 H. P. generator running as a motor. It will also have cars equipped and in operation as follows: Gilbert car (private) Anger truck; Short Company Gearless car with Short truck; Short Company single-reduction car with Brill truck; Brownell Company car with Brownell truck; Lamokin Car Company car with Robinson radial truck; St. Louis Car Company car with St. Louis Car Co. truck.

Dorner & Dutton are constructing a new truck for a Short Gearless motor to go under a private car. They received the drawings for this truck on Oct. 4, had to make the patterns and heavy castings, and delivered the truck at the Short works on Monday, Oct. 10. This is quick work and shows enterprise on the part of the firm. They also received on Oct. 7 from the Westinghouse Company an order for a new truck for the exhibition Westinghouse motor, and they had the same ready Oct. 13. In this time they had to make blue prints, new patterns and castings; but, with their extensive facilities, they seem to be able to handle orders of this sort with surprising rapidity. They have been making a new heavy automatic gear-cutting machine. They built the first one nearly three years ago for small work, but found it necessary to make them larger, as the demand for heavy motor gears increased. Now they have them practically completed in large sizes to cut hammered steel gear-pinions. While your representative was present at their works they were engaged in cutting a large three-inch pitch hammered steel pinion for the Thomson-Houston system. They are now preparing to put this automatic gear steel-cutting machine on the market, and will exhibit one of them, and one of their new elliptic and spiral spring non-oscillating motor trucks with wrought-iron side-bar, made of one piece and resting on the axle bearings.

The Universal Electric Company, 739–741 Cedar avenue, makes a specialty of renewing and repairing old incandescent lamps. It has a special process for cleaning the inside of bulbs and rendering the carbon filament equal to new, and it guarantees the lamps to be equal to new ones after passing through its hands. This work is done at a moderate cost. Mr. N. S. Possons, the president and manager of the company, has had large experience in the electric-light manufacturing business. He is an old Brush man, being one of the organizers of that company. Mr. George R. Lean is vice-president and superintendent, and Mr. W. J. Possons is secretary and treasurer.

Mr. I. H. Moses, successor to A. B. Lyman & Co., 36 South Water street, moved to the main floor of his building March last. He has since added a full line of electric-light supplies and branched out in the electric-light construction business, in which he has already attained considerable success. He recently wired the Tracy block in Cleveland, which work is said to be the finest of its class in the city. The wires, which are the celebrated Grimshaw White Core insulated wires, are run through the Interior Conduit and Insulation Company's brass-armored tubing, which is used throughout the building. The wiring is done for both arc and incandescent systems; 41 arc lamps and 100 incandescent will be used. Another excellent piece of work done by Mr. Moses was that in Mr. J. W. Sellers' residence, in which Grimshaw wire and Interior tubing are also used. Mr. Moses' store is completely stocked with as fine a line of household, office and telegraph apparatus as can be found anywhere. He manufactures all of his bells, batteries, annunciators, gas-lighting apparatus, etc., himself, and is the only manufacturer of telegraph instruments between New York and Chicago. He has brought out an improved Holtz-Toepler frictional machine that will give a spark in the dampest weather.

A UNIQUE SOUVENIR.

The other day we received in the mail an ancient-looking, musty-smelling and weather-beaten document (figuratively speaking), the appearance of which carried us back to our younger days—that is, the younger days of America. It proved to be a very cleverly executed *fac-simile* of an ancient document and contained a map of Western Europe and Eastern Asia as it was known in 1492, in Columbus' time. A big red star marks the location on the map of the American Electrical Works, of Providence, R. I., "which," as the document reads, "together with all the rest of America, was unknown to those ignorant geographers of 1492."

The American Electrical Works management shows commendable enterprise and patriotism on all special and appropriate occasions.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	93 00
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	169 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	118 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*107
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	107 00
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 50
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	119 00
General Electric Co., 5s	4,000,000		*106
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00

Names of Companies.	Capital.	Par.	Price
Interior Conduit & Ins. Co., N. Y....	1,000,000	100 00	75 00
Int. Okonite, Limited.....	1,700,000	50 00	49 00
Laclede Gas Co.....	7,500,000	100 00	24 75
Laclede Gas pref.....	2,500,000	100 00	66 00
Laclede Gas 5s.....	10,000,000		*84
Law Telephone.....	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s.....	30,000		*92
Marshalltown Elec. Co. 6s, Iowa... ..	65,000		*98
Marysville L. & W. Co. 6s, Ohio.....	60,000		*98
McLeod Railway Equip. Co.....	3,000,000	25 00	35 00
Metropolitan T. & T., 5s.....	2,000,000		*103
Montclair Elec. Lt. Co., Denver.....	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s.....	20,000		*170
Morristown L. H. & P. 5s, N. J.....	30,000		*102
Morristown L. H. & P.....	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co.....	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.....	10,394,600	100 00	61 00
N. Y. and N. J. Tel. and Tel. 5s.....	1,500,000		*98
N. Y. and N. J. Telephone Stock.....	2,535,000	100 00	98 00
N. Y. Storage Battery.....	100,000	100 00	96 00
North American Railway Co.....	39,767,200	100 00	13 00
Postal Telegraph.....	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston.....	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum....	1,000,000	100 00	105 00
Rockaway Elec. Light.....	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*90
Sawyer-Man Elec. Light Co., N.Y.....	125,000	100 00	100 00
Shaver Corporation, N. Y.....	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.....	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.....	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.....	50,000		*97
Suffolk Electric Co., Boston.....	300,000	10 00	10 50
Swan Incandescent.....	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.....	750,000	100 00	100 00
The Hall Signal Co., N. Y.....	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.....	100,000	100 00	115 00
The Ongley Electric Co., N. Y.....	250,000	100 00	85 00
The Siemens & Halske Co., Ill.....	500,000	100 00	par
The Washington Wat. Pow., Wash.....	1,500,000	100 00	90
The Wells & French Co., Ill...	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y....	500,000	30 00	*101
United States Elec. Co.....	1,500,000	100 00	25 00
United States Illuminating, N. Y.....	1,250,000	100 00	26 00
Western Union.....	86,188,852	100 00	99 25
Westinghouse Elec. & Manf. Co... ..	7,000,000	50 00	38 25
Westinghouse Elec. Co. pref. 7s.....	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.....	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The fortunate holders of electric securities in the neighborhood of New York, whether local residents or not, are having a most enjoyable time of it about this time. What with the Columbus celebration and the presidential election the whole area, which one hundred years hence will be known as Greater New York, is aglow with electricity, and most of it to be paid for at retail rates, while more electric power is being used every day. All of this means income to the electric trade from the General Electric Company down to the smallest financial interest connected with the industry ; and the illumination is elegant from the dome of the Electrical Age office, known to the world as the World or Pulitzer Building, and which can be seen from a distance of between twenty-five and fifty miles, down to the electric yachts, many of which have their incandescent machinery below the river level ; all is brilliant. The Columbus celebration, not including that of the 21st inst., is estimated to have cost at least $2,000,000, and the electric fraternity receives its full share. It does not seem possible to us who live in the city to get up a decent show after sundown without calling largely on electricity for it. One grand point connected with it is its safety. Altogether too many are being smothered and cremated by those deadly terrors, gas and kerosene. There should be some way devised to make the gas corporations financially responsible for every death proven to have been caused by the current from their mains; also for all damage caused by explosions or fires, of which we read every day. With the casualties from kerosene the manufacturer-corporation should be held responsible, and both of them criminally liable. This would at once bring innocent electricity in court face to face with the two proven enemies to life and property, and through the pockets of shareholders convince them of the truthfulness of the above proposition. There is going to be a grand evolution in this matter before the electric celebration of the advent of 1900. There are no electric accidents ; it is culpable negligence when a man employed among the conductors closes the circuit through his body. We don't hear of women or children being killed that way ; the wires are always carefully placed beyond reach and insulated from every thing that may convey the current except precisely where and when it is intended to go. I believe gas and oil will be held for all loss on the one side and electricity have a favorable verdict on the other. Investors take notice : The Edison Electric Illuminating Company, of New York, has listed on the New York Stock Exchange $400,000 more of their first mortgage convertible 5 % gold bonds of 1910, making a total of $3,050,000 of this class of security. The great confidence the investing public have in the future of this corporation is decidedly shown by the price at which they are held, as will be seen by referring to the list. One hundred and six is an extraordinary price for a five per cent. bond, and shows up bold as against the six and seven per cent. bonds and preference shares quoted from par to much below. There are several electric securities on the market seeking capital for extension, which are netting to-day eight per cent., but it is hard to make this known to the purchasers at the proper time, causing not only the local public to wait, but keeping so much money out of active employment. There should be an electric security exchange where these two elements can meet.

TRADE NOTES

Brown & Sharpe Mfg. Co., Darling, Brown and Sharpe, Providence, R. I., has an interesting exhibition at the fair of the Massachusetts Charitable Mechanic Association, Boston, which is now in progress. The exhibit comprises 1,300 articles.

The Electric Railway Engineering Co., 180 Summer street, Boston, J. F. McGowan, manager, has secured a corps of competent engineers and is prepared to do general engineering for the designing and construction of power plants for electric railways, lighting and other stations, also steam plants and water-powers. It makes electric-railway construction a specialty.

The Buffalo Street Railway Company recently placed an order with the Standard Underground Cable Company, of New York, for fifty miles of heavy underground feeders, the outside to be protected by braid thoroughly impregnated with the celebrated P. & B. Insulating Compound, manufactured by the Standard Paint Company, 2 Liberty street, New York. This is probably the largest single order ever placed by an electric street-railway company.

The W. C. Vosburgh Manufacturing Company, Limited. The above-named firm has just issued two new, magnificent and costly catalogues, consisting of a series of elegantly bound and engraved plates of electric, gas and combination fixtures, and for clearness of detail and perfect representation of the goods which they manufacture, these plates cannot be excelled. They are works of art and are for the trade only.

A glance through these catalogues will at once show that this company keeps itself abreast of the times and is equal to all demands made upon it for all kinds of fixt-

ures for electric lighting as well as for gas. Its business tact and enterprise is evinced in the fact that it has secured the services of Mr. James Beesley for the designing department. This gentleman's reputation as a designer of original and artistic productions is so well known that nothing need be said except that great results may be expected.

The company is now fully installed in its new and handsome building which has been erected at 269 and 271 State street, Brooklyn, alongside of its factory, which takes in the numbers from 273 to 281 State street. As the building is used for show-room and office purposes and being in such close communication with the factory, the entire plant is now practically under one roof, and by the introduction of pneumatic and speaking tubes between the factory and the offices and show-rooms all departments are in direct and instant communication, so that as soon as orders are received nc time is lost in putting them through the works. In fact every convenience has been introduced which will assist in the prompt despatching of their constantly increasing business.

The western branch of this company is located at 184 and 186 Wabash avenue, Chicago, Ill., where the demands of its large trade in that section of the country are met.

The durability of the finish and fineness of quality of the goods manufactured by this concern is well known, and the mere fact that goods have been furnished by this company insures their superiority, as none but first-class mechanics are employed in the making of the cheapest as well as the finest goods.

F. P. Little & Co., contracting and consulting electrical engineers, 141 East Seneca street, Buffalo, N. Y., report a lively business in their section. Among the large contracts they are now carrying out is the light installation for the Stone Opera House, in Binghamton, N. Y., in which they take particular pride. It consists of 660 incandescent lamps and one 600-light Thomson-Houston dynamo. The lamps are so arranged that they can be made to give light of any desired candle-power. Habirshaw insulated wires and vulca ducts are used in this installation. They are putting into the Buffalo Furnace Co. 31 arc and 125 incandescent lamps on the T.-H. system; a Rice automatic engine made by the J. T. Noye Mfg. Co., of Buffalo, and a 30,000-watt dynamo, and are wiring the Jewett Refrigerator Company's building with 150 incandescent lamps. They are also wiring the residence of G. B. Forman, one of Buffalo's oil "barons," using Grimshaw wires and Vulca ducts. The Lyceum Theatre in Buffalo was recently fitted up by them with 580 incandescent lamps in a manner similar to the installation of Stone's Opera House in Binghamton. Another contract of theirs is the installation of Bronner Bros.' large clothing house, Buffalo, with 365 lamps and Grimshaw wire. The insulators used in this installation are those of Pass & Seymour, Syracuse, N. Y., and the Imperial Porcelain Works, Trenton, N. J. Bryant's porcelain cut-outs and sockets are also used. On October 12 the firm closed a contract with the Atlas Refining Co. for 10 arc lamps and a dynamo on the Thomson-Houston system, and are now at work installing 450 lamps in the large dry-goods house of Adam, Meldrum & Sanderson, Buffalo, using Grimshaw and Habirshaw insulated wires, all run on Pass & Seymour porcelain floor tubes.

CENTRAL RAILROAD OF NEW JERSEY,
ELIZABETHPORT, N. J.

Messrs. FORREST SILVER BRONZE PACKING CO.,
No. 115 LIBERTY ST., N. Y. CITY.

Gentlemen: In reply to yours requesting me to inform you how your "Silver Bronze Packing" has been working in the engine of the Sandy Hook steamer "Monmouth," I take pleasure in stating that, notwithstanding the severe test to which it has been subjected, it has done the work perfectly without using any fibrous packing whatever.

Before applying the "Silver Bronze Packing" we were using the latest and most approved metallic packing put in by the builders, Messrs. Cramp & Sons; but although this packing was supplemented with soft packing which was removed almost daily, we were unable to stand on the working platform or feel of the journals below without being scalded with steam or water. Since you put in the "Silver Bronze Packing" two years ago we have had no trouble and the boxes have been steam and water tight.

I was favorably impressed with your packing when I first saw it, but it has exceeded in excellence my most sanguine expectations. In my opinion it is not only the best but the most economical packing for high steam and piston velocity in the world, and I shall be pleased at any time to afford any one interested an opportunity to examine my rods and packing for themselves.

The "Monmouth" has two triple-expansion engines, carries a steam-pressure of 160 pounds and makes 160 revolutions per minute. The pistons are carried by main and tail rods, and, owing to constructional freedom at the cross-heads, are very hard on packing.

Yours very truly,
(Signed) J. H. PERRY,
Chief Eng'r Steamer "Monmouth."

The Electrical Age's Illustrated Patent Record.

Issued October 11, 1892.

483,993. Rail-Joint. Winfield Curtis, Oakland, assign, or of one-half to E. F. May, San Francisco, Cal. Filed Nov. 16, 1891.

484,036. Railroad-Tie and Fastening. Thomas B. Moore, Philadelphia, Pa., and John G. Hodgson, Maywood, Ill. Filed Feb. 26, 1891.

484,045. Electric-Cable Splice. Frederic A. C. Perrine, Trenton, N. J., assignor to John A. Roeblings Sons Company, same place. Filed June 29, 1891.

484,062. Automatic Block-Signal for Railways. Sydney J. Stuckey, Danbury, Conn. Filed March 14, 1892.

484,068. Railroad-Signal. Eugene Urbain, Brooklyn, N. Y. Filed Oct. 20, 1891.

484,096. Galvanic Battery. John W. Hoffman, Chicago, Ill. Filed Dec. 12, 1891.

484,100. Railroad-Crossing. Moses G. Knight, Oak Cliff, Tex. Filed March 29, 1892.

484,110. Apparatus for Regulating the Intensity of Incandescent Lights. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, same place. Filed March 18, 1892.

484,120. Secondary Battery. William L. Silvey, Lima, Ohio. Filed Jan. 29, 1892.

484,123. Electrically-Operated Railway-Switch. Charles A. Stone, Newtown, and Edwin S. Webster, Boston, Mass. Filed Sept. 25, 1891.

484,140. Electric Fire-Alarm. Harvey Cortland, Toronto, Canada. Filed April 30, 1892.

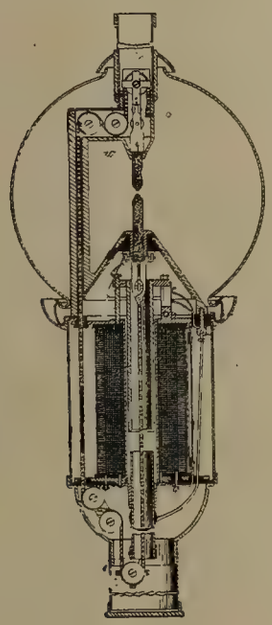
484,150. Magnetic Telephone. Charles S. Forbes, London, England. Filed May 16, 1892.

PATENTS.—Continued.

484,182. Method of Electrical Refrigeration. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Feb. 3, 1890.

484,183. Electrical Depositing-Meter. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 2, 1891.

484,184. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 27, 1886. Renewed March 30, 1892.



484,199.—ELECTRIC ARC LAMP.

484,185. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 27, 1886. Renewed March 30, 1892.

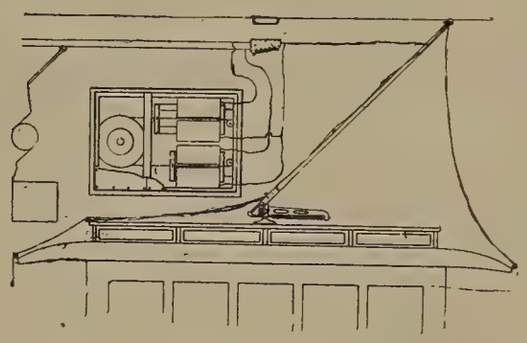
484,199. Electric Lamp. Joel A. Hayes, Carson City, Nev. Filed June 27, 1891.

484,206. Device for Preventing Accidental Closing of Electric Circuits in Signal-Boxes. William H. James, Boston, Mass., assignor to the E. Howard Watch and Clock Company, same place. Filed Feb. 16, 1892.

484,207. Incandescent-Electric-Lamp Socket. Charles J. Klein, New York, N. Y., assignor to the Bergmann & Company, same place. Filed Dec. 28, 1889.

484,208. System of Electrical Distribution. Harry W. Leonard, New York, N. Y. Filed June 3, 1892.

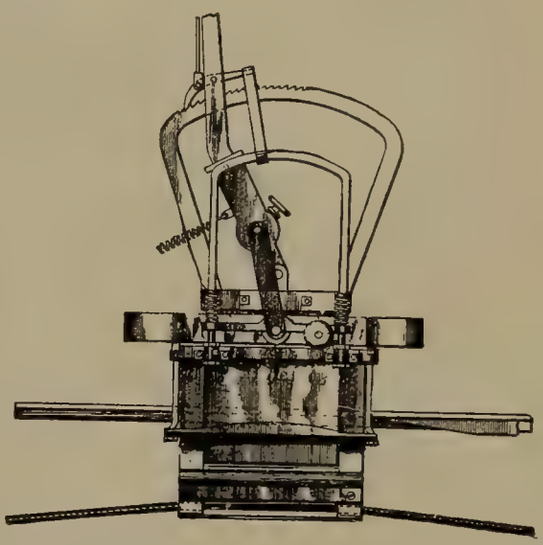
484,209. Insulator. Fred M. Locke. Victor, N. Y. Filed July 13, 1891.



484,123.— ELECTRICALLY-OPERATED RAILWAY-SWITCH.

484,215. Car-Seat. Conrad H. Matthiessen, Odell, Ill Filed March 7, 1892.

484,226. Rail-Joint. Milton C. Niles, Oak Park, Ill. Filed July 28, 1891.



484,346. — AUTOMATIC RELEASE FOR CABLE-CROSSINGS.

484,227. Rail-Joint. Milton C. Niles, Oak Park, Ill. Filed Oct. 27, 1891.

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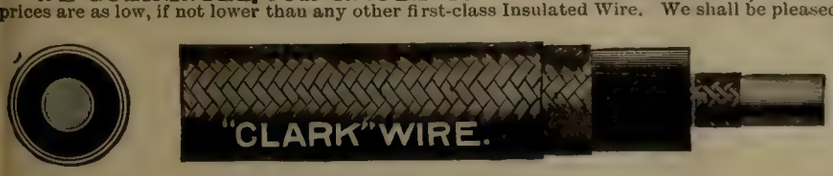
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

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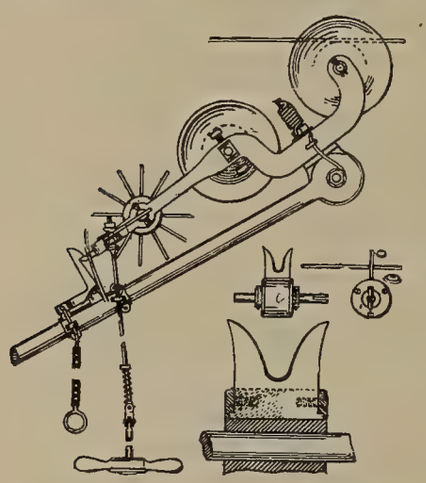
PATENTS.—Continued.

484,228. Rail-Joint. Milton C. Niles, Oak Park, Ill. Filed Nov. 17, 1891.

484,229. Rail-Joint. Milton C. Niles, Oak Park, Ill. Filed May 18, 1892.

484,232. Portable Burglar-Alarm. David D. Nolley, Wilson, N. C., assignor to E. K. Wright, Frank Rountree and J. D. Farrior, same place. Filed May 25, 1892.

484,233. Combined Electric Burglar and Fire Alarm David D. Nolley, Wilson, N. C., assignor to E. K. Wright, Frank Rountree and J. D. Farrior, same place. Filed May 25, 1892.



484,344.—TROLLEY-WIRE CLEANER.

484,250. Switch-Operating Device. Gerhard Schumacher, Milwaukee, Wis. Filed March 16, 1892.

484,280. Trolley-Wire Insulator. Albert Anderson, Boston, Mass. Filed Dec. 23, 1890.

484,315. Track-Rail. John T. Hill and Bernard Meiring, Cleveland, Ohio. Filed Oct. 8, 1891.

484,341. Rail-Joint. John H. Rouse, Advance, Mo. assignor of one-half to John T. Stratman, Jr., same place. Filed Nov. 27, 1891.

484,344. Trolley-Wire Cleaner. Ernest B. Smith, South Amherst, Mass. Filed Feb. 26, 1892.

484,346. Automatic Release for Cable-Crossings. Frank W. Smith, St. Louis, Mo., assignor of five-eighths to C. W. Crutsinger and Albert D. Smith, same place. Filed May 21, 1892.

484,375. Railway-Train Telegraph. Matthew S. Reiley, Washington, D. C., assignor, by direct and mesne assignments, to Melvin D. Peck and James McKendree Reiley, same place. Filed Jan. 4, 1888.

484,380. Electric Switch. Milton R. Utley, Minneapolis, Minn., assignor of one-third to Frank P. Seavey, same place. Filed March 5, 1892.

484,385. Battery Compound. William Wright, New York, N. Y., assignor to the Columbian Electric Light, Power, Heat and Manufacturing Company, of New Jersey. Filed Dec. 2, 1891.

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ELECTRICAL AGE

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THE CLEVELAND CONVENTION.

The annual convention of the American Street-Railway Association which was held in Cleveland, Ohio, last week, was, without any question, the most successful ever held by the association. In point of attendance we doubt if there ever was so large a turnout at any convention involving electrical interests. The utmost enthusiasm prevailed, and every one seemed to be delighted with the treatment received in Cleveland. The management of the various hotels were in harmony with the occasion and there was no extortion or anything disagreeable, which were two prominent features connected with the convention in Pittsburg last year. The hotel-keepers of Cleveland won the esteem of all the street-railway men by their generous treatment, and the street-railway people likewise deserve great credit for their generosity and hospitality. In fact all interests concerned spared no pains to make the meeting a successful and pleasurable one.

The electrical manufacturers and supply-men surpassed their previous efforts, and the exhibition feature of the convention was a very complete and attractive one. There were many novelties which attracted the attention of the street-railway men, and the exhibition as a whole was a great treat to the citizens in general. The hall and annex were thronged from early morning till late at night with curious and interested sightseers.

The entertainments provided by the local companies were elegant affairs and commensurate with the importance of the occasion, and the delegates went home with a very warm spot in their hearts for Cleveland and her street-railway people and those connected with allied interests.

The papers read at the meetings were of high order, but beyond the reading of these little else was accomplished.

The next annual meeting of the association will be held in Milwaukee. This will enable many of the members to attend the convention and visit the World's Fair on the same trip. Milwaukee is convenient to Chicago, and the street-railway interests there are of large magnitude and constantly growing.

Efforts were made during the convention to organize a supply-men's association to co-operate with the American Street-Railway Association, but as the latter body saw no necessity for such an organization the matter was allowed to drop.

PROMINENT FEATURES OF THE CONVENTION.

STREET RAILWAY NEWS, the brother of the ELECTRICAL AGE, was fully represented at the convention in Cleveland, and its headquarters at the Hollenden Hotel were constantly thronged with callers. The daily edition of STREET RAILWAY NEWS was the only daily convention paper published, and the contents of each day's issue were as eagerly devoured as are the proverbial "hot cakes." We introduced a feature this year that carried the convention by storm. We got up an aluminum medal for the occasion, to which was attached a metal tag with a number on it. The medals were thus numbered progressively, starting with 1, 2, 3 and so on. All street-railway men who placed their names on our register received the medal with the number corresponding with that opposite which his name was written. The names, with their respective numbers, were published in the daily STREET RAILWAY NEWS, and when one person met another whom he did not know, he could ascertain the name of the stranger by noting his number, then referring to that number in the daily bulletin of STREET RAILWAY NEWS, where the name of the person would be found. The result of this idea was far beyond our expectations, and at the end of the first day the supply of our badges had been completely exhausted, and much to our own disappointment, as well as that of a great many of our friends, we were unable to regale them with the badge that ruled the convention.

The staff of STREET RAILWAY NEWS desires to return thanks to all for the hearty encouragement and support received during the convention, and trusts that we may all meet in Milwaukee next year under as favorable circumstances.

CONVENTION OF THE AMERICAN STREET-RAILWAY ASSOCIATION.

The eleventh annual meeting of The American Street-Railway Association was held in the hall of the Young Men's Christian Association, Cleveland, Ohio, October 19–21, 1892.

The first business session was held on Wednesday morning.

President John G. Holmes, of Pittsburg, Pa., called for order and introduced Hon. William G. Rose, Mayor of Cleveland, who made an interesting address of welcome.

The address was received with great applause, and was followed by the address of President John G. Holmes.

The following is the address in full:

THE PRESIDENT'S ADDRESS.

GENTLEMEN OF THE CONVENTION: This is a patriotic year, and its culminating point is close at hand. Friday of this week has been designated by Congress as a national holiday in commemoration of the discovery of America. Happily for us, since we cannot be in Chicago on that day to take part in the opening of the World's Fair, it is our privilege to meet together as the representatives of one of the foremost American industries in the State, whose capitol is Columbus. In this way at least we are permitted to pay our tribute of respect to the memory of the bold and intrepid navigator who 400 years ago turned the prow of his vessel to the westward and sailed forth into the unknown seas on the most fruitful voyage of discovery in the history of mankind.

It is a felicity to meet in Ohio this year, and it is a pleasure and a privilege to come to Cleveland. We have heard much of the Forest City, with its far-famed Euclid avenue, its viaduct of massive masonry, its splendid Arcade and its beautiful Lake View Cemetery whose crowning feature is the mausoleum which holds all that is mortal of the martyred Garfield.

But of deeper interest than any of the sights of the city, and more closely bound to us by the ties of common interest, are the street-railway companies of Cleveland. Their officers have greeted us with such generous hospitality, and have made such excellent arrangements for our comfort and convenience, that we feel like reversing the usual order of business and to extend to them a vote of thanks at the very outset. This city offers a fine opportunity to study practical street railroading. Here we see the most advanced ideas of construction, the highest development of the electric system, and a splendid new cable plant, as near perfect as capital, invention and engineering skill have been able to make it. And by the way of contrast and historical interest, we find a few horse-car lines to remind us of the meetings a decade ago, when we used to grow excited over discussions of the relative merits of the horse and the mule as a street-railway motor.

The street-railway interests of the United States are assuming wonderful proportions. Every day some new company is born, and every morning paper brings us rumors of consolidations, absorptions and syndicate purchases, until the statistician lays aside his pencil and sheet in despair, utterly bewildered by the mass of accumulating and shifting figures. Definite data are out of the question, and I shall not attempt to tell you how great we are even in round numbers. But while the street railways are legion, there is but one American Street-Railway Association, and I know you will be glad to learn that Mr. D. F. Longstreet, one of the founders of this body, in compliance with the request of the executive committee, has prepared a historical paper, detailing the motives which led to the formation of the association, and giving due credit to the gentlemen associated with him in the movement. We shall be favored with this paper a little later.

This is pre-eminently an electric age, and most of us believe that as yet we are only standing on the threshold. The horse and his half-brother, the mule, are destined to disappear. The cable system, from its very nature and cost, must be confined to the thickly populated districts of large cities, but there seems to be no limitations to the electric railway. It leaps over the city lines wherever there is a large suburban town calling for rapid transit, it girds the summer lakes, it is forcing its way through the scenic splendors of the Niagara gorge, close beside the water's edge, and when the convention goes to California, as no doubt it will some day, we may expect to ride around the Yosemite on a train of trolley cars. And how rapidly it has all come about!

It was just ten years ago that the president of this association, at the Chicago meeting, with a foresight which must have been born of intuition, ventured to predict that the lightning would some day be harnessed to the horse car. We laughed at his visionary prophecy, and dismissed it from our minds as a piece of optimistic nonsense. But the prophet of a decade ago is with us to-day, and can take revenge by saying "I told you so."

So accustomed have we become to rapid strides and the complete overturning of the existing order of things in our business that I do not believe that one among you would venture a doubtful smile were I to assert that before the close of the nineteenth century the three successive convention cities—Buffalo, Pittsburg and Cleveland—will be joined together by a triangular electric belt line, with an immense power-house at Niagara Falls, where they are even now just on the point of developing 160,000 H. P.

But this is an assembly of practical men who have come together not to vie each with the other in making extravagant predictions, but rather to contribute each to a common fund the results of his observation and experience. The congestion of traffic in our business centres, the increasing throngs of passengers of the working class nights and morning, as the day of tenement-houses gives way to the age of suburban cottages, the safeguards against accidents required by the exigencies of rapid transit, the labor question, the unjust and burdensome taxation of corporations, the ways and means of increasing traffic and reducing the cost of maintenance and operating expenses, give us plenty of things to talk about. The principal subjects for discussion cover a wide range of practical matter having an important bearing upon street railroading as a business conducted for profit rather than for philanthropy, and the reports of the special committees will be worthy of your closest attention and most careful consideration.

While there are many other things which it would be a pleasure to say, I must not now trespass further on the time of the meeting. I thank you once more for the honor conferred and for your kind attention.

Very respectfully yours,

JNO. G. HOLMES.

The next business was the report of the executive committee.

The committee reports that at the opening of the Pittsburg meeting there was a membership of 184 companies. At that meeting and since the membership has been increased by 31 companies, several changes of names of members are reported, the result of which leaves the membership 204 companies; a net increase of 20 companies since last meeting.

The report gives a list of judicial opinions in street-railway cases since the last annual meeting, and the committee expresses its earnest appreciation "of the hearty expressions of good-will and manifest interest in the welfare of the association that have been made from time to time during the year by the street-railway and electrical press of the country."

Milwaukee is the place selected for the next annual meeting. "Its nearness to Chicago," the report states, "makes Milwaukee an especially desirable city in which to hold our convention, because of the advantage it offers to delegates by making it possible for them to attend both the World's Fair and the meeting of the association on the same trip."

The committee recommends that article VII. of the by-laws be amended by the addition to the first sentence of the following words: "Unless otherwise ordered by the executive committee." The purpose of this amendment is to give the executive committee power to change the date of the annual meeting when deemed advisable. It mentions the present meeting as an example case, the occasion for a change in this instance being

the conflict of dates for holding this meeting and those of the dedication ceremonies of the World's Fair. To change the date of this meeting, the committee says, a special meeting of the association would have been necessary.

The deaths of Lewis Lyon, president of the Third Avenue Railroad Co., New York; John H. Bonn, president of the North Hudson County Railway Co., of Hoboken, N. J., and Calvin A. Richards, ex-president of the association, are recorded.

Regarding the business future the report says: "The outlook for our business was never better. With scarcely an exception the pleasant and harmonious relations between the employés and the managers in the street-railway business in America have been undisturbed. The community of interest of both parties has been fully appreciated; and with the desire to work together harmoniously, with the purpose of furthering the best interests of the companies with which we are connected, but little friction has developed. May this state of affairs long continue! The financial outlook is the best. With peace at home and abroad, the people prosperous and happy, with the best country in the world, we look forward to the future with the brightest hope."

The report of the treasurer was then read. It shows receipts during the year of $7,574.31; expenses $6,049.54; balance in bank, $1,534.77.

The first paper read was by Mr. D. F. Longstreet, of Denver, Col., in which he traced the successive steps which were taken to create an organization among the street-railway men, and which culminated in the formation of the American Street-Railway Association in Boston, Mass., December 12, 1882. A vote of thanks was passed to Mr. Longstreet for his interesting sketch.

The next paper was that of Mr. George W. Baumhoff, of St. Louis, Mo., entitled, "A Model Electric Street-Railway Roadbed and Underground Wiring."

An abstract of this paper follows:

A MODEL ELECTRIC STREET-RAILWAY ROADBED AND UNDERGROUND WIRING.

The rail over which electric motors are operated through thoroughfares in various cities throughout the country is certainly subject to as much, if not more wear than that of many of the trunk lines; and as we have patterned closely after their method of construction we may perhaps profit by following their example in other details.

Of the various forms of the head the centre-bearing rail is the most desirable, because, with a lower tram on each side, the head is kept free from dirt, and consequently offers less resistance to the car-wheels.

In many localities the use of this form of head is prohibited. This was at a period, however, when cars were operated by animal traction, when at least seventy-five per cent. of all vehicle traffic along streets where cars were run were accustomed to use the track. If there ever was any valid objection from this source the introduction of rapid transit has certainly overcome it; for drivers of vehicles generally shun the tracks of roads operated by rapid transit. The public now demand that the quickest possible time be made in transporting them to and from their homes and places of business, and where once the unruly teamster held sway for blocks at a time, ahead of a slow-going horse car and patient passengers, he is now compelled by the change of motive-power and a strong public sentiment to keep to the right, as the law directs and the public demand. Passengers now figure on the exact time required to reach their destination, whereas under the old order of transportation the street-car ride was looked upon as a necessity only, for the convenience it afforded. What is therefore of most service to the railway company is likewise beneficial to the public; and your committee would earnestly recommend that in communities where objection is made to the use of the centre-bearing rail, that the authorities be asked to give the subject careful consideration, at least for a comparative test. We claim that it does not impede vehicle traffic, nor would it be objected to by owners and drivers of vehicles when properly laid, to the extent of prohibiting its adoption.

Next to the centre-bearing form of head, the side-bearing head is by far the most desirable, from the operators' standpoint; for the only other form made, of the girder type, is that with a groove instead of a lower flange. The latter form of head is suitable only for curves and cross-overs, when rolled with a wide groove, and should never be adopted for straight track, owing to the tendency of the groove to hold dirt, snow and ice.

In the selection of a girder rail of any form of head, and more particularly the style known as side-bearing, it would be well to remember that the rail having the widest base offers the greatest resistance to turn over; and care should therefore be exercised in the selection of the rail to secure the widest possible foot. This subject requires no argument to demonstrate its necessity, and your committee, knowing the desire of various manufacturers of rails not only to keep abreast of our wants, but who are constantly employed at large expense in devising new and perfecting existing styles, would urgently advise enlarging the rolls at the base of the rail, in order that the same shall at least equal in width the combined width of the tread and lower flange.

CHAIRS.

The less number of parts about the construction of a roadbed the more economically is it laid and maintained, and the use of a chair, the only purpose of which is to provide for the required height to the top of the rail for paving purposes, is not recommended. It is much better to secure this height by the adoption of a rail having a higher web, thus enabling the rail to be spiked directly to the cross-tie by means of a tie-plate, which tie-plate should be provided with a brace extending upwards to the bottom of the outer head of the rail, to prevent the rail from turning. Where a plain tie-plate is adopted a cast-iron brace should be spiked to each tie. No girder rail should be laid without making provision to prevent it from tipping, and the above plan, being more economical than the use of a tie-rod, is preferable, as its bearing at the upper portion of the rail is more serviceable in checking the strain than a tie-rod secured through the web of rail.

If chairs are required care should be exercised in selecting such as will insure the greatest possible bearing on the tie and such only as will not spring under heavy loads. A chair with a narrow base is apt to cut into the cross-tie and in time work loose or cause the rail to cant. All intermediate chairs should be provided with a brace extending well up under the outer head of rail, which is the best safeguard against the rail turning or canting.

JOINT SUPPORTS.

There are a large number of joint supports now in the market and in use, some of which are offered by the manufacturers of rail and some devised and manufactured by others, and it would be unfair to dwell on the merits of those of any particular manufacturer; but your committee would very urgently recommend the adoption only of such joint supports as are of sufficient length to cover at least two ties, but we consider such as secure a bearing on three ties preferable. The holes in the web of the rail should be not less than one inch in diameter, to admit the use of a bolt having a large size nut, which should be tightly secured by the use of a hammer and wrench. A six-hole fish-plate of sufficient height to reach from the foot of the rail to the bottom of the head, 26 inches or over in length, securely fastened with large size bolts, is considered by many who have used the same to be superior to all other joint fastenings.

We must bear in mind that cars, as now operated by electricity, are not only heavier than horse cars, but are operated at a much higher rate of speed, and require the most thorough construction. The slightest spring or looseness will gradually result in a low joint, which if not soon attended to will ruin the end of the rail beyond repair. It would, therefore, be well to relieve the fish-plate of much of this strain, by providing a support for the bottom of the rail extending over two or more cross-ties.

The rails, when laid in hot weather, may be closely joined, but if laid in low temperature proper allowance should be made for expansion.

There exists among railway managers a difference of

opinion as to the choice between a supported or suspended joint. Your committee, however, earnestly recommends the supported joint, with a support for the bottom of the rail extending to the adjacent ties, and does not deem it advisable to adopt the suspended joint construction unless the joint support has a firm bearing on the adjacent ties. There are a number of such joint chairs of various manufacture now in use, which your committee are reliably informed are giving entire satisfaction.

There is also a diversity of opinion as to the location of rail-joints with respect to each other, and on this subject we do not hesitate to take a firm stand in support of the joints being laid directly opposite each other, when constructed for electric traction, as the tendency where laid with broken joints is to cause the car to sway sideways, particularly at a high rate of speed, if the joints are not kept extremely perfect.

The former plan renders it also more economical to repair joints, especially in paved streets.

On motion of Mr. McLean, of New York, a vote of thanks was passed to Mr. Baumhoff; and it was ordered that three copies of the report be distributed to every company a member of the association, and one copy to every street-railway company in America.

The hour for taking a recess having arrived, the discussion of Mr. Baumhoff's paper was deferred until the evening session.

The secretary then read a letter of invitation from the Short Electric Railway Company inviting all in attendance to visit the works of the company and take luncheon on Wednesday afternoon. A letter was also read from the Walker Manufacturing Company, of Cleveland, inviting the delegates and others to visit its works on Friday, and take luncheon as the guests of the company. These invitations were accepted, and the meeting then adjourned.

In the afternoon all in attendance at the convention were taken in special cars to the works of the Short Electric Railway Company, and entertained in a very agreeable manner. Souvenirs were distributed by this company and also the Swan Electric Lamp Company. The weather was perfect and the affair was an entire success.

At the Wednesday evening session three companies applied for membership, viz.:

Roanoke, Va.—Roanoke Street Railway Co.

Washington, D. C.—Washington, Alexandria and Mt. Vernon Railway Co.

Wilmington, N. C.—Wilmington City Railway Co.

Mr. Eppley, of Orange—I would like to hear the experiences of some of the gentlemen in reference to the merits and demerits of the railway track-chair, as compared with the recent form of girder rail, nine or ten inches high. I should like to hear from some of the gentlemen who have been laying the new rail, and who have also used the chair which has been in use for the past six or seven years.

Mr. Payne, of Milwaukee—Up to within a year ago we used the girder rail on chairs—we had twenty miles of road of that construction—and about a year ago we commenced to lay the eight-inch rail spiked directly to the ties. It is laid twenty inches apart, centres. The rail on the chairs has not proven satisfactory, and we are replacing it in some places. The other rail is very satisfactory; indeed, you can hardly tell where the joints are. We think we have the best track in the world. Our present construction is the one in which we use the eighty-eight-pound rail. It is eight inches high, and it has taken the place of the other rail, which was only down two years and has been discarded.

Mr. Littell, of Buffalo—The road I am connected with has lately contracted for twenty miles of track, with the privilege of increasing it ten more, and we are going to use a 9-inch girder rail, without chairs. Splice bars ¾-inch thick and 32 inches long; 12 one-inch bolts; tie-rods every five feet; 8-feet ties three and one-half feet apart, 5 x 7. We will use yellow pine or oak. The rail is 93 pounds to the yard.

Mr. Richardson, of Brooklyn—The company of which I am president recently obtained about twelve miles of 70-pound rail, six inches in depth and four and a half inches wide at the base, laid on chairs. The substructure is made up of long-leaf, untapped Florida pine, free from sap or defect of any kind, 5 x 9, seven feet long. The ties were laid two feet six inches apart, from centre to centre, and under each joint we laid a special joint support of about 36 inches in length of 40-pound T rail reversed, properly supported by chairs. We have not yet operated this track with electric motors, but we thought when we laid it that we would have a perfect track. I think, however, we have decided on something better, and we are now laying a 90-pound rail, 9 inches in depth, 5 inches across the base, and we lay this on the same kind of ties. In addition at each rail joint we put in a 6 x 12, seven feet long tie, thoroughly tamped and laid as well as it can be. At each joint of the rail we have plates 26 inches long, ¾-inch thick, supported by two rows of bolts, four in each row; I think the size is an inch and a quarter, One thing referred to in the report I am doubtful about. The gentleman said in hot weather the joints may be laid close together; if not in warm weather there must be a space.

Mr. Hurt, of Atlanta—My experience has been that it is not the size nor the strength of the rail which you use; it is entirely the strength of the joint. In the construction I adopt, I endeavor to have no variation in the joints; I object to the difference of a thirty second of an inch in the elevation of the ends of the rail. I think if you have weak joints in a rail, to magnify that weakness you should use a large rail; the stronger you make the rail the weaker is the joint, because it throws the whole strain on the weak point. I lay track with seven-inch deep rail, on stone bearings, and there is no weak point about the track except where we break grade, and then we have a little difficulty about the joints.

Mr. Littell—My experience is that the best rail to lay is a deep rail, an eight-inch rail, without any chairs. Chairs are delusions. We tamp with broken stone or gravel, as the case may be. If we are laying the track where there is gravel, we tamp with gravel; if there is no gravel there, we use broken stone.

Mr. Pearson, of Boston—I think we have tried nearly every joint. Up to this time we have not found a joint which is perfectly satisfactory. The Johnson girder joint is the one which gives the most promise. We have, however, detected a fault which I think will be inherent in any girder rail laid on ties. The ties are cut into very rapidly by the rail. The width of the flange on the rail has not sufficient surface on the tie to prevent that, and unless you put a broad plate, ten or twelve inches long and six or eight inches wide, on each tie, it seems to me that the deep girder construction will go to pieces the same as all the lighter rails. I think that with the six-inch girder rail, laid on a stringer, with proper joint construction—Johnson joint or something similar—you get a good construction. In the stringer construction we get a large bearing surface; the rail bears its whole length on the stringer, and there is not that cutting into the rail that we will find with the use of a nine-inch rail. Another fault in rails, which I do not think is looked into carefully in laying track, is the importance of a slight difference in the height of two rails abutting together. You get a sixteenth or even a thirty-second of an inch difference in the height of the two rails, and you will have a bad joint, no matter how good the fish-plate may be.

Mr. Henry, of Pittsburg—I think that we have most of us been in error as to the construction of our trucks. I think that has nearly as much to do with the breaking down of our joints as anything else. I think we are all of us operating nearly the same kind of trucks. They are rigid on the axle-boxes. Half of the weight of the motor and the whole weight of the truck goes down on the rail like a sledge-hammer when an obstruction is met. We have got to find something that will take off that compression, that impact. It is like taking a weight of four or five tons and hammering it down on the rail. Every time you hit it it goes lower. The sooner we come to understand this the less trouble we will have. We are putting an elliptical spring on top of the axle-box, and suspending the whole weight by this spring, so that the wheel-box will work up and down as you come to a depression or elevation on the track. It allows the wheel to go up and down. I believe that the trucks have something to do with the rail-joint.

Mr. Wharton, of Philadelphia—As to the matter of rails, we all know that if it were possible to use a T rail nobody would use anything else; unfortunately, the railway companies are obliged to do what the local companies direct. In regard to the joints, I think one point has been overlooked, and that is in the proper tightening up of the bolts, in forcing them home. After they have been once tightened up they should be removed, and the oxide or other matter

which may have come there should be cleaned off, and the bolt put back and tightened up again. They should be again screwed up in about two or three months after, and the track would remain fairly permanent. On the steam roads they are continually tightening up their joints, and they have track-walkers whose business it is to look after weak points and especially to tighten up the nuts. This is quite an easy matter with steam roads, but not so simple with street railroads.

Mr. A. Johnson, of Cleveland—My recommendation to any man laying a street-railroad track is to put down at the joints extra large ties and ballast them in the best manner. The man who puts in an engine puts in a solid foundation. You can use all the heavy rails and heavy ties and heavy joint-plates, and if the track is not properly ballasted it will not stand. There is a road in St. Louis, which my brother is interested in, and which is managed by Mr. Minary, where the rail is 78 pounds, laid on rock ballast. It has stood up for the past two years and is as good a track as any I have ever seen. In straight track I put the joints opposite each other; you can take better care of your track in that way. With curve rails it is better to divide the joints. The thing I think the most important of all for street-railroad people to do is to ballast the track thoroughly; it will last longer.

Mr. Beckley, of Rochester—Three years ago last spring the company with which I am connected commenced the construction of an electric road in Rochester. It was a suburban road and constructed of 40-pound T rail. That rail is in use to-day upon that road, and I venture to say that no gentleman who has occasion to ride upon the cars can count the joints. The T rail is the best where it can be used under the ordinances of the local authorities. Our company in the past three years has constructed about 130 miles of track, on which we have been operating for nearly two years with electric cars. The reason why a T rail has been found to be the most satisfactory where it is in use is that it does not have a great depth. Take the T rail now being used by the New York Central and Hudson Railroad, and you will find that it has little depth. It has thickness; it has stability. My own judgment is that the best track which can be laid for electric traction is a track consisting of a rail weighing 52 to 60 pounds to the yard, say four and one-half or five inches in depth, and where you have paved streets, giving the necessary space for your paving block. I would put them on stringers, vulcanized preferably, upon cross-ties two and one-half feet apart. The stringer, it seems to me, should be six inches in width, giving you an opportunity to place the paving stone without interfering in any way with the track construction. I have had a track constructed in this manner recently, and I am satisfied that the track will be standing up, doing its work, when a great deal of the track which has been spoken of to-night will be in process of repair. My own judgment is that a rail which is five and one-half inches in depth is the proper rail to be laid where you have very heavy and frequent travel.

After further discussion the following gentlemen were appointed a committee to consider the question of a permanent industrial institute for the exhibition of all inventions and supplies relating to the street-railway business: H. C. Payne, of Milwaukee; D. F. Longstreet, of Denver; O. T. Crosby, of Boston; Wm. Wharton, Jr., of Philadelphia; H. A. Everett, of Cleveland.

The report on "A Perfect Overhead Electric Construction" was then read as follows:

A PERFECT OVERHEAD ELECTRIC CONSTRUCTION.*

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: The poles to be of tubular iron, thirty-two feet in length, and made in three sections in the usual way. The lower section should be at least seven inches in diameter, and the other two sections six inches and five inches respectively. The poles should be set in concrete, and at least six feet in the ground, and should not be more than 125 feet apart. The top of the pole should have about two per cent. of rake away from the curb, and should be fitted with a suitable pole-clamp, so that the span wire can be easily adjusted to the required height, which should be twenty-two feet above the track. On top of the pole should be a malleable iron cross-arm to carry the feeder wires and guard-wire spans. This cross-arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least eighteen inches, and the joints should be made solid throughout their entire length by means of shims or other contrivances.

If these joints are not properly made the poles will not stand the strain. For curves or extra strain there should be larger poles of the same make.

Span wires should be of No. 4 B. W. G. silicon bronze wire, and should be fastened to pole-clamps by means of insulated turn-buckles. Great care should be taken in insulating these turn-buckles from the poles.

All well-built lines should be sectional, and the trolley wire should not be of too great a size, as it would then call for clumsy supports. As it is not the main-current wire it can be of a smaller size. I would therefore recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity, and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages, where there is great liability of fires, it would be advisable to put trolley breakers at shorter intervals. Trolley-wire hangers and pull-off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made, and brass cone-shaped tubes slipped over the wire before the splice is made. After completing the splice the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches, or switch-pans, should be avoided, if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single-track road.

Great care should be taken in erecting the guard-wire spans. They should be properly insulated from the cross-arms by means of a strain insulator, or something equally as good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire at least three feet apart and four feet above the trolley wire. The guard wire must be well insulated from the guard spans; in case of other wires falling this would be of great importance.

Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed-in taps must not be more than five poles apart and should take the place of the trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would therefore recommend that the feeder wire be at least thirty per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulators or something equally as good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole at each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampère meter and cut-out switch for each section; then, in case

* Abstract.

of trouble on any section the location can be easily seen and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every thousand feet. They can easily be attached to the poles and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material or care used in constructing, a good line cannot be insured without a thorough daily inspection.

It is to be hoped that in the near future a perfect overhead electric construction will be realized in some of our large cities, for the example or fact will be of much more value and interest than any paper on the subject.

Respectfully submitted,

CHARLES H. SMITH, *Committee.*

Adjourned.

THURSDAY.—MORNING SESSION.

The president, John G. Holmes, having been called away by the receipt of a telegram, the vice-president, Thomas H. McLean, of New York, presided.

The secretary announced the committee on nominations after which the report of the committee on "Economy of Electric Street-Railway Machine-Shops" was read.

ECONOMY OF MACHINE-SHOPS FOR ELECTRIC STREET RAILWAYS.*

The one thing to prove is, whether there is economy in maintaining a machine-shop when there are so many manufacturing and supply companies which can furnish us with every conceivable thing we want (and many more we don't want) at short notice; and the local machinist stands ready to do our work at a price varying from fifty to seventy-five cents per hour for first-class workmen (and double price for apprentices)? * * * *

There is no denying the fact that to do a piece of work of any kind properly we must have proper tools; a make-shift in such a case only leads to the abominable temporary hitch. We would be much better off if this word "temporary" and all its modifications were left out of the English language. To do a thing half way results in gross extravagance in the end. There is no denying this; we have examples of it already on the electric railway. If this be true, what confusion follows, in view of our previous conclusion, that we must employ the skilled mechanic? Simply that we must provide him with the requisite tools and machinery to do the work in a skilled manner.

Now that we have arrived at this latter conclusion, there is yet another step, the last but by no means the least. It is this: How far shall we carry this equipment of the machine-shop? Shall we make it a manufacturing establishment? There is surely a point here where we must draw the line. There is a distinction between repairs and renewals, but for all this the queston arises whether, if we go so far as to establish a shop for repairs, is it best to go a little further and manufacture supply parts?

It will be useless for me to attempt to prove by theoretical reasoning that it is economical to maintain a manufacturing establishment, or even an additional equipment to that required for repairs, therefore I am simply going to present to you a few facts.

In the first place I wish to call your attention to the methods and practices of the steam railroads. It seems to me that we ought to a certain extent be guided by these people. They have spent over half a century in probing and sounding this matter of repairs and renewals, and even though we may not wish to follow their example in some things, it will surely be worth our while to consider what they are doing.

We find here what we have arrived at through our conclusions, viz.: complete repair-shops equipped with all the necessary machinery for doing the work in a thorough and economical manner and manned by competent help; furthermore, a thoroughly competent master mechanic at the head of the whole.

We find them manufacturing a great many supply parts, even complete cars and locomotives, and everything necessary for the maintenance of the road.

They have learned by experience that it is economical to manufacture in this way. This is shown by their still continuing to do so, and, so far as certain repairs are concerned, they know positively that such can be done in their own shops more satisfactorily than in a local machine-shop. Their own men having become familiar with all the requirements of the work, they know every condition under which the apparatus has to work, consequently the successful and economical operation of the road, so far as this department is concerned, is assured. In some instances it may cost a trifle more to make the article than it can be bought for. Suppose it does. If it will give better service and wear longer, it is more economical. As I said at the beginning, economy does not always consist in buying a thing cheap. Happily, however, in the experience of the steam roads they have found that it costs no more, and in many cases not so much, as to buy of supply companies, which is surely a conclusive proof that it is economical to maintain shops.

After viewing the experience of the steam roads, let us turn our attention to the substantial practical data which I have gathered from the more prominent electric roads. In attempting to write upon this subject I found that in order to present unbiassed information it would be necessary to gather as much practical knowledge as possible from roads other than those with which I am connected, therefore I prepared a list of questions covering the most important points of this branch of the business, and sent them to over two hundred and fifty of the more prominent electric street railways, asking them to co-operate with me in the preparation of this paper, by answering as many of the questions as pertained to their respective methods of operation and maintenance of line and car equipment. I am sorry to say that I received answers from but sixty-six roads, notwithstanding I prepared the circular so that it was only necessary to write *yes* or *no* after many of the questions, besides enclosing stamp and envelope for return.

It occurred to me that perhaps many thought that this information was for me personally, or else reasoned that if I was to present this subject, I ought to know enough about it without their help. However, the sixty-six answers which I did receive gave me valuable data to substantiate my own experience and enable me to write much more intelligently; and I wish to extend my thanks to those who did interest themselves in the matter sufficiently to give me the information asked for.

Among these answers received, I have found many things to strengthen my belief that it is economical to maintain a machine-shop, not only for repairs but for the manufacture of supply parts. It turns out to be a fact that no less than twenty-four roads are maintaining machine-shops, doing all their own repairs and manufacturing many supply parts. They say unhesitatingly that there is economy in so doing. They give as their reasons: First, that they can *make* better material than they can *buy*; that they are perfectly familiar with the requirements and conditions of the business; they are operating the roads and are in a position to know just what is needed, and are better able to judge of the strength and durability of the apparatus than those who have never been in a similar position. Is not this a natural consequence?

In presenting this I do not mean to cast reflection on the earnest efforts of my good friends in the manufacturing business, but I must say from personal experience that there is much material on the market to-day that is not up to the standard. Why? Simply because the

*Abstract.

makers of it do not understand thoroughly the requirements of the business. Some may be unscrupulous enough to put goods on the market just for what is in them for awhile, regardless of their stability ; but I hope this is not the case, for surely we had much rather believe to the contrary.

A second reason given is that there is a saving of from 25 to 50 per cent. by manufacturing the majority of parts.

What further, then, *can* we say ? Is not this, coupled with the experience of the steam roads, sufficient to enable us to conclude that there must be economy in machine-shops for electric street railways ?

* * * * * *

I will give now a few of the prices for which supply parts are being made in the shops of the different roads. These figures are an average taken from 11 roads which are using Sprague, T.-H. and Westinghouse double-reduction motors.

Refilling commutator (copper bars)	$18 50
Two halves armature bearing, T. and H., $3.96, single Sprague	1 85
Two halves axle bearing	3 50
Brush-holder	1 35
Rocker arm, T. and H., $1.00, Sprague	3 00
Int. shaft (steel), T. and H., $10.00, Sprague	3 00
Int. pinion (steel)	4 20
Int. gear	3 88
Axle gear	5 66
Armature pinion (steel)	3 58
Trolley-wheel (brass)	1 06
Line-frog	1 90
Clips for line-hangers (brass)	15
To bore and press on 30-inch wheel	95

The average price for which roads sell scrap car-wheels is $13.65 per gross ton ; the lowest being $8 and the highest $20.

* * * * * *

Being anxious to know, myself, and thinking it might be of benefit to many others, I asked the roads to give an opinion as to which of the different types of motors gave them the most trouble. With but two exceptions, the single-reduction costs less to maintain.

JOHN H. BICKFORD, *Committee.*

During the discussion which followed Mr. Wardwell, of Duluth, said : "The repair-shop, if not properly cared for, will be the largest institution about your lines."

Mr. Lawless, of Paterson, thought there was no question that a machine-shop on a proper scale is desirable, for a cable or an electric road. The trouble is that when it is once started it keeps growing. If you have a machine-shop do not have it too expensive or elaborate; have it in accordance with the size of the road.

Mr. Wason—I think there is one point outside of the machine-shop that should be taken into consideration in the repairs of motors, namely, the pits in which you do your work, the manner of handling the motors to facilitate putting them on and taking them off. The number and length of pits should, of course, be in proportion to the number of cars you operate. There is such a thing as having a pit too long; for it will generally be found that the car which requires only simple repairs, and which is first needed, is invariably the last one on the line, and the others must be first moved before you can get it. In our shops the pits are so arranged that you can put four cars over them, but three is all we take over each pit. We have an hydraulic lift underneath the car running on the track, which we have found very serviceable; and when I tell you that we have taken off two motors and put on two, and had the car running out in thirty minutes, you will be sure it is a handy pit. We have taken an armature out and put one in, and had the car running on the road in five minutes. The facility with which you can handle your cars in the pit will greatly help the men, and I think it is as essential as a complete machine-shop. I think our machine-shop comprises about the number of tools that the report suggests. We have ninety motor cars, and I do not think we have any superfluous machines. I am sure that we have more than paid for all our machinery in the saving over what we would have to pay to have the work done, especially taking into consideration the matter of cartage. I am confident that taking the motors from underneath the car rather than raising the car-bodies is preferable. We have found this system very advantageous and complete. We have a 35 H. P. Sprague stationary motor that we put in three years ago and have not had any trouble with it. We are not doing more than 10 or 12 H. P. work with it, but we start it and stop it, and put a little oil on it once a month, and that is all it requires. It is run from the street-railroad circuit. I think it would run a number of years without any trouble.

At the close of the discussion a resolution was passed condoling with President Holmes in the bereavement he had sustained in the death of his father-in-law.

The report of the committee on the relative cost of operating horse, cable and electric roads was then read, and a discussion thereon followed.

Mr. Baldwin, of Cincinnati, made a statement giving the comparative cost of operating cable and electric roads in Cincinnati, and said that as to the actual cost of operation per car mile, it was found that the cable roads were far cheaper to operate than electric cars, over the same route. It requires more than double the men to clean motors and make the usual repairs to electrical apparatus. Most of them are high-priced men in place of being ordinary mechanics as in the case of the cable, so that when the cost of this labor is taken into account, it is found to be fully three times that necessary to keep the cable cars in good order. In operating a cable road, especially in heavy rain or snow storms, it is impossible to maintain the same regular service that it is possible with a cable system. Mr. Baldwin recommended that a committee be appointed to prepare suitable blanks and learn the operating expenses of the different roads in the country, and report at the next meeting.

The recommendation was referred to the executive committee.

A report of the World's Columbian Exposition committee was presented.

The committee reports that it has been advised by Mr. Willard A. Smith, chief of the Department of Transportation Exhibits, that the circular issued by the association May 25 last* met with a hearty response, and that the exhibit of manufactures and inventions, under the auspices of this association, at the World's Columbian Exposition, to be held in Chicago in the year 1893, will be altogether creditable to the street-railway industry.

We earnestly request all intending exhibitors, who have not yet attended to the preliminary arrangements necessary to secure admission of their novelties and products at the exposition, to do so forthwith, in order that the exhibit shall be systematically arranged, as well as perfect in the ground covered.

The committee on formulating standard system of accounting forms for statistical information reported that the work had been too considerable for them to accomplish it, and recommended the employment by the association of a statistical clerk to compile such information as might be necessary. The question of appointing this clerk was referred to the executive committee.

An invitation from the Walker Manufacturing Co., of Cleveland, to visit their works at 10 o'clock Friday morning and partake of luncheon, the guests to be conveyed in carriages to the works, was read and on motion accepted.

The convention then took a recess.

THURSDAY.—AFTERNOON SESSION.

The report of the committee on standards was then read.

STANDARDIZING OF ACCOUNTS—ACCOUNTING METHODS AND STATISTICS.†

The subject of formulating a standard system of accounting and forms for statistical information is of great importance to this association, and I appreciate the weight and value of the undertaking as much as any one, and perhaps more than the majority of the members of this association, having given the subject considerable study.

* See STREET RAILWAY NEWS of June 4 for copy of circular.
† Abstract.

The prodigious strides which the street-railway business has made in the last few years now causes this subject to come to the front. The meetings of this association for the discussion of the knotty problems which are continually perplexing our managers have also impressed upon us the necessity of more reliable statistics for comparative study.

The ultimate object of all accounting is to ascertain with accuracy the amount of net income after all operating expenses and fixed charges have been paid.

With this object in view, and no other, the art would be reduced to a very simple profit and loss account, debited with all expenses and credited with the entire income; but the owners and managers of our street-railway properties for many reasons desire some further information than this.

It is not sufficient for them to know that their road has a certain income, or that the expense has reached a certain amount.

They desire to know many things in addition to these: what was the source of income; how many miles of track they have; how many cars; how many trips those cars make; how many passengers they carry. What other sources of income were there; what was the expense of operating the road; what portion was simply for the transportation of the passengers; how much was paid for motive-power; for repair of cars; of apparatus; of track, buildings, etc., etc.; has anything been expended in construction, improvements, or betterments.

Having all this information well in hand, the owners and managers can determine more readily wherein the expenses have been too large, and have thereafter a basis upon which to calculate their future operations.

Moreover, what is of incalculable benefit, they can compare the cost of operating expenses of other lines throughout the country.

Heretofore, the great difference of opinion on the part of street-railway officials, as to the necessity or value of any reports or statistical information, has rendered it almost impossible to get any reliable information, and above all to make any comparisons, one road with another.

In order to get any beneficial results by comparison it is necessary that we have statistics compiled from some standard basis.

We cannot compare wheat with potatoes, neither can we compare the cost of operation of one road with the operation of another, unless like expense accounts are included in each case, and the data compiled under the same rules.

In the case of the steam roads of the United States the Interstate Commerce Commission has caused to be compiled a *Classification of Expenditures* and certain rules for their guidance in making their annual reports to the Government.

Most of the railroad commissions of the several States have adopted this classification, and nearly all the railroad companies use the same in their accounts.

It is quite probable that in the near future the interstate commission may extend its jurisdiction over the street-railway companies, and in that case would compel them to adopt a uniform system of accounting as a basis.

Such a system of accounting to be accepted by all the railroad companies in this association can only be adopted after due consideration, and the co-operative endeavors of our accounting officers.

This committe will not attempt to prescribe a set of rules and reports, but only to suggest certain distinctive lines which we believe should be followed in the future, when deciding upon a basis for accounting statistics.

Division of Expenses.

We are all agreed that it is essential for the expenses which add to the present or future value of a property to be separated from those which do not, and that the three great divisions should be

1. Transportation Expenses.
2. Maintenance "
3. Construction "

This established, the various subdivisions may be few or carried to infinity, but the final results are necessarily the same.

The differences between these divisions are as follows:

1. *Transportation* expense is simply the expense of transporting the passengers, and includes nothing whatever expended upon the property. Under this heading we should find wages of conductors, drivers, gripmen, motormen (engineers and firemen on dummy lines), fuel, provender, lubricants, wrecking, etc., etc.

2. *Maintenance* expense is the expense of keeping the properties in their original condition, and consists of the amounts expended upon repairs of track, buildings, cars, power plant, engines, etc., etc.,

3. *Construction* expense is such as adds to the value of the original plant, such as additional buildings and machinery, new tracks laid, less the value of old ones taken up, etc., etc.

Improvements and betterments should also be included under the head of construction—that is, for such portion as the property is improved over the first cost.

One question deserving your consideration is that of taxes, and whether it should be included in the operating expenses or not. I have noticed that the majority of the roads do now include it, while a few deduct it from the net income after operating expenses.

In comparative statements this is an important item, and it would be well to decide this question. Our road deducts taxes after the operating expenses as one of the fixed charges, which I think is correct.

Material.

Another point we would suggest is to recommend the accounting for material as closely as possible. It is the practice upon many roads to keep no account of material purchased and kept in stock for future use, but to charge all material purchased to expense, whether used at once or not.

It must be perfectly clear to this convention, that when material is purchased, there is no decrease in the assets of the company and consequently no expense. There has been simply an exchange of cash for material. The expense does not occur until the material is used.

When we can impress upon our accounting officers the necessity of accounting for material as closely as for the paltry nickel, we shall have advanced one important step in the right direction; and until this is accomplished our monthly returns will not show us what they are intended to show, *i.e.*, the business done and the expenses incurred during the month.

It is absurd to charge to the expenses of one month all the bills paid in that month, or the bills contracted in that month, when the material covered by the same may have been used long ago, or may be in stock and for future use.

Material used represents from 30 to 40 per cent. of the expenses of operation, and yet on the majority of our roads it receives no attention whatever.

I would like to say something concerning the care of material, the method of handling supplies, method of keeping stock accounts, of the care of tools and old material, but fear to take too much of your valuable time upon subjects of minor importance.

Unit for Comparison.

It has been suggested that we adopt as a unit for comparison *the car mile*, especially in regard to motive-power, and consider the single truck with double-motor car as the standard; double-truck cars to be equal to two trains of two cars each.

It is difficult to say what should be the unit, whether it should be the car mile, the passenger, or neither.

When we consider the vastly different conditions to be contended with on the various roads, in the shape of grades, distances from power-house, amount of traffic, etc., we can hardly settle upon any factor for a unit.

It may be decided that the best results for comparison will be found by comparing the percentage which operation bears to gross income.

Future Work.

I would advise for the continuance of this work that a committee, selected from the accounting officers of roads in this association, be appointed to prepare a standard classification of expenditures, with blanks for statistical reports to be referred to the next annual convention; the same to be previously circulated among the members of the association, in order to obtain the fullest possible criticism and examination at the convention.

H. I. Bettis, *Sub. Com.*

Mr. Holmes, of New York—The matter of rating motors is, in my opinion, a very important one. The manufacturers of dynamos for electric-light stations have been accustomed to rate them according to the number of lamps they will burn in candle-power. One company will say, "Here is a machine that will develop four hundred incandescent candle-power lights." Another company says, "Here is a ma-

chine that will also develop four hundred incandescent lights," but the difference between the two machines is the difference between six and five. Now, gentlemen, if we can standardize our motors as dynamos ought to have been, we shall not be subjected to confusion by overheating generators by subjecting them to greater duty than they are supposed to perform. I therefore offer the following resolution:

Resolved, That it is the sense of this convention that the standard rating of railway motors shall be the horizontal pull which the motor can exert when running the car at ten miles per hour, with thirty-three inch wheels, and that when so running the temperature of the motor shall not be raised to more than sixty-five degrees centigrade above the surrounding atmosphere after a ten-hour run.

The resolution was adopted.

On motion, the executive committee was empowered to appoint another committee on standards.

The committee on nominations then reported the following names of gentlemen nominated for the officers of the association for the ensuing year:

President, D. F. Longstreet, Denver, Col.; first vice-president, A. Everett, Cleveland, O.; second vice-president, Joel Hurt, Atlanta, Ga.; third vice-president, W. Worth Bean, St. Joseph, Mich.; secretary and treasurer, W. J. Richardson, Brooklyn, N. Y.

Executive committee: John G. Holmes, Pittsburg, Pa.; J. D. Crimmins, New York City; T. J. Minary, Louisville, Ky.; J. R. Chapman, Grand Rapids, Mich.; B. E. Charlton, Hamilton, Ont.

The secretary reported that the executive committee had considered the matter of the formation of a supply dealers' association in connection with the American Street-Railway Association, and that in the judgment of the committee they could see no necessity for the formation of such an association at this time.

A communication was presented from the Massachusetts Street-Railway Association relative to the subject of the provision of proper interacting signals at crossings of steam and electric railroads, which was read. It urged that the American Association send a circular to every street-railway company in America, and to the boards of railroad commissioners of the different States, recommending the passage by each State legislature of regulations upon this most important subject, to secure the greatest possible safety to passengers in electric cars at steam-railroad crossings. On motion, the matter was referred to the executive committee.

The convention took a recess until Friday morning.

FRIDAY'S SESSION.

The papers on "Experiments on the Expansion of Continuous Rails" and "Is a Standard Rail-head Possible?" were read by title only.

Mr. Cronyn, of London, Canada, offered the following:

Resolved, That the American Street-Railway Association sends greeting to the tramway managers and officers of European and foreign countries, and most cordially invites them to attend the 12th annual meeting of this association, to be held in Milwaukee, Wis., U. S. A., in 1893, during the World's Columbian Exposition.

The resolution was adopted.

Mr. McLean moved that the secretary be authorized to express to the Short Electric Railway Company the appreciation of the association of the courtesies shown by that company to the delegates in attendance at the meeting.

A vote of thanks was passed to the different traffic associations for their courtesy in granting reduced rates to the gentlemen and ladies in attendance at the convention.

Messrs. Watson, of Buffalo, and Martin, of Cincinnati were appointed a committee to escort to the chair the newly-elected president, Mr. Longstreet, who fittingly acknowledged the compliment paid him in his election, and expressed the hope that he would meet all in attendance at this meeting at the convention to be held in Milwaukee next year.

The association then adjourned to meet in Milwaukee Wis., on the third Wednesday in October, 1893.

THE BANQUET.

The annual dinner of the association was given at the Hollenden Hotel on Thursday evening and was a most brilliant affair. Four hundred people sat down to the tables which, with the beautiful room itself, were tastefully decorated.

The following is a copy of the menu:

Blue Points.
Celery.
Clear Green Turtle. Victoria.
Sherry. Olives. Salted Almonds.
Lobster à la Newburg.
Sauterne.
Boiled Salmon, Sauce Verte.
Cucumbers. Dauphine Potatoes.
Fillet of Beef à la Montglas.
Sweet Potato Croquettes.
Pontel Canet.
Sweet Breads Glacé, Jardinière.
French Peas.
Cigarettes. Frozen Egg Nogg.
Moet & Chandon. Burt Imperial.
Breast of Prairie Chicken, with Truffles.
Saratoga Chips.
Dressed Lettuce.
Neapolitan Ice-Cream. Cake.
Assorted Fruit.
Water Crackers. Edam Cheese.
Brandy. Cigars.
Coffee.

The menu card was in unique design. On the first page was Cupid mounted on a car-wheel and wielding a trolley. Below the trolley wire was a picture of one of the new Woodland Avenue and West Side cars. On the other pages were the menu, toasts, musical programme and list of officers of the association.

First Vice-President McLean acted as toast-master, and when cigars were reached the guests rose at his request and sang the national hymn. After this very appropriate opening of the post-prandial exercises, Mr. Andrew Squire responded to the toast, "Some Phases of the Legal Liabilities of Street-Railroad Companies." He spoke of the marvellous improvements in street-railway service, and impressed upon his hearers the importance to give the greatest possible protection to the public. Caution is one of the first lessons to be taught employés. From both commercial and humane standpoints it is well to make the roads as safe as possible.

"The City of Cleveland" was responded to by Gen. Ed. S. Meyer.

"The Ideal Street Railway: a Prophecy," was the subject of a happy response by Mr. L. A. Russell.

Mr. Hoyt responded to the toast, "The Street-Railway Carrier from the Standpoint of the Carried."

Among other things, he said the street railroad has been and is one of the mightiest agents in the development of this country. No city is without street railroads for the reason that, but for them, it could never have become a city. They are the arteries running from its throbbing heart centre. Because of them, pleasant homes, pure air, the meadow's sweet expanse and blooming flowers are within reach of all. The street car is the poor man's carriage, and it is always at his beck and call, yet it is curious that the people most benefited are usually the most eager to oppose this great agent of progress. The problem of rapid transit is one of the most important, and the prosperity of our centres of manufacture and trade depends largely upon the solution of this problem. We look to you and men like you to solve it. You have already done much. The cable or the electric car of to-day is far ahead of the bobtail car of yesterday and will be far behind the street car of to-morrow. In spite of grumbling passengers, stupid and venal councils and ignorant and unjust criticism, you are doing your work well. The public might as well try to dim the brilliance of the sun with a rushlight as to prevent your progress. Every man who lays an additional rail, runs an additional street car, or invents or adopts a useful appliance is a credit to the carrier, benefactor to the carried.

This speech was the gem of the evening, and was interrupted by frequent laughter and applause.

Mr. Richard Bacon responded to the toast, "Benefits of Street Railroads to Cities and Citizens." He described how the railroads have made homes possible and contributed to the happiness of the people. He said that upon this more than upon anything else they ought to congratulate themselves.

Mr. D. F. Longstreet, of Denver, the newly-elected president of the association, was called upon for the first informal toast and responded briefly.

Other toasts were responded to by Major W. W. Armstrong, Hon. Tom L. Johnson and Wm. Richardson, after

which all present united in singing "Auld Lang Syne," and thus the most successful and elegant banquet the association ever held was brought to a close.

EXHIBITS.

P. L. SWORD & SON, 6 South Water st., Cleveland, was represented by Mr. P. L. Sword, who showed illustrations of Hamilton-Corliss engines, Skinner engines, Weston Engine Co., Racine Hardware Manufacturing Co., Barr Pumping Engine Co., Stewart heater and the Sterling boiler. The firm represents all of these concerns in the territory between Toledo and Syracuse.

MR. H. W. BROOKS represented the American Circular Loom Co., of Boston. He had no exhibit.

G. A. LAUGHLIN, 469 Broadway, Cleveland, showed the "Stever" suspended rail joint, which is claimed to be the only rail joint that will hold, and is stronger than the rail itself.

THE CHARLES SCOTT SPRING CO., of Philadelphia, had an attractive display of spiral and elliptic springs for horse, cable and electric cars.

THE PORTER RAILWAY SWITCH CO., Cleveland, showed on the sidewalk in front of the hall the Porter Tramway Switch. Its operation was practically explained and it attracted much attention.

THE WALKER MFG. CO., Cleveland, had at the entrance to the hall several photographs of cable pulleys, drums, etc.; sample pulleys and models of cable machinery. In the annex the company had a unique exhibit. It consisted of sections of patterns of a 30-foot gear wheel made for a South African diamond mine; of a sheave 5 feet in diameter; a rope wheel centre 8 feet in diameter; a model of the operating mechanism of the Weston-Walker friction clutch, as well as models of other devices. The 8-ft rope-wheel centres referred to were designed for the Broadway and Third avenue cable lines in New York city.

THE COMBINATION CAR CO., 23 Court st., Boston, occupied a space in the corridor of the main hall and had on exhibition a section of a combination car window with automatic blind, also a car seat. In the annex a zigzag car seat was shown by Mr. G. B. Bolton, who is treasurer and manager of the company and who looked after the company's affairs.

THE CLEVELAND ELECTRICAL MFG. CO. made a display of Watchman's Time Detectors made by this company. It is also general electrical contractor. Mr. W. C. Marker represented the company.

THE MCINTOSH-HUNTINGTON CO., Cleveland, was represented by Mr. W. W. Johnston, who had a complete line of hardware and street-railway supplies.

WASHBURN & MOEN, Worcester, Mass., displayed a sample case of their well-known wires, etc.

THE W. BINGHAM CO., Cleveland, O., was well represented by C. E. M. Young and J. H. Peters. The display of this company was a very large and complete one and consisted of electric-railway supplies, also a hydraulic motor lift for which the company is agent.

THE SPERRY ELECTRIC RAILWAY CO., Chicago, showed the practical operation of its system. A truck was equipped with the Sperry motor on its well-known system, one motor driving both axles. Besides this the company displayed a switchboard, a trolley pole, gear, and the cushioned universal clutch. The exhibit was in the charge of Mr. C. A. Pratt.

MR. L. B. WHITNEY, of the firm of A. Whitney & Sons, manufacturers of car wheels, Philadelphia, was in attendance.

THE FORD-WASHBURN STORELECTRO CO., of Cleveland, had a notable exhibit consisting of several cells of its indestructible storage battery, fan motors designed to be operated by one and two storage cells; three motors of 5, 2 and 1½ H. P. running on a 500 volt circuit, The company's specialties are the self-ventilating motor armatures and the indestructible storage batteries. On Friday afternoon and evening a car equipped on the Storelectro system was in practical operation on St. Clair street and its performance was all that could be desired. The company was represented by Mr. George Washburn, G. A. Ford, James Chamberlain, Fred. Hills and Percy Warwick.

THE JOHNSON ELECTRIC CO., Cleveland, had a display of gears, commutators, trolley wheels and an improved trolley base. The company makes a specialty of rewinding fields and armatures of all machines. Mr. John G. Hoenecker was in charge.

THE E. S. GREELEY & CO., New York, had samples of electric and oil headlights, and a case with various electrical instruments. Mr. Frank A. Magee looked after the company's interests.

THE MITCHELL-BRANT COPPER CO., Erie, Pa., Mr. A. L. Daniels representative, had a display of a large line of commutator segments.

THE DEWEY ELECTRIC HEATING CO., Syracuse, N. Y., kept things warm with an office heater and four car heaters. The construction of the Dewey heaters is remarkably simple, and there is no useless waste of heat. The heating surface is large and it requires small amount of current to operate the heater. The porcelain which is used in the construction of these heaters is made by Pass & Seymour, of Syracuse. Mr. M. W. Dewey, the inventor, and E. B. Wyman, general manager, of Niagara Falls, were present.

THE SHORT ELECTRIC RAILWAY COMPANY'S exhibit in the hall was one of the most elaborate and attractive of all. It consisted of single-reduction and gearless motors, all the parts of the same, and many samples of other apparatus made by this company. The exhibit was on the stage at the back of the hall, and the decorations were especially tasty. Over the stage arch were the words, "Short Electric Railway Co.," made up in incandescent lamps, and at the back of the stage the word "Gearless" shone out from incandescent lamps with delicate green-colored bulbs. In the annex the company had a Short generator of 175 K. W. capacity (280 H. P.) ruuning as a motor, and driving two brush dynamos, supplying current for some of the lights in the hall, and also for the Ford-Washburn Company's exhibit.

THE W. H. H. PECK CO., Cleveland, O., had a line of electrical supplies for street railways, including a new trolley, waterproof cord, etc. The company also showed its new rubber tubing for general electrical purposes. Mr. O. A. Foote was in charge.

THE STILLMAN LIGHT RAILWAY EQUIPMENT CO., of Providence, R. I., exhibited a section of its improved railway. This rail is said to be economical, practically jointless, and cannot be broken down.

THE JOHNSON SAFE AUTOMATIC ELECTRIC CO., of Richmond, Va., had on exhibition a sample of its current disconnector which renders electric railway or electric-light wires harmless in case of rupture. Mr. F. B. Jacobs represented the company.

THE W. D. GRAVES ELECTRICAL AND MFG. CO., Cleveland, supplied several of the arc lamps which were used in lighting the hall. These lamps are used on low-tension circuits. A line of commutators, etc., was also shown.

THE ELLIOTT ELECTRIC CO., Cleveland, showed some commutators of a very fine finish. This company makes a specialty of repairing of every system of electric light and power apparatus.

THE LIMA REGISTER CO., of Lima, Ohio, was represented by Mr. J. H. Rose, who exhibited a couple of samples of the well-known Lima fare registers.

THE MAGUIRE MFG. CO., of Chicago, exhibited one of its No. 19 F pressed steel trucks, complete. Mr. J. A. Hanna represented the company. Six cars used by the General Electric, Short and Sperry companies for exhibition and excursion purposes, were equipped with Maguire trucks.

THE RAILWAY EQUIPMENT CO., Chicago, had an attractive display of line materials in which it deals; also Ahearn's electric heaters which were in practical operation. This company had a parlor at the Hollenden where Mr. W. R. Mason and his assistants entertained all callers in a very hospitable manner. The parlor was profusely decorated with choice plants and flowers.

THE RELIANCE GAUGE CO., Cleveland, had a notable exhibit on the second floor of the hall, consisting of Reliance Safety Water Columns; Reliance Patented Soldered Floats. Among the exhibits were aluminum models of extra heavy columns. Mr. A. J. Wright, the president, and Mr. L. H. Elliott, secretary and treasurer, were in attendance.

MR. W. M. MCCANDLESS, contracting engineer of Warren Webster & Co., Philadelphia, Pa., represented his company on the second floor of the hall.

THE ELECTRIC SUPPLY CO., of Chicago, displayed a complete line of samples of overhead materials.

THE CARPENTER ENAMEL RHEOSTAT CO., of Bridgeport, Conn., had a full line of its enamel rheostats used for motors, arc lamps and as feeder equalizers.

JOHN. KUEHNLE, of Detroit, Mich., had a full line of "Kuehnle" trolley wheels on exhibition.

THE CAMPBELL & ZELL CO., of Baltimore, showed a nickel-plated model of its well-known water-tube safety boiler.

MR. R. A. CRAWFORD, of Pittsburg, had a model of his pat-

ent automatic wheels and pick-up guards for cars. They are said to be the lightest, simplest and most durable of any on the market.

THE TAYLOR ELECTRIC TRUCK CO., of Troy, N. Y., showed a model of the Taylor Electric Truck. The claims for this truck are non-teetering, noiseless, durable, economical, easy riding and quickly disconnected from car-body.

THE TECHNIC ELECTRICAL WORKS, Philadelphia, exhibited a sample of the Philadelphia trolley, which that company has just brought out and which was described and illustrated in the ELECTRICAL AGE of October 22.

THE BRADLEY GENERAL ELECTRIC CO., of Chicago, was represented by Mr. Wm. Bradley. This gentleman exhibited a full working model of his company's electric-railway conduit.

MR. JOSEPH FISCHER, of Cleveland, Ohio, had two models of a very simple and effective car-brake. He also explained his underground trolley system, which he claims is the best system in existence.

THE H. W. JOHNS MFG. CO., of New York, exhibited a full line of railway material in moulded mica, and also in sheet mica; samples of rosettes and special pieces in moulded mica, monarch and vulcabeston. Mr. W. F. D. Crane, E. B. Pratt of the Johns Pratt Co., Hartford, and F. E. Delano, local agent, Cleveland, looked after the company's interests.

THE PITTSBURG TROLLEY CO., Pittsburg, Pa., exhibited samples of trolley wheels This company is manufacturer of Duncan's trolley and wheel, which is well known among electric-railway people.

THE J. G. BRILL CO., of Philadelphia, showed elegant plated models of its various trucks. On the sidewalk in front of the hall it exhibited one of the handsome cars made by it for the Woodland Avenue and West Side Railroad, Cleveland. This car has a 21-foot body on a No. 21 truck. The Brill company will furnish 40 of these cars, and they are to be operated on the Westinghouse system. Other exhibits of the company were a solid frame for No. 21 truck, and an Eureka Maximum traction truck with solid frame. The company was represented by G. M. Brill, president, W. H. Huelings, sec. and treas., Payson K. Andrews, Chicago, S. M. Curven, western agent, and F. C. Randall, eastern agent.

THE ST. LOUIS REGISTER CO., St. Louis, Mo., exhibited two samples of its Security register. This is claimed to be the simplest, most accurate and durable register on the market.

MR. GARSON MYERS, of the Standard Railway Supply Co., Chicago, exhibited and explained the features and advantages of the company's street-car heaters.

THE SHAWMUT FUSE WIRE CO., Boston, was represented by Mr. Sears B. Condit, Jr., who had a line of samples of fuses of all capacities.

THE MEAKER MFG. CO., Chicago, was represented by Mr. J. W. Meaker. Mr. Meaker had on exhibition three different kinds of portable, two stationary and one combination registers.

THE NEW PROCESS RAW HIDE CO., Syracuse, N. Y., had a large display of rawhide pinions. These pinions, it is claimed, outwear metal, are noiseless, and need no lubricating.

THE VAN DORN IRON WORKS, Cleveland, O., displayed samples of iron electric railway poles, insulators, brackets, etc.

DORNER & DUTTON, Cleveland. Ohio, had two non-oscillating trucks, one No. 21 and the other No. 22; track-scrapers, journal-boxes and gears on the platform corner of Vincent and Bond streets. In the annex to Army and Navy Hall they had one of these trucks equipped with Short motor, railway poles and track-cleaners on a truck. Mr. Dutton was in charge,

THE PAIGE CAR-WHEEL CO., Cleveland, had an exhibit in the annex of boltless steel-tired car-wheels for electric, cable and horse cars.

J. H. GRAHAM & CO., 113 Chambers st., New York, had a display of "Rotary" alarm-bells.

THE Q. & C. CO., Chicago, showed a Bryant improved rail-saw in practical operation. It cuts rails at any angle with great facility.

THE PITTSBURG STEEL HOLLOWARE CO., Allegheny, Pa., had in charge of Mr. H. Reybender a complete line of rolled-steel gongs in all sizes, These gongs are said to be absolutely indestructible.

THE NEW YORK CAR-WHEEL WORKS, Buffalo, N. Y., had several samples of "machined" car-wheels.

THE P. WALL MANUFACTURING SUPPLY CO., Allegheny, was represented by Mr. J. P. Wall, who had an exhibit of samples of the various styles and sizes of the forged-steel indestructible gongs manufactured by his company. These gongs are guaranteed for 5 years.

THE LODGE & SHIPLEY MACHINE TOOL CO., Cincinnati, O., had a motor-gear lathe in operation in the annex. This machine bored a motor gear 23 inches in diameter 4½ inches face with a 3⅜ bore in 17 minutes. Mr. William Lodge, president, and Mr. Murray Shipley., Jr., vice-president, were in attendance.

THE HACKNEY HAMMER CO., of Cleveland, exhibited a tool-dressing machine in the annex.

THE SHEFFIELD CAR CO., Three Rivers, Mich., had an exhibit of a No. 2 E Equalizing truck. These trucks are designed for any type of motor, and are so made as to equalize strains.

MR. J. O. HADDOX, Louisville, Ky., exhibited Littell's patent track-cleaners, which are said to be the only cleaners that are operated by the foot of the motorman. They are claimed to be simple, durable and effective.

MARK & STERLING, of Cleveland, O., had a large display of their rail-joints, rail-chairs, tie-plates, etc. These devices were fully described and illustrated in STREET RAILWAY NEWS of October 22. Both Messrs. Mark and Sterling were about and pointed out the advantages of their goods to all interested.

THE FITZGERALD-VAN DORN CO., Lincoln, Neb., was represented by Mr. Van Dorn. Mr. Van Dorn had a sample of his street-car coupler, which is automatic, and by its use there is no lost motion nor buckling.

THE R. D. NUTTALL CO., Allegheny, Pittsburg, Pa., had one of the largest exhibits of all. It was in the annex, and consisted of a full line of samples of gears, pinions, commutators, armatures, steel trolley poles, the Nuttall trolley, and about everything the company manufactures and deals in. Messrs. P. H. Carey and H. J. Mayer represented the company.

WM. WHARTON, JR., & CO., Philadelphia, exhibited sections of the various styles of rails they make, a 9-inch girder rail, a crossing, etc.

THE exhibit of the C. & B. Manufacturing Co., Troy, N. Y., consisted of a trolley-finder. This device facilitates the rejoining to the trolley wire, particularly at night. Mr. C. H. Smith represented the company.

THE operation of the Brightman mechanical stoker, manufactured by the Brightman Stoker Co., Cleveland, was shown in the annex. The front of a fire-box and boiler were used for the purpose.

THE RELIANCE MANUFACTURING CO., Boston, Mass., had an exhibit of a sand-distributer, track-switch, trolley-wheels, poles and brake-handles. Mr. F. C. Hinds, the president of the company, looked after matters.

THE ESMOND STREET RAIL CO., 106 Broadway, New York, had a large exhibit, including rail sections of the all-metal system, interlocking duplex rail, a continuous head-rail. Also sections of anti-creeping track for steam roads, and models of the Esmond Rocker Link truck and Rocker Link cantilever truck for both steam and electric railways. Mr. E. R. Esmond is the inventor of these trucks and rails, and they are to be made by the Esmond Street Rail Co. Mr. Esmond and Mr. L. E. Shinn were present in the interest of the company.

MR. F. H. DAVIES, of the Barnes Brake Co., Cleveland, showed the practical operation of the Barnes brake on a set of wheels and axle. He also showed the principle of the brake by a model.

THE CROSSLEY BRAKE CO., of Cleveland, had a model of its brake in the annex. Its brakes are in operation on the Jennings ave. line, Cleveland, and the company invited members to witness it in practical operation on this line.

THE PENNSYLVANIA STEEL CO., of Philadelphia, had a full exhibit of switches, crossings, frogs, sections of all styles of rails made by the company, guide-chairs, tie-plates, etc. Mr. John F. Ostrom looked after the company's interests and Mr. Ralph Lee Crump had charge of the exhibits.

THE HILL CLUTCH WORKS, of Cleveland, showed clutches, pulleys and a belt-tightener.

THE FULTON FOUNDRY, Cleveland, had a large exhibit consisting of 2 Fulton Foundry motor trucks, the wheels of which were provided with patent independent brake rim wheels. The trucks were connected with Robertson's patent draw-bar. The company also showed a Haycox's patent door-fastener, a sample of trailer truck with indepen-

dent brake rim wheels, Lyon's patent brush-holder for motors; Haycox's patent brake shoe and slippers, and automatic diamond switches. The company was represented by Mr. S. M. Carpenter, C. J. Langdon and W. E. Haycox.

THE CRESCENT MFG. CO., Cleveland, had a full line of engineers' specialties.

THE CHAPMAN VALVE MFG. CO. had samples of valves and a special valve for power stations. Mr. Edward L. Ross represented the company.

THE WESTERN ELECTRIC CO. showed a sample reel of feeder wires for the Woodland avenue and West Side street railway of Cleveland.

THE OSBORN MFG. CO., Cleveland, exhibited samples of steel wire brushes and brooms.

C. H. SMITH, of Troy, N. Y., exhibited a sample of his changeable signal-light box.

J. M. JONES' SONS, West Troy, N. Y., had a sample of their platform alarm-gong.

THE BROWNELL CAR CO., of St. Louis, was represented by Mr. F. B. Brownell, C. W. Joslin and F. Baier. Its exhibit in the annex consisted of a model of its improved non-oscillating truck and a patent trolley bridge. The company also had an exhibition car in operation.

THE BROOKLYN RAILWAY SUPPLY CO., of Stamford, Conn., was represented by Mr. Chas. B. Allyn, who had an exhibit on the sidewalk in front of the hall of a Walkaway snow-plough.

THE EDISON MFG. CO., New York, was represented by Mr. E. M. Stiles, and showed two of the new Edison Electro-Static Voltmeters in operation. These instruments are intended for either straight or alternating currents and are unaffected by proximity to dynamos or jarring of engines.

MR. JOHN R. COFFMAN represented the Eureka Tempered Copper Co., of North East, Pa., and had a full line of samples of Eureka tempered copper specialties in Army and Navy Hall. The company has a general display of tempered copper castings made from patterns of the various manufacturers of electrical appliances of North America. Mr. Coffman has invented a new automatic brush-holder and had a model with him.

THE GENERAL ELECTRIC COMPANY'S exhibit consisted of 2 W. P. 30 single-reduction railway motors mounted on a Brill truck; a W. P. 50 motor, with the hollow field and field-coil thrown back for inspection; a S. R. F. 30 motor; a standard S. R. G. railway motor; an Edison No. 14 motor; a press-gear for applying and removing gear-wheels from motors; a series-parallel controller, and a complete line of overhead material. The company also exhibited a station switchboard equipped with automatic circuit-breaker and current-indicator of the latest improved type. The name of the company was displayed in small electric lamps. The General Electric Company had two elegant exhibition cars in operation. The company was represented by a small army, at the head of which was Mr. W. J. Clark, general agent of the railway department, who had the entire management of the General Electric Company's affairs at the convention. The following are the names of those who represented the General Electric Company: W. J. Clark, O. T. Crosby, G. K. Wheeler, Paul T. Brady, F. H. Clarke, C. S. Rusling, W. H. Knight, E. W. Rice, Theo. Stebbins, Arthur W. Jones, A. A. Glazier, Caryl D. Haskins, John McGhie, Geo. W. Mansfield, E. G. Waters W. A. Stern, H. H. Harrison, C. E. Hart, A. H. Lewis, T. H. Pearey, R. J. Randolph, F. H. Strieby, C. T. Hamilton, F. E. Jackson, F. E. Allen, C. R. Stearn, Percy Hodges, T. F. Mullaney, M. H. Hamilton, J. A. Kimball, W. S. Eliott, Mr. Ewing, F. H. Bostwick, B. M. Barr, F. Houston, G. H. Stout, E. P. Sharp, W. B. Potter, G. H. Alton, C. A. Woolsey, R. E. Hood, Geo. M. Haskell, F. J. Reynolds.

A. G. HATHAWAY, Cleveland, had a transfer-table and a Roche malleable-iron draw-bar, manufactured by the Phœnix Iron Works Co., for which concern Mr. Hathaway is agent.

THE CLEVELAND FROG AND CROSSING CO. exhibited a combination steam and girder rail crossing.

THE ROCHESTER CAR-WHEEL CO., Rochester, N. Y., was represented by Mr. E. Packer, who had a display of wheels, wheels on axles, and chills. The depth of chill of the wheels was shown in a fractured wheel.

THE JEWELL BELTING CO., Hartford, Conn., displayed a full line of belts, in the charge of Mr. C. L. Tolles. Mr. C, E Newton, the secretary of the company, and G. W. Bancroft, western sales agent, were also present.

THE BILLINGS & SPENCER CO., Hartford, Conn., had a display of commutator-bars and drop-forgings in charge of F. C. Billings, superintendent and electrician.

THE HART & HEGEMAN CO., Hartford, Conn., showed several samples of its switches on a wall panel.

THE TOLEDO HEATING CO. exhibited its electric heaters, which are comparatively new. The heaters in use are said to give great satisfaction. The company was represented by C. S. Jones, vice-president; F. B. Perkins, electrician, and Paul Terhune, general agent.

THE JOHNSON CO., of Johnstown, Pa., had a large exhibit in the Army and Navy Hall annex, consisting of samples of electrically welded frogs and switches, curves and crossings, chairs, tie-plates and joints; three-tie joints, standard girder joints, and everything for street-railway track up to 8½-inch solid rail. The temporary track on Bond street was of the Johnson Company's make, and was made up of sections of different classes of rails, including a long stretch of girder rails, with electrically welded chairs. The ordinary construction with standard girder joints was also used. A portable branch switch connected the Bond street line with that of the East Cleveland road on Euclid avenue. The company was represented by the genial Major H. C. Evans, of New York city; Mr. W. W. Kingston, of Atlanta, Ga.; W. E. Boughton, Philadelphia, and O. C. Evans, Cincinnati.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Pittsburg, Pa., had a notable exhibit in Army and Navy Hall. It consisted of one 150 H. P. multipolar railway generator in operation, and a complete switchboard, with voltmeter, ammeter, circuit-breaker, lightning-arrester, switches and rheostat. On a large table was a full line of switches, a brush-holder, samples of armature laminations, a non-arcing lightning-arrester, and several other pieces of railway apparatus which this company manufactures, Mr. A. J. Wertz was in charge of the exhibit. The company had its headquarters in the main corridor of the Hollenden, where callers were entertained and an abundance of Westinghouse literature distributed. The company was well represented. The names of the representatives are as follows: Lemuel Bannister, general manager; Wm. F. Zimmerman, assistant general manager; W. C. Clark, general agent; Albert Schmid, general superintendent; H. McL. Harding, E. W. Seymour and E. N. Sanderson, of the company's New York office; R. S. Brown, of the Boston office; Norman McCarty, of Toledo; C. A. Bragg, of Philadelphia; Messrs. Rutherford, Gray and Wertz, of Pittsburg.

THE BODIFIELD BELTING CO., of Cleveland, exhibited a line of belting of various sizes.

THE PARTRIDGE CARBON CO., of Sandusky, Ohio, had a display of a full line of dynamo, motor and generator brushes, for the excellence of which goods the company is celebrated. Messrs. Partridge and Speer were both in attendance.

THE RAILWAY EQUIPMENT CO., of Chicago, of which Mr. W. R. Mason is general manager, had a very attractive display of samples of line material which it deals in.

THE CONSOLIDATED ELECTRIC AND MFG. CO., of Boston, was represented by Mr. C. E. Bibber. This gentleman had, in the General Electric Company's space, a sample of the "Lyon" brake. This brake wears indefinitely.

THE H. M. LOUD & SONS LUMBER CO,, Oscoda, Mich., showed some of its celebrated octagonal poles for electric railways. Mr. G. H. Keating represented the company.

THE PECKHAM MOTOR TRUCK AND WHEEL CO., Kingston, N. Y., had a notable exhibit, consisting of one of its improved 5 A trucks, with flexible "cushioned" truck and motor bearings, axles, cushioned motor-wheels and various other parts of the company's trucks. The 5 A truck is warranted to ride easily and prevent oscillation of 30-foot cars. The exhibit was in the annex to Army and Navy Hall. Mr. Edgar Peckham, M. D. Peckham and E. C. Stark represented the company.

THE GARTON DANIELS ELECTRIC CO., Keokuk, Ia., had on exhibition several Garton Lightning Arresters in Army and Navy Hall. Mr. W. R. Garton was present explaining the operation of these devices. It is said that these arresters are reliable protectors of electric-railway apparatus.

MR. C. S. VAN NUIS, of New York, was around protecting his many friends with his celebrated "Fulmen" arrester.

AMONG the notable exhibits was that of the Duplex Street Railway Track Co. It consisted of two sections of track, thirty feet long, fully set up, after the interesting method of construction of this system representing the side-bearing and centre-bearing rail of this company's make; a switch and mate, with a frog and curve. It was the first

exhibit opened for display, Mr. J. D. Elwell and H. L. Cargill represented the company.

C. A. SCHIEREN & Co., of New York, the well-known belt-makers, were represented by C. A. Schieren, Jr. They had in Army and Navy Hall a roll of belting 116 feet long, 72 inches wide, 3-ply, which was made for the Brooklyn City Railroad Co., Brooklyn, N. Y.

THE UNITED TRAMWAY SPRINKLER CO., of Louisville, Ky., was represented by Mr. Jno. R. Gathright, the inventor of the sprinkling car; also by Mr. W. N. Claggett, general agent. They had one of their sprinkling cars at the Lake View car barns of the East Cleveland R. R. Co. on exhibition.

M. D. REED, of the Genett Air Brake Co., New York and Chicago, exhibited a sample of the Genett air-brake. These brakes are largely used and giving excellent satisfaction.

NOTES.

Capt. W. L. Candee, of the Okonite Company, was at the Hollenden.

Henry D. Stanley is the latest addition to the Okonite Company's staff. He was at the Hollenden with his business eye wide open.

On Friday morning the Walker Manufacturing Co. conveyed a large party in carriages to its works where the guests were shown around the various departments. After thoroughly examining the working of the foundry, machine-room, etc., a bountiful lunch was served. Many were the congratulations given the Walker people for the admirable manner in which this immense establishment is conducted. In the evening a splendid entertainment and dance were given to the employés. The weather was delightful during the entire trip.

Mr. Charles B. Raymond, a "hard rubber" for the Goodrich Rubber Co., Akron, Ohio, had his pockets full of hard-rubber window tubes, magnet heads, keys, knobs and other useful goods in the hard-rubber line.

The Baltimore Car Wheel Co., Baltimore, Md., was represented by Mr. John S. Pugh, of Baltimore.

The Railway Register Manufacturing Co., of Buffalo, N. Y., was represented by its general manager, Mr. Edward Beadle, of New York city. Mr. Beadle had in his own room in the Weddell House samples of the different styles of registers.

The John Stephenson Co., Limited, of New York, car manufacturers, was represented by Messrs. D. W. Pugh and J. A. Tackaberry. These gentlemen gave away elegant black Russia leather-covered memorandum books.

J. H. Bunnell & Co., of New York, were represented by Chas. McLaughlin and J. J. Ghegan.

Mr. H. W. Smith, of the Smith Closed Conduit System, Newark, N. J., was about headquarters.

The Paterson Central Electric Railway, of Paterson, N. J., was represented by Chas. McLaughlin, Wm. Ring and Wm. McLaughlin.

Mrs. Sidney H. Short gave an excursion about the city on Thursday on the Short private car to the wives and daughters of members and guests, and afterwards entertained them at dinner at the Union Club.

On October 20 the Ford-Washburn Storelectro Co., of Cleveland, gave two excursions on its storage-battery car "Ideal." The car is equiped with 180 cells of storage battery placed under the seats, and it runs very smoothly and noislessly. A six-mile trip was made, and when the car started the voltmeter registered 375 volts; on the return of the car the record was 370 volts. Both Messrs. Ford and Washburn were present and entertained the passengers.

Mr. Julius Lefman, of St. Louis, dealer in general electric railway supplies, expected to be present at the convention, but could not, on account of injuries sustained in Denver recently.

The elegant menu card of the banquet was designed by Mr. J. B. Hanna, of the Woodland Avenue and West Side Railroad Company. It was very artistic.

On Wednesday evening, October 19, a large meeting of supply-men was held in obedience to a call to consider the advisability of organizing a national association of dealers in street-railway material, street-railway publications, etc. The matter was referred to a committee appointed to consult the American Street-Railway Association, and ascertain whether such an association would meet with the approval of the Street-Railway Association. The latter voted that it could see no necessity for a material men's association, and the matter was dropped.

A special track was built on Bond street from the Hollenden Hotel connecting with the lines of the East Cleveland Railroad Co., on Euclid ave. Excursions through portions of the city were made at frequent intervals on the special exhibition cars of the various companies, starting from the Hollenden. The Johnson Company's girder rails were used for the track, the rails being spiked to ties which were laid on the street surface. A portable switch provided connection between the Bond street track and the Euclid avenue lines, and a branch of the trolley wire was run for the occasion. The special cars were models of beauty and elegance. The General Electric Co., had two cars. One was beautifully finished in polished mahogany on the outside with gold decorations. The windows were of heavy plate glass and richly curtained, and the chairs were of rattan. The car had a vestibule on each end, was equipped with 2 W. P. 30 motors and had a Maguire truck. The other car had a body 40 feet long on 2 Maguire trucks, and was equipped with a W. P. 50 motor. The Sperry Company had a handsome car operated on its system, with a single motor geared to both axles. This car had a Maguire truck. The Short Electric Railway Co. had a car equipped with Gearless motors, on a Dorner & Dutton truck. The private car of the Short Company was also placed at the disposal of the members and friends. This car was illustrated and described in our issue of October 22. A Cedar avenue car with Short single-reduction motors and Fulton Foundry trucks was also used as an exhibition car. The Short Company had a single-reduction 20 H. P. motor on another car, made by the Lamokin Car Works, Chester, Pa., with a Robinson all-steel truck. The Brownell Car Co. had Accelerator car No. 616. It was painted a bright yellow, and attracted much attention.

The delegates to the convention were supplied with a packet of 24 tickets good on any line in Cleveland during the three days of the convention,

The Short Electric Railway Co., gave away elegant Russia leather pocket-cases containing a book with valuable information for electricians.

The General Electric Company distributed rich souvenirs in the shape of an oblong book bound in seal-skin, giving much valuable information concerning its apparatus, etc.

The Short Electric Railway Company's reception-rooms on the parlor floor of the Hollenden were beautifully decorated with flowers and plants, which, combined with the elaborate fittings and furnishings of the room themselves, produced a charming effect. Several representatives of the Short Company entertained all callers.

The J. G. Brill Co. had a parlor, which was rendered attractive for the occasion.

The Detroit Electrical Works gave a reception in its parlor on Wednesday night and an enjoyable time was had. There were a large number of gentlemen present.

Four bright cars on the Public Square attracted a good deal of attention. They were of Brill's make and equipped on the Westinghouse system for the Woodland avenue and West Side Railway Co.

On Wednesday afternoon about 400 delegates boarded special cars and went out to the works of the Short Electric Railway Company. The general offices of the company were first visited, and all were cordially greeted by Prof. Sidney H. Short. The offices were elaborately decorated with flowers and presented a most beautiful appearance. Every one was presented with a buttonhole bouquet.

Passing from the offices, the visitors walked through the main shop of the company, and from there to one of the large rooms adjoining, where an elegant luncheon was served. In the centre of the room was a long table beautifully decorated with flowers and laden with salads, meats and candies. In an adjoining room were other tables burdened with substantials. A novel feature of the luncheon was that each guest was presented with a model of an armature made of ice-cream and lemon ice.

After the luncheon all the guests sauntered about the works of the Short Company and also watched the interest-

ing process of manufacturing Swan incandescent lamps. An especially interesting feature of the process is the exhausting of the air from the glass bulbs by means of the mercury pump. After leaving the works some of the visitors went to the shops and power-house of the East Cleveland Street Railroad Company.

An elegant dinner was given at the Stillman, on Tuesday evening, to Mr. John G. Holmes, president of the association; H. H. Little, founder and first president of the association; Henry Watson, ex-president of the association, by the Duplex Street Track Company, of New York, represented by John D. Ellwell, general manager; H. L. Cargill, assistant manager, and S. Russell, Jr., engineer. Among the guests present were: John N. Beckley, president of the New York State Association; Charles Cleminshaw, president of the Troy, N. Y., Street Railway Company; Judge Kent, of Troy, N. Y.; Louis Perrine, Jr., president Trenton, N, J., Street Railway Company; Thomas McLean, manager Sixth Avenue Street Railway Company, New York. Of the electric companies: H. McLellan Harding, general manager of the Westinghouse Company; O. T. Crosby, general manager street-railway department; and W. Worth Bean, General Electric Company; J. G. White, New York; also engineers and representatives of several companies. The room was beautifully decorated with potted plants and cut flowers.

The electrical and street-railway press turned out in full force at the convention. The following-named papers were represented: *The Electrical Engineer*, *Electrical World*, *Electrical Review*, *Electricity*, ELECTRICAL AGE, *Street Railway Gazette*, STREET RAILWAY NEWS, *Street Railway Journal*, *Street Railway Review*, *Electrical Industries*, and *Power*.

THOSE PRESENT.

NOVEL MEANS OF IDENTIFICATION.

The following is a list of the names of those who were in attendance at the convention and who recorded their names in our register. The names appear in the order in which they were registered. As each person wrote his name he was presented with a STREET RAILWAY NEWS aluminum medal to which was attached a metal tag with a number on it. This number corresponded with that set opposite the name of the holder of the badge, and as these names with their respective numbers were printed in the daily edition of STREET RAILWAY NEWS it was an easy matter to identify a stranger by noting his badge number and then referring to that number in the list in the daily STREET RAILWAY NEWS, where the name would be found.

John G. Holmes, Prest. A. S. R. A., Pittsburg, Pa.
Wm. J. Richardson, Sec. and Treas. A. S. R. A., Brooklyn, N. Y.
T. E. Crossman, Stenographer A. S. R. A., Brooklyn, N. Y.
Luther E. Shinn, Esmond S. R. Co., New York.
G. M. Smith, Alum Brass & B. Co., Chicago, Ill.
J. B. Taltavall, STREET RAILWAY NEWS, New York.
W. T. Hunt, STREET RAILWAY NEWS, New York.
A. E. Kornfeld, STREET RAILWAY NEWS, New York.
H. H. Harrison, General Electric Co., New York.
T. R. Taltavall, STREET RAILWAY NEWS, New York.
E. M. Smiles, Edison Manufacturing Co., New York.
T. B. Lashar, Bridgeport H. R. R. Co., Bridgeport.
J. E. Wallace, Railway Supplies, Boston.
H. P. Manning, Pitts. Trolley Co., Pittsburg.
F. W. Brown, Youngstown St. R. R. Co., Youngstown, O.
E. H. Oswald, Benedict & Burnham Mfg. Co., New York.
L. McCarthy, W. T. Macallen Co., Boston.
F. H. Boswick, Gen. Elec. Co., Pittsburg.
F. E. Bruce, Sterling Boiler Co., Chicago.
G. M. Haskell, Gen. Elec. Co., Boston.
C. L. Tolles, Jewell Belting Co., Hartford.
John Taylor, Taylor Truck, Troy, N. Y.
Alex. H. Lewis, Gen. Elec. Co., New York.
W. E. Boughton, Johnson Co., Philadelphia, Pa.
L. H. Parker, Trenton P. R. Co., Trenton, N. J.
P. E. Hurley, Trenton P. R. Co., Trenton, N. J.
G. Bancroft, Jewell Belt Co., Boston.
W. F. Gurley, Taylor Truck, Troy, N. Y.
Elmer P. Morris, Gen. Elec. Co., Boston, Mass.
Chas. F. Uebelacker, Short Elec. R'y Co., Cleveland, O.
J. B. Coffman, Eureka Temp. Cop. Co., Detroit, Mich.
G. H. Keating Elec. R'y Poles, Bay City, Mich.
J. H. Rose, Lima Register, Lima, O.
S. L. Nicholson, Short Elec. R'y Co., Cleveland, O.
Wm. W. Kingston, Johnson Co., Philadelphia.
R. R. Hammond, Supply Mfg. Co., Pittsburg.
H. C. Johnston, Chas. Scott Spr. Co., Philadelphia.
Chas. Scott, Jr., Chas. Scott Spr. Co., Philadelphia.
E. J. Lawless, Mgr. Paterson R'y Co., Paterson, N. J.
H. M. Doremus, N. J. Traction Co., Newark.
T. C. Barr, Pres. N. J. Traction Co., Newark.
G. D. Haynes, N. J. Traction Co., Newark.
A. Radel, South Orange R. R., Newark.
J. S. Pugh, Balt. Car Wheel Co., New York.
J. A. Tackaberry, John Stephenson Co., New York.
F. P. Ford, Short Elec. Co., Chicago.
H. J. Davies, Brooklyn St. R. R. Co., Cleveland.
J. B. McClary, Birmingham R. & E. Co., Birmingham, Ala.
H. J. Geriken, A. French Spring Co., New York.
D. B. Dyer, Augusta R'y Co., Augusta, Ga.
D J. Kurtz, The W. Bingham Co., Cleveland, O.
A. C. Harrington, Sargent & Lundy, Chicago, Ill.
Gus. Luckow, Rich'd Vose Car Spr. Co., New York.
W. H. Heulings, Jr., J. G. Brill Co., Philadelphia.
D. W. Pugh, The John Stephenson Co., New York.
L. F. Miller, Valentine & Co., Chicago.
P. M. Eppley, Orange Cross T. R'y, Orange, N. J.
Mayor Haynes, Newark, N. J.
H. P. Barr, Sperry Elec. R'y Co., New York.
G. S. Whipp, Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
C. M. Fuller, Burrows Car Shade Co., Portland, Me.
W. A. House, Jr., Baltimore Traction Co., Baltimore, Md.
R. Mc Culloch, St. Louis St. R'y, St. Louis, Mo.
C. G. Stearns, Car Trucks, New York.
J. H. Zerbey, Schuyler Elec. R'y Co., Pottsville, Pa.
L. K. Hammon, Potts. & Twigsburg R. R. Co., Pottsville, Pa.
A. Bartlett, Syracuse S. R. Co., Syracuse, N. Y.
F. A. Morrell, Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
W. Robinson, Robinson Tr. Co., Boston, Mass.
O. C. Evans, Johnson Co., Cincinnati, O.
L. E. Robert, Lewis & Fowler Co., Brooklyn, N. Y.
E. S. Goodrich, Hartford West H. R. Co., Hartford, Conn.
E. D. Stockwell, Washburn & Moen Mfg. Co., Chicago.
W. H. Morrison, Brooklyn City R. R. Co., Brooklyn, N. Y.
D. Moffett, Brooklyn City R. R. Co., Brooklyn, N. Y.
G. Myers, Standard R. S. Co., Chicago.
W. S. Silver, W. S. Silver & Co., New York.
B. W. Russell, Newburyport & A. H. R. R. Co., Salem, Mass.
T. H. Johnson, Newburyport & A. H. R. R. Co., Salem, Mass.
C. Odell, Newburyport, Salem, Mass.
W. R. Garbisson, St. R'y Supplies, Cleveland, O.
F. B. Smith, Met. S. R. Co., Springfield, Mo.
P. K. Andrews, J. G. Brill Co., Chicago, Ill.
G. H. Herenden, Brightman Stoker Co., Cleveland, O.
Jos. Leidenger, Dayton M'f'g Co., Dayton, O.
P. Leidenger, Dayton M'f'g Co., Dayton, O.
A. W. Field, Peckham Tr. & W. Co., New York.
E. Peckham, Peckham Tr. & W. Co., New York.
S. S. Leonard, Hill Clutch Works, Cleveland.
E. Packer, Roch. Car Wheel Works, New York.
F. W. Russell, Roch. Car Wheel Works, N. Y.
P. S. Burns, Jr., Peckham T. & W. Co., Chicago.
C. J. Hill, Perkin Elec. Lp. Co., Manchester, Conn.
W. A. Hathaway, Am. Elec'l Works, Providence, R. I.
G. M. Angier, Mather Elec. Co., Boston, Mass.
W. W. Bean, St. Jo. & Benton H. E. R. R. Co., St. Joseph, Mo.
A. T. Potter, Union R. Co., Providence, R. I.
Chas. A. Schieren, Jr., C. A. Schieren & Co., New York.
Ed. G. Reynolds, *Street Railway Gazette*, New York.
E. A. Record, Vacuum Oil Co., Boston.
J. H. Parker, C. S. Knowles, Boston.
M. H. Hamilton, Genl. Elec. Co., New York.
John McGhie, Genl. Elec. Co., New York.
F. M. Laughlin, Solar Carbon & Mfg. Co,, Pittsburg.
W. H. Delany, Railway Supply Co., New York.
H. E. Webb, Solar Carbon & Mfg. Co., Pittsburg.
P. H. Carey, Nuttall R'y Supply Co., Chicago.
H. J. Mayer, Nuttall R'y Supply Co., Allegheny.
R. O. Hood, Gen. Elec. Co., Boston.
David Reid, Genett Air Brake Co., Chicago.
Frank A. Rogers, Short Elec. R'y Co., Cleveland.
S. B. Fortenbaugh, Short Elec. R'y Co., Cleveland.
R. L. Andrews, Brush Elec. Co., Cleveland.
J. W. Baumhoff, Lindell R'y Co., St. Louis, Mo.
A. H. Hagermey, Lindell R'y Co., St. Louis, Mo.
Frank A. Magee, The E. S. Greeley & Co., New York.
Capt. W. L. Candee, Okonite Co., New York.
Henry D. Stanley, Okonite Co., New York.
J. F. Macartney, Railway Equip. Co., Chicago.
E. R. Esmond, Esmond St. Rail Co., New York City.
Jas. P. McQuaide, National Conduit Mfg. Co., New York.

Geo. H. Alten, Gen. Elec. Co., Lynn, Mass.
C. C. Hart, Central T. H. Co., Cincinnati, O.
Chas. E. Rowe, R'y. Equip. Co., Boston, Mass.
J. A. Hanna, McGuire Mfg. Co., Chicago, Ill.
J. H. Shay, Chas. Munson Belting Co., Chicago, Ill.
Jno. E. R. Dall, Short Elec. R'y. Co. Pittsburg.
H. C. Evans, Johnson Co., New York.
Jos. S. Minary, Southern R'y. Co., St. Louis.
Jos. Wills, Short Elec. R. R. Co., Cleveland, O.
R. D. Hassan, Short Elec. R. R. Co., Cleveland, O.
A. W. Dutton, Short Elec. R. R. Co., St. Louis.
Edw. P. Sharp, American Mica Co., Boston.
Percy Hodges, Gen. Elec. Co., Boston.
G. H. Bryant, Gen. Elec. Co. Chicago.
Geo. F. Small, Wakefield Rattan Co., Boston.
W. F. Wittemore, No. Hudson Co., R'y. Hoboken.
W. B. Potter, Gen. Elec. Co., Lynn.
Jas. C. DeLong, Gen. Elec. Co., Boston.
J. A. McCune, Short Elec. R'y Co., Cleveland.
W. S. Atchinson, Short Elec. R'y Co., Atlanta.
G. K. Wheeler, Gen. Elec. Co., Chicago.
R. M. Fuller, East Cleve. R. R. Co., Cleveland.
Arthur S. Partridge, Elec. Supplies, St. Louis.
Albion E. Lang, Toledo Con. St. R. Co., Toledo, O.
John F. Ostrom, Penn. Steel Co., Philadelphia, Pa.
Wm. Bradley, Bradley Gen. Elec. Co., Ft. Wayne.
W. S. Elliott, Gen. Elec. Co., Chicago.
F. E. Allen, Gen. Elec. Co., St. Louis.
G. D. Watson, Buffalo R'y Co., Buffalo.
S. H. Short, Short Elec. Co., Cleveland.
J. G. Troggardh, Pitts. & Duquesne Tr. Co., Pittsburg.
Wm. H. Perkins, Pitts. & Duquesne Tr. Co., Pittsburg,
J. Paul Baker, Balt. Car Wheel Co., Balto.
Wm. M. McCandless, W. Webster Co., Phila.
V. M. Nellman, Penna. Br. Wks. Erie, Pa.
C. W. Phipps, Brush Elec. Co., Cleveland, O.
E. C. Sawyer, St. Gauge & Lantern Co., Syracuse, N. Y.
W. O. McClure, Short Elec. Co., Cleveland.
Sidney H. Wheelhouse, Star Head Lt. Co., Rochester, N. Y.
W. P. Seguine, Frost Veneer Seat Co., New York.
Chas. A. Woolsey, Gen. Elec. Co., Boston.
E. A. Hewitt, E. A. Hewitt & Co., Cleveland.
E. R. Larter, Ft. Clark St. R'y., Peoria, Ill.
J. H. Hall, Ft. Clark St. R'y., Peoria, Ill.
S. M. Hamill, Brush Elec. Co., Cleveland.
Edward L. Ross, Chapman Valve Mfg. Co., Indian Orchard, Mass.
Chas. Hathaway. C. C. Cable R. R. Co., Cleveland.
G. H. Bunch, East End R'y. Co., Memphis, Tenn.
J. D. Hall, Fort Clark St. R. Co., Peoria, Ill.
Wm. Hazleton, Short R'y. Co., Cleve.
Wm. J. Clark, Gen. Elec. Co., New York.
A. C. Kendall, New Haven, Pa.
E. Webster, Stilwell & Bierce Mfg. Co., Dayton, O.
J. A. Rutherford, Westinghouse Co., Pittsburg.
A. M. Orr, Piqua S. R'y. Co., Piqua, O.
T. M. Flesh, Piqua S. R'y. Co., Piqua, O.
Jos. E. Lockwood, Detroit Elec Wks., Detroit, Mich.
Frank B. Rae, Detroit, Mich.
J. A. Taft, Babcock & Wilcox Co., New York.
Howard Wheeler, New York City.
R. D. Nuttall, R. D. Nuttall Co., Allegheny, Pa.
W. C. Groetzinger Allegheny, Pa.
E. C. Stark, Peckham M. T. & W. Co., Oneida, N. Y.
Henry Cochran, Lamokin Car Works, Chester, Pa.
G. E. Pratt, Lamokin Car Works, Chester, Pa.
Thos. H. McLean, Houston West St. & P. R. R. New York City.
Lewis Perrine, Jr., Trenton Pass. R. R. Co., Trenton, N. J.
J. B. Hanna, Woodland Ave. St. R. Co., Cleveland.
Jno. H. Fry, Detroit, Citizens S. R. Co., Detroit, Mich.
H. S. Haywood, Jersey City & Bergen H. R. Co., Jersey City,
W. M. Ramsey, Pleasant Valley S. R. Co., Pittsburg.
Louis B. Whitney, Whitney & Son Car Works, Phila.
David McDonald, P. V. R'y. Co., Allegheny.
Wm. T. Jackson, Jersey City & B. H. R. Co., Newark, N. J.
M. L. Knight, Shenango Valley S. R. Co., Beaver Falls, Pa.
F. J. A. Keller, Cleve. Elec. Mfg. Co., Cleveland.
C. A. Dainz, Cleveland Elec. Mfg. Co., Cleveland.
Wm. M. Sturges, Utica Belt Line, R. R. Co., Utica.
A. W. Anderson, Dayton St. R'y Co., Dayton.
O. J. Mulford, Mich. S. C. Co., Detroit.
George Kissam, Carleton & Kissam, New York.
W. H. Shaffer, Richmond City S. R. Co., Richmond.
Geo. C. McCullough, Richmond City S. R. Co., Richmond.
J. H. Mason, Simplex Electrical Co , Boston, Mass.
F. N. Cleland, W. Bingham Co., Cleveland.
F. H. Lincoln, Toledo Consol. S. R. Co., Toledo.
Clark Rude, Cit. Elec. R'y. St. & Power Co., Mansfield.
A. J. Wurts, Westinghouse Co., Pittsburg.
Edw. F. Gray, Westinghouse Co., Pittsburg.
Benj. Taft, Cotton and Woolen Ins. Co., Boston.
B. F. Jones, Riverside Park R'y, Sioux City, Ia.
E. P. Roberts, Swan Lamp Mfg. Co., Cleveland, O.
C. T. Hamilton, General Elec. Co., Pittsburg.
C. F. Rand, Everett, Wash. R. & E. Co., Seattle, Wash.
A. L. Dickerman, Everett, Wash. R. & E. Co., Seattle, Wash.
Edw. J. Wessels, Short Elec. Co., New York.
Chas. J. Mayer, R. D. Nuttall Co., Pittsburg.
Wm. I. Waterlich, Gas & Elec. Co., Danville, Ill.
W. J. Shipman, Columbia R. R., Wash., D. C.
R. J. Mereur, N. Y. Car Wheel Wks., Buffalo.
C. C. Curtis, Short Elec. Co., Cleveland.
A. H. Hough, Brush Elec. Co., Cleveland.
D. A. Rapp, York S. R. Co., York, Pa.
Jos. Partridge, Partridge Carbon Co., Sandusky, O.
John Mahoney, St. Louis, Mo , Peoples' R'y., St. Louis.
Milton H. Bronsdon, Prov. Cable Tram. Co., Providence, R. I.
E. C. S. Larrison, Nuttall R'y. Supply Co., Chicago.
V. Cronyn, L. S. & R'y. Co., London, Ont.
Thos. H. Suralman, L. S. & R'y. Co., London, Ont.
W. Jens, Johnson Co., Johnstown, Pa.
H. C. Hunt, Camden & Atlantic R. Co., Atlantic City, N. J.
J. H. Blackwell, Trenton Pass. R. R. Co., Trenton, N. J.
R. S. Shoodniff, Trenton Pass. R. R. Co., Trenton, N. J.
Jno. J. Burleigh, Cape May D. B. & S. Pt. R. R., Trenton, N. J.
J. M. Smith, McKeesport & R. P. R. Co., McKeesport
L. A. Gray, Adams & Westlake Co., Chicago.
T. B. Jones, Adams & Westlake Co., Chicago.
H. C. Hartman, Bradley Gen. Elec. Co., Chicago.
H. P. Bradford Elec. R. Co., Little Rock, Ark.
W. Estey, City Elec. Co., Little Rock, Ark.
Maurice Hooper, Lynn & Boston R. R. Co., Lynn, Mass.
H. T. Paiste, Trolley Wheels, Phila.
A. Tindalph, Citizens' S. R. Co., Vincennes, Ind.
E. F. Tindalph, Citizens' S. R. Co., Vincennes, Ind.
C. A. Denman, Toledo Con. S. R. Co., Cleveland, O.
D. J. Hauss, Cincinnati, O.
H. C. Rhoades, W. P. R'y. Co., Williamsport.
A. L. Register, Pepper & Register, Phila.
W. A. Garton, Garton Daniels Elec. Co., Keokuk, Ia.
A. E. Hay, Robinson Mch. Co., Altoona, Pa.
H. H. Archer, Wilm. S. R. Co., Wilmington, Del.
F. D. Sweeten, Wilm. S. R. Co., Wilmington, Del.
W. L. G. Thomas, Nonesuch Fibre Co., Wilmington, Del.
E. H. Heinrichs, Westinghouse E. & M. Co., Pittsburg.
G. M. Boles, Westinghouse, Church, Kerr & Co., Pittsburg.
J. Finley, Central R'y. Co., Peoria, Ill.
B. Owen, Reading City R'y., Reading, Pa.
E. S. Ward, Newark & Orange R'y. Co., Newark, N. J.
W. Scheerer, Newark & Orange R'y. Co., Newark, N. J.
W. G. Eno, Wilkesbarre & Wyoming Valley Tr. Co., Wilkesbarre.
J. Graham, Wilkesbarre & Wyoming Valley Tr. Co., Wilkesbarre.
C. A. Benton, Sprague Elec. Co., N. Y. City.
W. H. Patterson, Bloomington City R'y., Bloomington, Ill.
Frank De H. Robinson, Cleve. City Cable R. Co., Cleveland.
J. Fagan, Wilkesbarre & Wyoming Tr. Co., Trevorton.
A. Everett, E. C. R. R. Co., Cleveland, O.
F. P. Howe, W. Wharton, Jr. & Co., Philadelphia.
J. N. Beckley, Rochester S. R. Co., Rochester.
A. W. Slee, W. Wharton, Jr. Co., St. Louis.
W. M. Lamus, York St. R'y Co., York, Pa.
Chas. F. Luther, Pawtucket St. R'y Co., Pawtucket, R. I.
John Kast, Cleveland City Cable R'y, Cleveland.
John R. Hopper, Des Moines St. R'y Co., Des Moines, Ia.
A. C. Anderson, Citi. St. R'y Co., Indianapolis, Ind.
W. S. Jewell, Elec. Dept. Cit. St. R'y Co., Indianapolis, Ind.
W. F. Hazelrigg, Cit. St. R'y Co., Indianapolis, Ind.
R. F. Rusberg, S. and G. M. West Bay City, Bay City, Mich.
B. L. Kilgore, Cin. S. R. Co., Cincinnati, O.
F. J. Reynolds, Central T. H. Co., Cincinnati, O.
H. H. Brooks, Am. Circular Loom Co., Boston, Mass.
Chas. E. Bibber, Cons. Elec. Mfg. Co., Boston, Mass.
J. R. Gathright, United Tramway Sprinkler Co., Louisville, Ky.
W. N. Claggett, United Tramway Sprinkler Co., Louisville, Ky.
J. S. Park, Des Moines S. R. Co., Des Moines, Ia.
Jos. Fischer, Underg. Trolley System, Cleveland, O.
L. B. LeVake, Brush Elec. Co., Cleveland.
L. Gutman, Johnson Elec. Co., Cleveland, Ohio.
T. B. Griffith, H. S. R. Co., Hamilton, Ont.
B. E. Charleton, H. S. R. Co., Hamilton, Ont.
J. B. Griffith, H. S. R. Co., Hamilton, Ont.
W. G. Soper, Ottawa City Pas. R'y, Ottawa, Can.
F. A. Scheffler, Brush Elec. Co., Cleveland.
H. C. Payne, Milwaukee St. R'y Co., Milwaukee.
F. B. Brownell, Brownell Car Co., St. Louis.
C. C. Baker, Topeka City R'y, Topeka, Kan.
R. H. Smith, Pass Belt R'y Co., Lexington, Ky.
F. C. Delnaas, H. W. Johns Co., New York.
E. Martin, Hamilton St. R'y Co., Hamilton, Can.
Chas. Campbell, Western Elec. Co., Chicago.
F. Stible, East Cleveland R'y Co., Cleveland.

H. M. Littell, Cincinnati Inc. R'y, Cincinnati.
J. A. Smith, Cincinnati Inc. R'y, Cincinnati.
E. H. Seixas, *Street Railway Gazette*, Chicago.
S. H. Silverman, Gen. Elec. Co., Pittsburg.
J. S. Sweeten, Bodifield Belting Co., Cleveland.
E. S. Canman, Hale & Kilburn Co., Chicago.
H. J. Crowley, Gen. Elec. Co., Atlanta, Ga.
P. B. Huyette, Babcock & Wilcox Co., New York.
S. H. Scovell, Babcock & Wilcox Co., New York.
W. C. Clark, Westinghouse E. & M. Co., Pittsburg.
A. S. Hatch, S. W. P. A. R'y Co,, Windsor, Ont.
L. E. Myers, Detroit Elec. Works, Chicago.
W. C. Temple, Babcock & Wilcox Co., N. Y.
J. S. Speer, Partridge Carbon Co., Sandusky.
Emil G. Schmoat, Sandusky St. R'y Co., Sandusky.
W. B. Sterling, Mark & Sterling, Cleveland, Ohio.
W. F. D. Crane, H. W. Johns Mfg. Co., N. Y.
R. A. Crawford, Wheel Guards, Pittsburg, Pa.
A. G. Hathaway, Trans. Table and Railroad Supplies.



BRILL CAR ON WOODLAND AVE. AND WEST SIDE R. R., CLEVELAND, O.

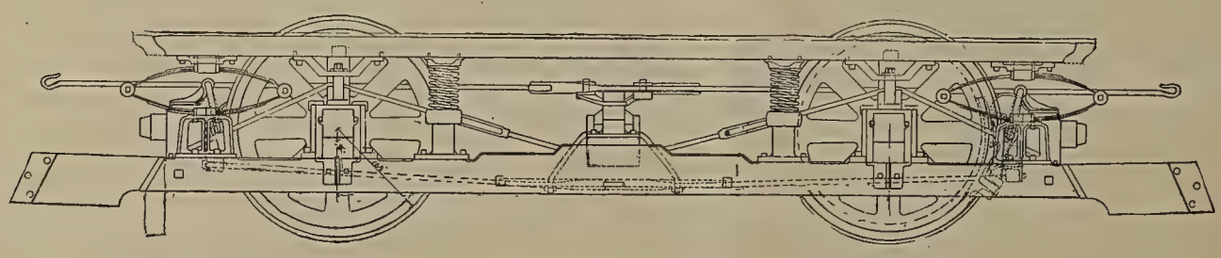
M. D. Pratt, Eng. Penn. Steel Co., Sheldon, Pa.
H. S. Littlefield, Johnson Co., Chicago, Ill.
T. E. Harding, E. C. R. R., Cleveland, Ohio.
J. C. Turk, Kings Br. Co., Cleveland, O.
J. McRae, O. E. S. R'y, Ottawa, Can.
C. B. Raymond, Goodrich H. R. Co., Akron, O.
C. B. Clegg, Oakwood St. Railway Co., Dayton, O.
R. B. Corey, Elec. Con., and Supply Co., New York
C. E. Mark, Mark & Sterling, Cleveland O.
W. H. White, Brush Elec. Co., Cleveland, O.
W. F. Sayles, Brush Elec. Co., Cleveland, O.
E. D. Carter, Ball Engine Co., Erie, Pa.
J. Grant, Detroit Cit. R'y Co., Detroit.
R. S. Garth, Chicago City R'y Co., Chicago.
C. S. Clark, Pa. Steel Co., Boston.
F. C. Billings, The Bil ings & Spencer Co., Hartford, Ct.
H. L. Adams, R'y Equip't Co., Chicago.

W. E. Haycox, Fulton Foundry, Cleveland.
R. S. Hubbell, Walker Mfg. Co., Cleveland.
H. R. Hul, Westinghouse, Church, Kerr & Co., New York.
C. D. Van Nuis, New York.
W. H. Hammett, Ham. Corliss Eng. Co., New York.
S. A. Madigan, Partridge Carb. Co. Sandusky.
E. D. Carter, Ball Eng. Co., Erie, Pa.
P. H. Hover, Standard Paint Co., New York.
G. M. Hoadley, Bemis Car Box Co., Springfield, Mass.
C. L. Cullen, Globe Iron Works, Cleveland.
Jos. R. Ellicott, New York.
J. W. Philpott, Akron Belting Co., Cleveland.
W. J. Johnston, *Electrical World*, New York.
S. L. Coles, *Electrical Review*, New York.
J. H. McGraw, *Street Railway Journal*, New York.
C. E. Stump, *Street Railway Journal*, New York.
E. L. Power, *Electrical Industries*, Chicago.
E. E. Wood, *Electrical Industries*, New York.
J. H. Dickerson, *Street Railway Journal*, New York.
J. B. O'Hara, *Western Electrician*, Chicago.
M. J. Sullivan, *Street Railway Gazette*, Chicago.
F. L. Kenfield, *Street Railway Gazette*, Chicago.
Mr. Pool, *Street Railway Journal*, New York.
L. W. Collins, *Electrical Engineer*, New York.
T. C. Martin, *Electrical Engineer*, New York.
F. R. Colvin, *Electrical Engineer*, New York.

TELEPHONE TO CHICAGO.

A new epoch in the history of long-distance telephony was inaugurated on the afternoon of Tuesday, October 18, when about 150 representatives of the press and other invited guests assembled in the offices of the American Telephone and Telegraph Company, 18 Cortlandt street, New York, to assist at the formal opening of the long-distance line to Chicago, a distance of 950 miles. Hitherto the longest telephone line in successful operation has been the one between Paris and Marseilles, about 500 miles.

Mr. John E. Hudson, president of the company, announced that a cornetist in another room would play "America," after which another cornetist would do the same in Chicago. Forty receivers were in circuit, so as to give every one a chance of hearing. The results were eminently satisfactory, and when this portion of the programme was completed, Mr. Hudson introduced Mayor Grant, who called up Mayor Washburn, at the Chicago end, and said: "We in New York wish you all success in the dedication ceremonies which you hold in Chicago this week, and we extend our congratulation over a telephonic wire nearly twice as long as any operated until now." Mayor Washburn returned the compliment, which was distinctly heard by those in possession



SIDE ELEVATION FULTON FOUNDRY TRUCK EXHIBITED AT CLEVELAND CONVENTION.

W. D. Graves, W. D. G. Elec. Mfg. Co., Cleveland.
F. B. Jacobs, Johnston Safe Aut. Elec. Co., Richmond, V.
S. A. Hand, Detroit Elec. Works, Detroit, Mich.
P. F. Leach, Cushion Car Wheel Co., Chicago.
J. H. Graham, Con. R'y. Supply Co., Boston.
L. B. Wheildon, Mass. Car Co., Boston.
J. L. Barclay, Westinghouse Co., Chicago.
Daniel Coolidge, Johnston Co., Johnstown, Pa.
A. L. Daniels, Mitchell-Brant Copper Co., North East, Pa.
J. H. Jones, Jones' Sons, Troy, N. Y.
Edw. Caldwell, *Elec. World*, New York.
E. E. Wood, *Elec. Industries*, New York.
F. R. Low, *Power*, New York.

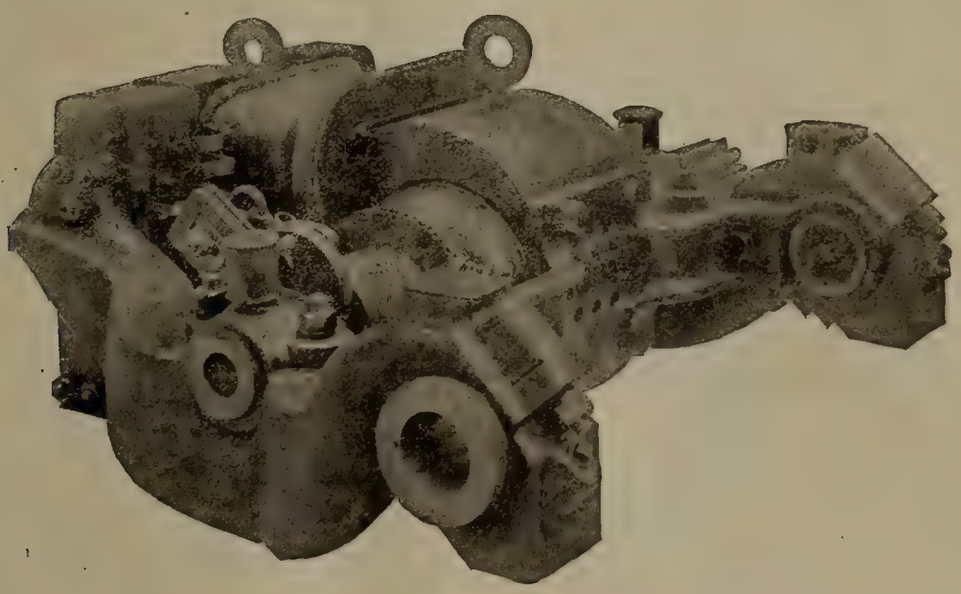
of the receivers. Prof. Bell, the inventor of the telephone, exchanged compliments with Mr. William H. Hubbard, of Chicago, who assisted at the first public exhibition of the telephone in 1876. As a further proof of the successful operation of the line, one of the company's staff in Chicago recited the "Charge of the Light Brigade," every word coming as clearly and distinctly as could be desired. At the conclusion of the ceremonies an elegant luncheon was served in an adjoining room, where souvenirs made of the wire used on the line, with receivers at each end, were distributed.

The line is constructed in a most substantial manner. The poles are of cedar and chestnut, thirty-five feet and upwards in length, and average about forty-five in number per mile, making the total number of poles 42,750. The circuit consists of No. 8 hard-drawn copper wire, weighing 435 pounds to the mile ; the total weight being 826,500 pounds. On a circuit of the same length the wire that is ordinarily used for telephone purposes would weigh 200,000 pounds.

The principal points on the main line are Newark, N. J., Harrisburg and Pittsburg, Pa., Cleveland and Toledo, Ohio, and South Bend, Indiana. Extensive additions will soon be made, connecting all important points in Ohio, Indiana, Illinois, Michigan and Wisconsin.

THE S. R. F. 30 RAILWAY MOTOR.

The many advantages of the single-reduction motor for electric-railway service have, during the past year, been so emphatically proven that the General Electric Company has re-designed its old double-reduction F. 30 motor, making it a single-reduction machine and designating it as the S. R. F. 30 Railway Motor. In compliance with the demand, already apparent, for the conversion of F. 30 motors, the company is now rebuilding for many of its customers a considerable number of these machines.



GENERAL ELECTRIC CO.'S S. R. F. 30 RAILWAY MOTOR.

In effecting the change the side-arms, nose-plate, intermediate shaft-pinion and gear of the old F. 30 motor have been discarded and replaced by newly designed side-arms which support the motor proper. As will be seen from the illustration, they occupy a position exactly the reverse of that in the F. 30. The nose-plate becomes a support to the pole-pieces, and the pinion and gear are similar to those used on the General Electric Company's W. P. railway motor.

By doubling the turns or convolutions in the armature winding, and leaving the field-spools unchanged, two very important improvements have been secured—the armature speed is reduced one-half, and the strength of the torque of the motor doubled.

An improvement has been effected in the arrangement of the armature bearings, facilitating lubrication. The axle and armature bearings are now similar and the same kind of grease can be used on both.

The efficiency of the new S. R. F. 30, when compared with that of the F. 30, shows a decided increase in favor of the new type, although its speed under similar condition of strength of fields is slightly less. The amount of heat developed after a run under full load is also considerably less than the F. 30.

The satisfactory results of the trial tests of the S. R. F. motor tend to show that the transformation of the F. 30 from a double-reduction to a single-reduction motor will be satisfactory wherever effected.

A NEW ELECTRIC-LIGHT PLANT.

The Heisler Electric Company, of Philadelphia, recently installed an electric-light plant to be operated by its incandescent system of lighting in Deckerstown, N. J. Mr. John Karr, of Hackettstown, the special agent of the company, had charge of the installation, and much praise has been given for the thorough manner in which the details of the work have been carried out. The Heisler Company's system has given every satisfaction wherever installed and ably holds its own in competition with those of other concerns. A full description of it was published in the ELECTRICAL AGE of February 6, 1892.

The Electric Heat Alarm Company, 113 Devonshire street, Boston, has an interesting exhibit of its journal-bearing alarm and general fire-alarm at the Mechanics' Association Fair now being held in that city.

MONTREAL NOTES.

Work on the Montreal street railway system is being rapidly pushed ; large gangs are working on the east and west ends. In a few days the electric service will be completed to both the Grand Trunk and Canadian Pacific stations. The Montreal Street Railway has 36 miles of road in operation with 125 horse cars, 20 electric cars, and by June 1, 1893, will have over 50 miles of road and 100 electric cars running.

The capital stock of the company is $900,000. The officers are : President, L. J. Forget ; managing director, H. A. Everett, sec'y and treas., Edward Lusher ; supt., J. J. Franklin.

At the meeting of the Côte St. Antoine Council, held Thursday, October 20, Albert J. Corriveau, on behalf of himself and associates proposed, if the council gave a franchise, to construct and put into operation in that municipality during 1893, an electric railway, and connect the same with the City Passenger and other municipal lines. Mr. Corriveau's associates in New York and elsewhere own several storage patents, and will if practicable use that system.

Mr. Corriveau expects his American associates to visit Montreal during November, and will select the route of the electric railway to and through Sault au Recollet for which he has been granted a 30-year franchise including the installation of an electric-light system. Work will begin on the electric railway early in the spring, ties and other material being got ready during the winter. All the municipalities are preparing to have electric railways, and the coming spring promises an era of electric progress.

The remarkable demand for the installation of electric-light plants and electric street-railway systems which one meets with on all sides, unquestionably received its impetus from the electric-light convention held in Montreal during September, 1891. Ever since then electrical business of all descriptions has wonderfully increased and keeps on growing steadily. The stimulating effects of these conventions on business generally is admirably demonstrated by the great electrical boom Canada is experiencing.

BOLTE AUTOMATIC TIME-KEEPER.

The Bolte Automatic Time-Keeper is a new device for keeping accurately a record of the time of arrival and departure of employés.

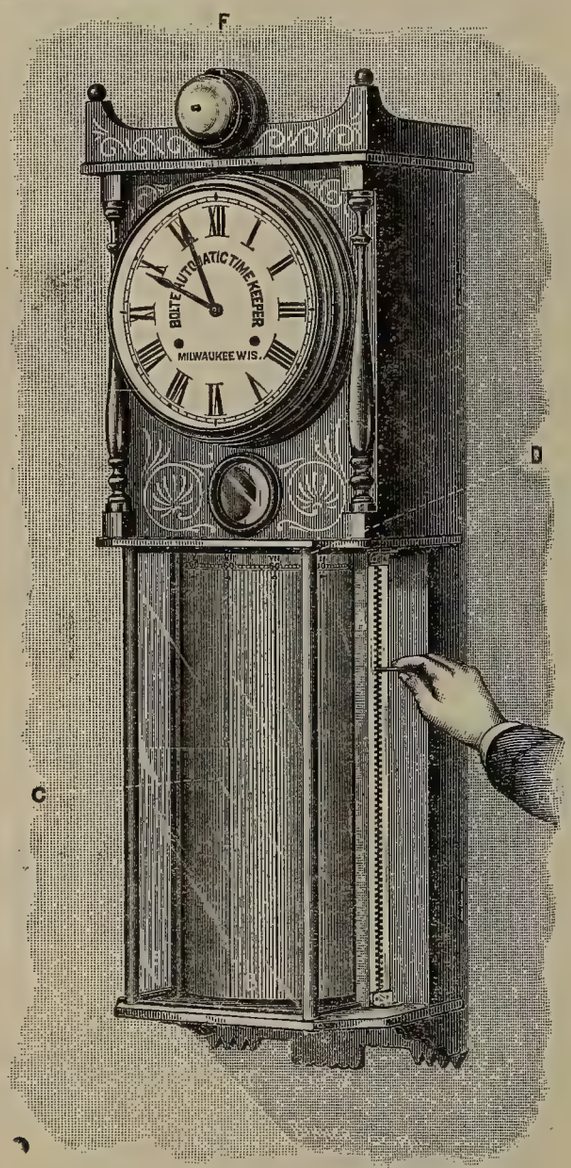


FIG. 1.

Fig. 1 shows the complete detail with clock dial and the hand making the registration.

Fig. 2 shows a section of the upper part of the record-sheet. The cylinder around which this record-sheet moves turns in time with the hour-hand, making one revolution every twelve hours. The heavy lines marked 7 o'clock indicates the hour at which the workmen are expected to arrive. The numbers recorded on the left of this line are early, whereas those on the right are late.

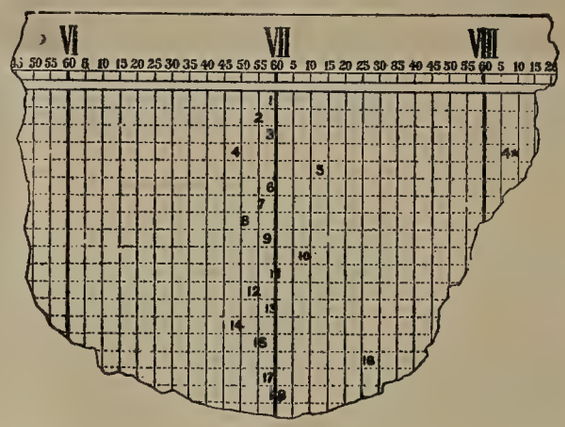


FIG. 2.

Each of the light-colored lines indicates five minutes therefore any one registering three lines to the right of the 7 o'clock line would be fifteen minutes late, and as the proprietor enters his establishment in the morning one glance at the clock will indicate just those employés who are absent or late and how many minutes they are behind time.

Fig. 3 shows a section of the key-rack, through the openings of which the registrations are made.

Fig. 4 shows the registering key full size. Each work-

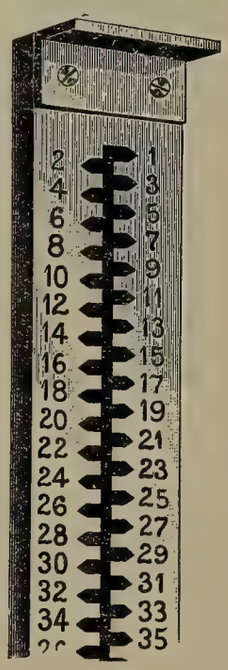


FIG. 3.

man draws his pay according to a certain number, and in this case the one shown is No. 75. This number appears in raised letters on each end of the key, the end marked "in" being nickel, the end marked "out" being of copper. The indication of an employé registering "out" is shown by a star (*) being placed after the number, thus, 75*.

The value of this device is self-apparent. Each workman makes his own registration and cannot complain of the time-keeper. No collusion is possible between time-keeper and employé. By actual use it has demonstrated

the fact that employés are much less liable to be late, as by the use of the Bolte Automatic Time-Keeper not only the workmen themselves are able to inspect the record, but their employers are able each day at a glance to as-



FIG. 4.

certain the numbers and names of those who are arriving on time, or others who are habitually late or absent. The device will be placed on the market by the National Time Recorder Co., 361 and 363 East Water street, Milwaukee, Wis.

NEW YORK NOTE.

The committee on art of the Columbian celebration held in New York has awarded to the Hotel de Logerot a gold medal for the decoration installed by the Conduit Wiring Company, 12 West 29th street, New York.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	87 50
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	93 00
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Commercial Cable Co	7,716,000	100 00	169 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	118 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*107
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	107 00
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 50
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	119 00
General Electric Co. 5s	4,000,000		*106
General Electric pref.		100 00	119 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 75
Laclede Gas pref.	2,500,000	100 00	66 00
Laclede Gas 5s	10,000,000		*84
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	61 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	13 00
Postal Telegraph	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark.	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	26 00
Western Union	86,188,852	100 00	99 25
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	38 25
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

For the first time since last spring the railway securities are attracting more attention than the industrials, and the brokers are quite jubilant over it. Industrial specialists have not as yet made themselves known, and the business has not centred in a few hands, as is the case with other stocks. Next spring will find this all rectified, and those who desire to invest in electrics or shares which are other than railway will know the brokers handling them. I hope to see quite a number of our street and electric railway stocks dealt in and regularly quoted on the New York Stock Exchange early in '93, although like their aging steam companions they are located all over the grand domain. Every city of 100,000 should be represented in the list; it is public business, the people are entitled to an interest in the profits and there is no other commercial way for them to do it. The latest industrial opportunity for investment is the American Type-Founders Company, incorporated, very properly, in New Jersey, with a capital stock of $9,000,000 (is there luck in odd numbers, that it was not made an even $10,000,000?) in $100 shares, of which 40,000 cumulative preferred shares bear 8 % and 50,000 are common stock. Thirty thousand shares of the preferred stock are offered at par, $1,000,000 of the preferred and the majority of the common stock is retained by the vendors. The business of the corporation is to include the greater portion of the type-founders of the United States. That it will be a success is certain, and I advise those who have enough electrics to place their surplus in this stock. Now we want a printers' ink company on the same scale, and the public will have no further trouble in distributing or receiving printed information; its cost will be within the reach of all.

LADIES AT THE CONVENTION.

One of the pleasantest features of the street-railway convention held in Cleveland last week was the large attendance of ladies. Many delegates brought their wives and daughters with them, who were very generously entertained during their stay in Cleveland, the Short Electric Railway Company especially making things pleasant for the fair visitors. Mrs. Short won many friends among her sex by her generous hospitality, and the Cleveland convention will always be a pleasant memory to the ladies, as well as the gentlemen who were fortunate to be present. The ladies should go to conventions oftener, as their presence lends a tone and grace to these occasions that are unattainable without them.

HOUSE-WARMING.

The employés of the Standard Paint Company, of 2 Liberty street, New York, manufacturers of the celebrated P. & B. compounds, and the residents of Bound Brook, N. J., were entertained by the officials of the company at the house-warming of a large extension recently erected at their extensive plant in that place. This extension was rendered necessary in order to increase the company's facilities to satisfactorily handle the immense number of orders that keep constantly pouring in from all over the country. The company's works already cover 3 acres of ground, the various buildings are connected by a cable railway, and they will soon have to be enlarged. This extension will be equipped with new and improved machinery.

At the house-warming there was a large gathering, the various fire companies and other local bodies turning out in honor of the event. Refreshments were served, dancing indulged in, and all thoroughly enjoyed themselves way into the early hours of the morning.

Those of the company present were: Ralph L. Shainwald, president; J. C. Shainwald, F. S. De Ronde, Samuel Cochrane, Jr., Alfred Georgi, Wm. Griscom, Jr., superintendent of the factory, and Eugene Trotter, foreman of the paint-house, who acted as master of ceremonies.

NEW BOOKS.

TELEGRAPHIC CONNECTIONS, embracing recent methods in quadruplex telegraphy, by Thom and Jones, 59 pp. with 20 illustrations. D. Van Nostrand Company, New York. Price, $1.50.

The object of this work is to give the telegrapher a thorough and clear understanding of the various parts and connections of the quadruplex apparatus. In order to make the subject the more readily understood, numerous plates showing diagrams of the connections in different colors have been introduced. Many new improvements in telegraphic apparatus and methods and the application of the dynamo for the generation of the current have been recently made, all of which are treated in detail.

That the authors have been conscientious and painstaking in their efforts to thoroughly and completely cover the ground is apparent from the character of the work. To every telegrapher desirous of familiarizing himself with the technical details of his profession the book will be found an invaluable aid, and the general reader will find it very interesting and instructive.

THE ROOT SECTIONAL SAFETY BOILER.

The Root Improved Water-Tube Safety Boiler has many qualities which commend it for service in central electric lighting or power stations. That this is recognized is proved by the extensive use of this popular form of water-tube boiler in such situations. In central electric light and power stations, more than anywhere else, is the best workmanship and service necessary in the mechanical equipment. Only the best boilers, pumps and other machinery should be used, in fact must be used, for break-downs and delays are expensive and ruinous. The Root boiler is primarily an absolutely safe boiler. One of the tubes might explode, but that would be the extent of the damage. The injured tube with its connecting member could be withdrawn and others replaced, with very little time or trouble being given to the operation. The boiler generates steam rapidly, is easily cleaned and attended to, is sectional and easily erected.

The Abendroth & Root Manufacturing Company, 28 Cliff street, is constantly in receipt of flattering accounts of the working of its boiler, which after many years the company has brought to a very high standard.

The Root boiler is used by the large electric-light companies of Cincinnati, Louisville, Columbus, St. Paul, Detroit, Philadelphia, Jersey City and other places.

The manufacturers issue a finely illustrated catalogue for gratuitous distribution.

COIN WRAPPERS.

Street-railway companies and all other concerns handling large amounts of small coin will find the coin-wrappers manufactured by A. N. Webb, 4 Central street, Salem, Mass., a first-class article in every respect. These wrappers are made of strong manilla paper, thoroughly gummed, and with the amounts printed in large, clear type. They are already being extensively used by banks and bankers throughout the country and giving every satisfaction. They are so strong that there is no danger of the paper breaking and spilling the coin all over, and are sold at a very low figure. Any further information and samples may be had from the manufacturer.

TRADE NOTES.

MUTUAL ELECTRIC LIGHT CO.
ALLIANCE, OHIO, Aug. 8, 1892.

To Whom it may Concern: We have in use leather belts of various makes, but none are giving us the satisfaction the Akron Belting Co. do. They put in good stock and are thoroughly stretched, and consequently run perfectly true. Very respectfully,

W. W. CANTINE, Sec'y.

The following is a partial list of sales of Ball engines recently made by the Ball Engine Company, of Erie, Pa.: Coulee City Electric Light Co., Coulee City, Wash., one 25 H. P. engine; Englewood Electric Light Co., Englewood, Ill., one 600 H. P. cross-compound engine; Port Huron Electric Railway Co., Port Huron, Mich., one 450 H.P. cross-compound engine; Royal Light, Heat and Power Co., Front Royal, Va., one 100 H. P. engine and steam plant complete; Commercial Electric Light Co., Columbus, Ind., one 150 H. P. engine and complete steam plant.

The Okonite Company (Limited), 13 Park Row, New York, finds a large and steady demand for its Okonite specialties, particularly the feed-wires and cables insulated with Okonite, which the company manufactures for electric street railways. These last-mentioned goods are daily gaining in popularity. Extreme flexibility, efficiency and durability are their distinguishing characteristics.

STEAM YACHT "CONQUEROR."
NEWPORT, R. I., July 6, 1892.

FORREST SILVER BRONZE PACKING CO.,
115 LIBERTY STREET, N. Y. CITY.

Gentlemen: Your favor of the 28th ult. with enclosures is at hand. Regarding your Silver Bronze Packing put on piston and valve rods of steam yacht "Conqueror" in April last, I beg to state that up to the present the working is entirely satisfactory according to the report of our chief engineer, Mr. Evans, who I find is entirely won over to it. Should its staying properties prove to be what you claim for it, I can safely say it will be an unqualified success. The working pressure of the "Conqueror" boiler is 160 lbs., and making up to 109 revolutions per minute. I am, gentlemen,

Very truly yours,
(Signed) J. E. WOOD,
Master S. Y. "Conqueror."

This yacht belongs to Mr. F. K. Vanderbilt; was bought in England.

We took out "Katzenstein" for the "Silver Bronze.'

W. S. Chesley & Co., electrical engineers and contractors, 136 Liberty street, New York, have severed their connection with the Easton Electric Company, of Brooklyn, and desire agencies for electric-light apparatus and appliances. This firm has just completed a new machine-shop at 24 Morris street, Jersey City, near the Cortlandt street ferry, and have facilities for repairing all kinds of electric light and power apparatus. They have sold a great deal of apparatus and have a very nice trade.

The Mather Electric Company, 97 Nassau street, New York, has placed during the last week a 15 H. P. motor with the Jennings' Lace Works, Brooklyn; a 3 H. P. motor with Mr. Thos. F. Larkin, Brooklyn, and a 1 H. P. motor with Mr. J. B. Hoecker, Brooklyn.

The Electrical Age's Illustrated Patent Record.

Issued October 18, 1892.

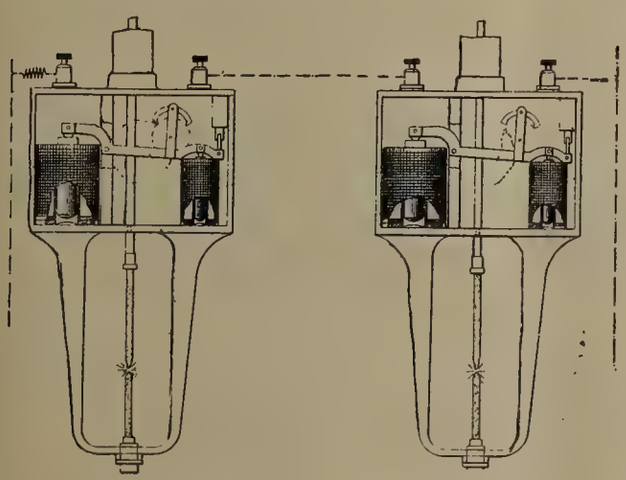
484,386. Electric Fire-Alarm. Joaquin J. d'Almeida and José Y. da Silva, Lisbon, Portugal. Filed May 2, 1890. Patented in Germany; in France; in Spain; in Portugal, and in England.

484,416. Apparatus for Refining Metals by Electricity. Charles R. Fletcher, Boston, Mass. Filed Nov. 25, 1891.

484,449. Lantern for Electric Lighting. Daniel S. Page, Malden, and Joseph L. Bertsch, Cambridge, assignors to said Page and Albert N. Page, Malden, Mass. Filed Dec. 12, 1891.

484,450. Electric-Light Fixture. Daniel S. Page, Malden, Mass., assignor to himself and Albert N. Page, same place. Filed Dec. 12, 1891.

484,466. Lightning-Arrester. Lewis Searing, Denver, Col. Filed Jan. 20, 1892.



484,479.—ELECTRIC-LIGHTING SYSTEM.

484,479. Electric-Lighting System. Barton B. Ward, New York, N. Y. Filed March 1, 1892.

484,483. Insulating-Joint. Charles Wirt, Chicago, Ill. Filed Aug. 29, 1891.

484,522. Electrode for Medicinal Purposes. Edward H. McBride, Springfield, Mo., assignor of one-half to Albert W. Mahle. Filed July 21, 1892.

484,530. Electric-Arc Lamp. Carl Coerper, Coeln, Germany. Filed June 18, 1892.

484,535. Apparatus for Electroplating. Frank H. Howard, Irvington, N. J. Filed Aug. 13, 1890.

484,543. Electrical Inductorium. Lazarus S. M. Pyke and Harry T. Barnett, London, England, assignors to said Pyke and Edward Stephen Harris, same place. Filed Feb. 5, 1892. Patented in England.

484,544. Electrical Inductorium. Lazarus S. M. Pyke and Edward S. Harris, London, England. Filed Feb. 5, 1892.

484,545. Electric-Fuse Box. William Stanley, Jr., and John H. Kelman, Pittsfield, Mass. Filed Dec. 21 1891.

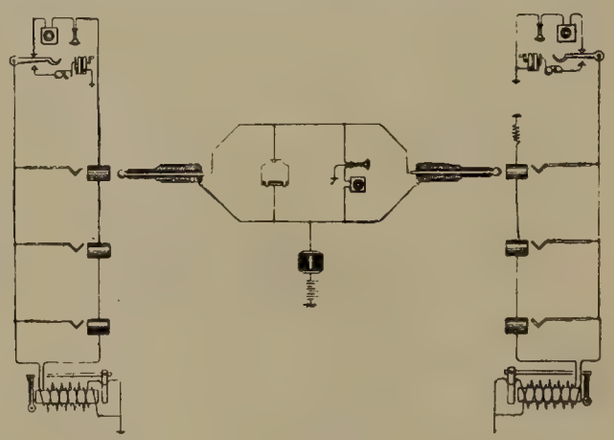
484,549. System of Electrical Distribution. De Witt B. Brace, Lincoln, Neb. Filed Sept. 16, 1891.

484,553. Electrode and Incandescent Electrical Conductor. Lewis L. Jones, Brooklyn, N. Y. Filed Sept. 16, 1885.

484,565. Mast-Arm for Electric-Light Poles. Alonzo B. Allison and Gabriel B. Scott, Pittsburg, Pa. Filed March 21, 1892.

484,574. Electrically-Heated Hand-Stamp. John B. Venker, St. Louis, Mo. Filed Dec. 11, 1891.

484,577. Combination Lock and Alarm. Robert Baumann, St. Louis, Mo., assignor to the Electric Alarm Lock Company, same place. Filed Aug. 20, 1891.



484,612.—MULTIPLE-SWITCHBOARD SYSTEM.

484,580. Lamp-Socket and Circuit-Closer Therefor. Sigmund Bergmann, New York, N. Y. Filed May 18, 1892.

484,582. Process of Duplicating Phonograms. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Phonograph Company, of New Jersey. Original application filed Jan. 5, 1888. Divided and this application filed Jan. 30, 1888. Renewed March 30, 1892.

484,583. Phonograph Cutting-Tool. Thomas A. Edison, Llewellyn Park, N. J. Filed May 27, 1890. Renewed March 30, 1892.

484,584. Phonograph-Reproducer. Thomas A. Edison, Llewellyn Park, N. J. Filed May 27, 1890. Renewed March 30, 1892.

484,585. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed July 30, 1890. Renewed March 30, 1892.

484,611. Regulator for Dynamo-Electric Machines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 5, 1890.

PATENTS.—Continued.

484,612. Multiple-Switchboard System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 21, 1892.

484,613. Sub-Station Apparatus for Telephone Systems. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 21, 1892.

484,614. Electrical Railway-Signal. Benjamin C. Seaton, Nashville, Tenn. Filed March 1, 1892.

484,618. Electric Appliance for Canes. Stephen D. Smith, Milwaukee, Wis. Filed Dec. 7, 1891.

484,626. Telephone-Exchange Apparatus. John J. Carty, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 29, 1889.

484,637. Apparatus for Annealing Wire or Metallic Rods by Electricity. Joseph H. Hunter, Pittsburg, Pa. Filed June 2, 1891.

484,695. Lamp-Shade Support. Max Bauer, Louis Harry and John Bunger, Greenville, N. J. Filed Dec. 10, 1891.

484,704. Apparatus for the Manufacture of Metallic Articles by Electrolysis. Alexander S. Elmore, Leeds, assignor to Elmore's American and Canadian Patent Copper Depositing Company, Limited, London, Eng. Filed July 23, 1891. Patented in England; in France; in Belgium; in Switzerland; in Norway; in Luxemburg; in Italy; in Victoria; in New South Wales; in South Australia; in Queensland; in New Zealand; in Spain; in India; in Canada; in Austria-Hungary, and in Western Australia.

484,724. Electric Motor or Dynamo. Albert W. Smith, San Francisco, Cal. Filed Jan. 25, 1892.

484,762. Electric Bell. John E. Thron, Philadelphia, Pa. Filed June 18, 1892.

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ELECTRICAL AGE

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DEADLY GAS.

Six lives have been sacrificed during the past 10 days in Hyde Park, a suburb of Chicago, by inhaling fuel gas while the victims slept. Electricity cannot produce such a record, and yet the newspapers are not kicking up a very great rumpus. Wherein lieth the difference?

SUBMARINE CABLE TO CHINA.

An interesting article is that of Mr. Romyn Hitchcock which will be found on another page. Mr. Hitchcock presents a strong argument in favor of the laying of a submarine telegraph cable between the United States and China, by way of the Sandwich Islands. No doubt such a line would be of great value to American commercial interests, and to the government itself, and to lay such a cable with American capital would be a matter for justifiable pride, as it would surpass all other undertakings of similar character so far realized.

EFFECTIVE BURGLAR-ALARM.

An ingenious method of protecting our homes, stores or warehouses against unlawful intrusion is that described and illustrated on another page in this issue. It is practically an electrical mat which is placed on the floor in front of doors and windows, and is so constructed that when it is stepped on an alarm is sounded, thus drawing attention to the particular spot whence the alarm proceeds. It is proposed to make the mats large enough in area to render it impossible to step over it; so there will be little chance for escape if an intruder "puts his foot in it."

PROPELLING CANAL-BOATS BY ELECTRIC POWER.

At the New York Canal Convention recently held in Buffalo Governor Flower, in a letter, suggested the advisability of enlarging the Erie canal and using electricity as the propulsive power of boats thereon. He thought the trolley system might be applied with advantage. The governor is progressive and public spirited, and there can be no reasonable doubt of the practicability of the plan he suggests. Electric power possesses many advantages over steam for use in canal operations, which entitle it to favorable consideration, one of the greatest being economy of space as compared with a steam plant of equal power. Horses and mules are being driven off street railroads; it is about time that electricity was getting after the canal mule, which is a synonym for the slowest progressive motion on the face of the earth. The fabled tortoise would be a good match for him.

TELEPHONE FROM NEW YORK TO CHICAGO.

The opening of the long-distance telephone line to Chicago on October 18 last was an event of more than passing interest; it will prove to be one of vast importance to business men in New York and Chicago. A good deal has been said about the long-distance telephone encroaching on the telegraph business, but experience has proved to the contrary. The telephone has created a business of its own which could not be transacted by telegraph, and it in no way affects the business or the revenues of the telegraph companies. Indeed, if there is any effect at all upon the latter it is in the direction of increased service rather than its diminution. In five minutes more business can be transacted over a telephone line than could be accomplished by an all-day's telegraphic correspondence; besides the risk of error is quite completely eliminated. Frequently an important deal can be closed by a telephone conference of five minutes that could not be closed by telegraph, and which might require a week's time to execute by mail. It is in such transactions as these that the value of the long-distance telephone is apparent, and the cost of the service, which may appear at first sight as rather high, dwindles into insignificance when compared with the advantages business men derive by the practical elimination of the time factor in business transactions between distant points. The New York-Chicago line will, no doubt, prove to be a decidedly profitable investment for the Long Distance company, and the business public will also find the use of the line equally profitable.

A NEW RHEOSTAT.*

BY CHARLES E. CARPENTER.

It is a well-known fact that an insulated wire suspended in the air will carry a given amount of current at a lower temperature than the same wire without this covering of insulation under the same conditions. This is obviously due to the fact that while the cross-section of conductors is the same, the one which is insulated has a much larger radiating surface than the bare wire, and therefore dissipates the heat conducted through the insulation more rapidly. Suppose, for convenience of illustration, we conceive a conductor to be first covered with some insulating substance, and then enclosed within a metallic tube so that its insulated surface shall fit perfectly within and against the inside surface of the tube, as shown in section in Fig. 1. We thus have a comparatively small conductor with a largely increased radiating surface, and the insulation between the two metallic bodies does not materially obstruct the flux of heat from the conductor to the outside metallic shell.

One of the early experiments of the writer in electric heating—in fact, his first successful apparatus—consisted of two iron plates, between which was interposed an iron resistance wire of the "reflex" or "zigzag" type insulated from both plates by means of thin sheets of mica or asbestos paper, with screws passing through one plate and engaging the other. By this means the plates could be pressed into close relation to the resistance wire. By connecting this apparatus to a constant-potential system the current at first would be comparatively large, but would gradually decrease as the temperature of the plates increased until a point was reached where the heat was dissipated as fast as generated. By tightening or loosening the screws the current could then be either increased or decreased. This increase of the current by increasing the mechanical pressure is due to a reduction of temperature effected by the more intimate heat conducting relations between the resistance and plate, facilitating the flux of heat. The better the conduction for heat is made, the less will be the difference of temperature between the wire and the outside radiating surface plate, and it follows that the larger the surface of the radiating plates, which are closely impressed upon the conductor, the larger will be the current-carrying capacity of the latter.

These experiments are cited as an illustration leading to a thorough appreciation of the extent to which the current capacity of a resistance wire may be carried, as it is upon this principle, but with modifications of construction, that the new and improved rheostat herein described is based—that is, a resistance wire of small cross-section is used, but a large radiating capacity is secured by placing the wires in such relations to a metal plate as to practically increase its radiating surface to a very great extent.

The results of the experiments described above suggested a modified form of construction, one in which the resistance would be entirely covered by a medium which would protect the wire from oxidation and yet act as a good insulator of electricity and a good conductor of heat, and which will permanently attach the wire to, but insulate it from, a radiating plate. A special enamel was finally found by the writer to be suitable for this purpose. A section of this construction is shown in Fig. 2.

The injurious effect of linear expansion of the resistance wire, due to heat, is avoided in this method by the "reflexed" or "zigzag" form in which the wire is bent, as shown in Fig. 3, and it has been demonstrated by experience that this linear expansion is thereby so distributed as not to injure or crack off the enamel in practice.

On this principle, since we are able to greatly reduce the cross-section of the conductor, it follows that its length is also proportionately shortened for any required resistance, and no consideration of mechanical strength of the wire enters into this construction, since it is so perfectly confined and supported on all sides.

Practice has demonstrated that 20 watts of electrical energy may be dissipated continuously to each square inch of resistance surface without injury to the apparatus. However, on account of the excessive temperature of the plate used in close proximity to the other materials, it is not practicable to dissipate over 8 or 10 watts to the square inch in continuous service.

By placing one surface of the plate in contact with water, so that its heat is dissipated in this manner, we are able to continuously dissipate about 25 watts to the square inch. From this it will be seen that by means of water we are able to increase the capacity of a certain plate to about three times that of the same plate dissipating its heat directly into the atmosphere, or we may decrease the size of the plate to one-third for the same capacity where water is used.

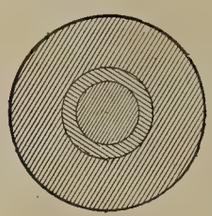
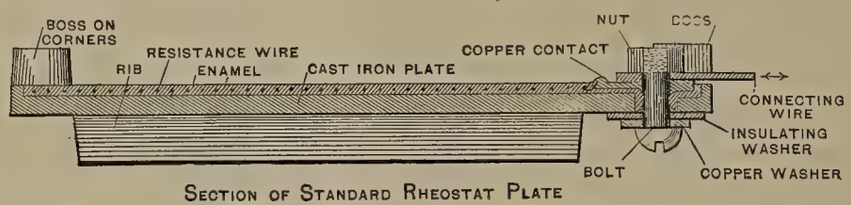


FIG. 1.



SECTION OF STANDARD RHEOSTAT PLATE

FIG. 2.

In many applications, especially in railway work, apparatus is often subjected to a load far beyond its rated capacity. Rheostat plates for such service are made with narrow ribs, between which the resistance wire and enamel are placed. It is found that by means of these ribs the safe carrying capacity of a wire is greatly increased, while the ribs serve also to protect the insulation and wires from mechanical injury.

In adapting this construction to meet practical requirements in its several applications it is necessary to alter only in detail the general construction and distribution before explained, and shown in Fig. 3, which shows the usual plan of distributing the wires in a simple rheostat plate. Connection to the resistance wire is made by means of a sheet copper contact strip, one portion of which is folded back upon itself, and after inserting a portion of the wire this sheet copper is crushed about it. The joint so formed cannot oxidize, since it is completely sealed by the enamel fused about it.

To divide the resistance so formed into steps, it is only necessary to place contacts for connection to the resistance wire at convenient points where the loops approach the edge of the plate, as at *a*, and so on, in Fig. 3. This particular way of locating the connecting points on one side of the plate is especially convenient in using these plates with small motors, where only few steps or divisions of the resistance are required. A modification of

*A paper presented at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 7, 1892.

this arrangement is to have the connecting points alternate from one side of the plate to the other, as at *b*, *a*, etc., Fig. 3. A distribution best adapted for stage or field-controlling rheostat, or one in which a great number of steps are required, is secured by arranging the resistance in a similar manner around the entire outer portion of a disc with contact connections near the circumference. Another arrangement is required in a plate of low resistance and high ampère capacity. In this case several coils are placed in parallel and connected to a common contact piece.

The plates, with their coils and contacts distributed as above described, are well suited for use in connection with rheostat switches. They are provided with ribs or blades for extending their radiating surface, and lugs at the corners for convenience in attaching them to the back of the switch. Each contact of the resistance plate is connected by a very short wire or strip to the corresponding contact piece on the rheostat switch.

A very simple and complete rheostat is made by placing the switch contacts and lever, properly insulated, directly upon the radiating plate, on the surface opposite the resistance face. With this arrangement as shown in Fig. 4, a rheostat is obtained which is no larger than the switch parts alone of existing rheostats.

To make a single plate large enough to dissipate the

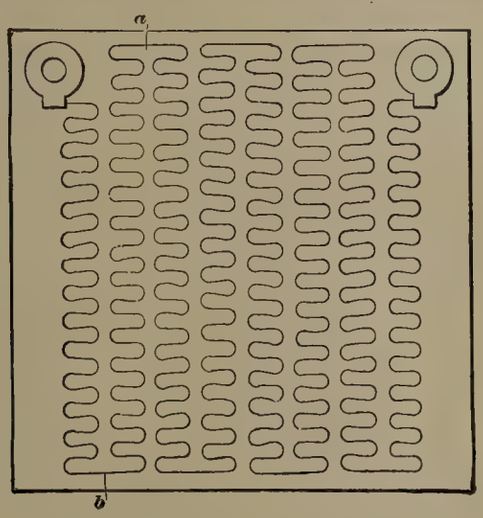


FIG. 3.

energy wasted in the rheostat in starting a large motor, would make it necessary to have a surface so large as to be objectionable. To avoid this difficulty, a number of plates of, say, 10 inches square, are placed in parallel with each other, but separated by sufficient space to admit of proper ventilation, and connection made from the switch contacts to the contacts upon the various plates as required. With this arrangement a rheostat of very large watt capacity may be placed within a small cubic space.

This form of rheostat, by reason of its compactness, is well adapted for use with arc lamps on constant potential circuits. In this application, the resistance plate may be attached directly to the outside of the casing, leaving just sufficient space between the casing and the plate for ventilation. Where the casing is cylindrical, the plate may be disc-shaped and placed on top of the cylindrical casing, with holes in the plate for the hooks and chimney to pass through. A valuable feature of this rheostat in this application is that it will endure exposure to the weather while in use. As an example of this, the writer knows of a case where one of these plates has now been in use on a pair of lamps for over seven months, where the plate is in a horizontal position, with the enamelled side up and water dripping on it continually.

In some places the heating effects of rheostats should be avoided. For example, in stage controllers 5 to 10 kilowatts continuously converted into heat is extremely objectionable in warm weather. This may be done by conveying the heat away through the agency of running water. To accomplish this the resistance plate may be hollow, with inlet and outlet pipes connected directly to a source of water supply. By this means and with proper circulation the plates will always be comparatively cold, and no sensible amount of heat will be given off to the surrounding atmosphere, while the size of the apparatus is so reduced as to occupy no considerable amount of space.

It is evident that numerous modifications of this general design may easily be made to adapt the apparatus to the requirements of practice.

The following facts are true regarding this form of rheostat:

1. It is fireproof, as no combustible material enters into its construction, and it can never be submitted in normal use to a temperature so high as that to which it is subjected in the process of manufacture.

2. It is durable, since the resistance wires cannot deteriorate from oxidation, electrolysis, etc.

3. It is compact, as it requires less than 5 per cent.

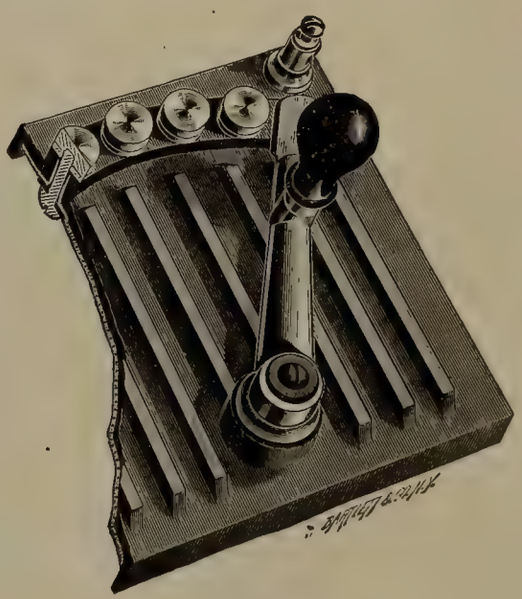


FIG. 4.

of the cubic space required by the ordinary coiled wire rheostat of the same capacity.

4. It is simple, the three necessary elements—resistance wire, insulation and radiating surface plate—being fused into one integral mass.

5. It is cheap, for a certain resistance and carrying capacity can be obtained by the use of a wire whose cross-section and length will both be but one-tenth of that required for a wire used in the air. That is, the total weight of wire, and hence the cost of the same, will be but one per cent. of that usually required.

6. It is unaffected by heat, cold, acids, alkalies, oils and other chemicals, and for this reason is especially adapted for use in mines, breweries, marine vessels, etc., where chemical action rapidly destroys ordinary insulators. It is even practicable to operate these plates submerged in flowing water, in case it is desirable to carry off the heat in this way.

Another and important application of this method of converting electric energy into heat in a compact form is for the operation of various heating devices.

The requirements of a commercially successful electric heating device are:

1. The concentration upon the working surface of the apparatus of practically all of the heat produced in the

resistance, thus preventing as far as possible the dissipation of heat by radiation or conduction to other bodies or parts than those it is required to heat.

2. The ability to rapidly supply a large amount of heat energy from the resistance to the working surface, through a medium having a high conductivity for heat, thus keeping the working surface at the proper temperature even when a large amount of heat is rapidly drawn from it.

3. The protection of the resistance wire from deterioration by chemical and electrical action, so that its life shall be indefinitely prolonged.

All the above requirements are fulfilled in this device.

DISCUSSION.

In reply to a question as to whether the rheostat had been designed for heavy current, Mr. Carpenter said :

"We are manufacturing resistance plates of low resistance and high ampère capacity. In these low-resistance plates several wires are in parallel or multiple and have a capacity depending upon the kind and size of the wire, from 25 to 200 ampères or more. A 50-kilowatt, 500-volt motor-starter is made up of a number of these low-resistance plates connected in series. Each plate has 4 wires in parallel, and each plate forms a step or division of the rheostat. The plates for this size of motor are 18 inches long and 3 inches wide, and weigh about 4 pounds. Twelve or fourteen of each are used for this size of machine.

"These series plates have the coils or wires enamelled between ribs for increasing the adhesion of the enamel to the plate. It has been found by experience that 50 per cent. more current may be passed through a wire when placed between the ribs in this manner, without breaking the enamel, than where the wire is simply enamelled on a plain surface. It is also a fact that these plates used in this way will endure splashing of water about them without breaking the enamel, when the temperature is as high as will be reached in normal use."

CONVENTION ECHOES.

DISCONNECTOR FOR RAILWAY CIRCUITS.

At the Pittsburg convention last year the Johnston Disconnector was practically exhibited and attracted much attention, and it was described and illustrated in STREET RAILWAY NEWS of October 31, 1891. Since that time several important improvements have been made in the device, and in its improved form it was exhibited at the Cleveland convention last month.

The accompanying illustration is made from a photograph of the disconnector. The object of the apparatus is to render a broken trolley wire harmless, so that the broken end may be handled without fear or danger of receiving a shock. When the wire is intact the hanging end, shown at the right of the illustration, is kept in a horizontal position as shown by the corresponding part on the left. The tension of the wire keeps these end pieces in a horizontal position and at the same time preserves the continuity of the circuit through the catches,



J. G. BRILL CO.'S EXHIBIT, CLEVELAND CONVENTION.

which are shown; the one at the left closed and that at the right open. The moment the wire breaks the catch is released and the current is cut off at the disconnector itself, which hangs in midair out of reach, while the dangling broken wire is "dead," because it is disconnected from the source of current.

This device is not intended for use on trolley wires alone; however it is, of course, equally serviceable on electric-light wires, or any other wires which either carry heavy currents of their own or may be charged with dangerous currents by becoming crossed with heavily charged wires.

The Johnston Safe Automatic Electric Co., of Richmond, Va., handles this valuable device, which is the invention of Mr. A. Langstaff Johnston, C.E., of Richmond, Va.

The use of these disconnectors robs a trolley or electric-light line of all its terrors.

The officers of the company are: John Rutherford, president; A. W. Garber, vice-president; F. B. Jacobs, secretary and treasurer.



JOHNSTON DISCONNECTOR FOR RAILWAY CIRCUITS.

THE J. G. BRILL EXHIBIT.

We give herewith an illustration made from a photograph of the main part of the exhibit of the J. G. Brill

Co., of Philadelphia, the well-known car-builders. This part of its exhibit was located on the sidewalk in front of the exhibition hall, and consisted of a Eureka Maximum Traction Truck with solid frame, and a solid frame for a No. 21 truck. The latter is shown in the picture, leaning against the tree. The car at the right is one of the 40 being made by the Brill Co. for the Woodland Avenue and West Side Railroad, Cleveland. It has a 21-foot body, and its electrical equipment is on the Westinghouse system. Four other cars of this company's make equipped with the Westinghouse system, were displayed on a side-track on the public square, and attracted



SPECIAL CARS, CLEVELAND CONVENTION.

much attention. The bodies of these cars are painted an emerald green, which, in combination with the colors of the trimmings, gives a very pleasing effect.

THE WALKER MANUFACTURING CO.'S ENTERTAINMENT.

On Friday, Oct. 21, the Walker Manufacturing Co., of Cleveland, entertained a very large party of convention delegates at its immense works, on the west side of the city, at the corner of Detroit street and Waverly avenue. This concern is known all over the country—indeed all over the civilized world—as the manufacturer of machinery for cable railways, hydraulic machinery, presses, shears, pumps, gearing and cranes.

The company provided a large number of carriages to convey its guests from the Hollenden to its works, and our picture was taken while the vehicles were standing in line waiting their turn to take on passengers. The reception accorded by the Walker Company was a brilliant one, and is described in STREET RAILWAY NEWS of October 29.

THE PECKHAM TRUCK.

The Peckham Motor Truck and Wheel Co., of Kingston, N. Y., had its exhibit in the temporary structure erected on a vacant lot adjoining Army and Navy Hall.



EXHIBIT OF PECKHAM TRUCK, CLEVELAND CONVENTION.

The exhibit consisted of one of the company's improved 5A trucks, with flexible "cushioned" truck and motor bearings, and various other parts of the company's trucks. It is claimed by the company that the 5A truck will carry a 30-foot car-body without oscillation; indeed the company warrants the truck to do so, and ride easily besides.

SPECIAL CARS.

Our next view shows the special cars operated by various companies on the occasion of the convention.

The General Electric Company operated 2 cars; the Short Electric Railway Co. had 4 cars, including a "gearless," and 2 single-reductions, and its private car; the Sperry Company had 1 car, and the Brownell Car Co. had 1. A temporary track was laid on Bond street, connecting with the Euclid avenue lines. The rails were furnished by the Johnson Co., of Johnstown, Pa., the girder type being used. These were spiked to ties laid on the surface of the street, and with the aid of a branch trolley line from Euclid avenue to the hotel, the cars were able to take care of themselves from the starting point. These cars were in frequent use taking private excursion parties about the city, and when our picture was taken some of them were "out on the road."

The view shows the cars standing at the side entrance of the Hollenden Hotel, on Bond street.

FIRE.

The factory of the R. D. Nuttall Co., the well-known electric-railway supply-house, Allegheny, Pa., was seriously damaged by fire on Sunday, October 16. Fortu-



CARRIAGES TO THE WALKER MFG. CO.'S RECEPTION, CLEVELAND.

nately, the fire was confined to the lower story, and the valuable machinery, tools, patterns and drawings suffered but slight damage. The loss, which approximates $25,000, extends chiefly to building, belting and stock, and is fully covered by insurance.

Mr. Nuttall, whose energy is well known to all street-railway men, at once set his entire force to reparing the damage. The Munson Belting Co. has already shipped a complete new equipment of belts, and it was expected that the establishment would be in perfect running order within a week.

ELECTRICITY ON THE ERIE CANAL.

The New York Canal Convention was held in Buffalo the middle of last month, during which a step was taken that may result in the introduction of electricity as a means of propelling boats on the Erie canal. A letter was read from Governor Flower in which he emphasized the importance of enlarging the canal. What is most urgently needed along the canal, however, the governor said, is faster navigation. He suggested that if steam

could not be successfully utilized without injury to the canals, electricity might offer some encouragement if applied possibly after the fashion of the trolley system, and that there are between Niagara Falls and the Hudson river ample water-powers for generating the electricity required. Resolutions were passed by the convention providing that the legislature of the State of New York be petitioned to make such appropriation at the next session as may be required to accomplish these objects; and that any further plans and improvements be left to a board of competent engineers, selected by the executive committee of the Canal Improvement Union.

One of the great advantages that electric power would possess over steam for the propulsion of canal-boats would be the economy of space on board. Electric motors take up much less space than does a steam plant of equal power, and the expense of maintenance is correspondingly low, and the item of space on a canal-boat is an important one. As to the application of the trolley system to such use, it is a simple engineering calculation, and can be easily accomplished. This method of propelling canal-boats seems to offer a complete and satisfactory solution of the problem of increasing the facilities of the canal, and no doubt it will be adopted sooner or later.

BURGLAR-ALARM.

The necessity for a simple and efficient method of sounding an alarm in case of unlawful intrusion upon premises through windows or doors has led to the invention of the device described and illustrated below.

Fig. 1 shows a plain view of the arrangement. The strips D and the strips A are in metallic connection, and form one terminal of the circuit, and the strips C, which are in metallic connection with D form the other terminal. The strips C are so formed as to arch over the strips B, and the strips B and C in their normal position are not in contact with each other on account of the arch or

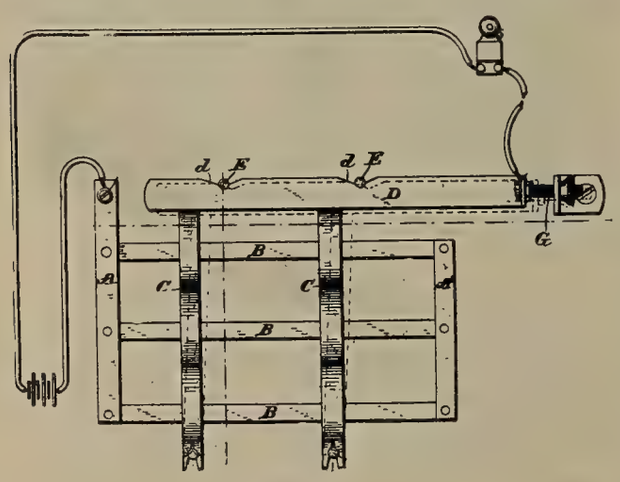


FIG. 1.

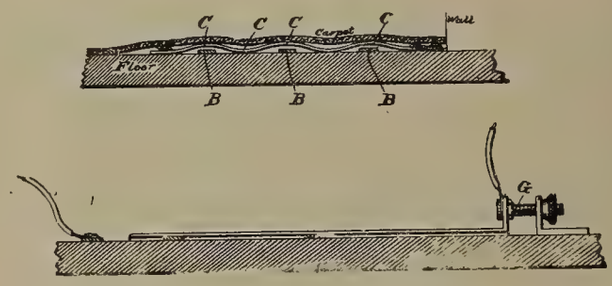
wave form of strips C, which may be made of any springy metal—brass for instance. It is evident from the description of the apparatus that should the latter be stepped upon, the strips C would be pressed down so as to form contact with strips B, thus closing the circuit and sounding the alarm. The moment the pressure upon C is withdrawn those strips will return to their normal position; that is, they will separate from strips B, and thus break the circuit.

Fig. 2 shows a sectional view, wherein B and C correspond with the same letters in Fig. 1. The wave or arch form of strip C is clearly shown in Fig. 2, and from it the operation of the apparatus will be, with the aid of Fig. 1, clearly understood.

In Fig. 2 the carpet, matting or other floor covering is shown on top of the strips C; thus the device is hidden from view. It is designed to be placed under a window or in front of a door, and is made sufficiently large so that an intruder will be sure to step on some portion of it.

In case the strips C should become pressed down and fail to open the circuit when pressure is removed, their normal condition can be restored by means of the thumb-screw G, shown in Figs. 1 and 3.

By operating this screw the strip D is moved lengthwise, and in doing this the studs E in combination with



FIGS. 2 AND 3.

the wedges *a* cause the strips C to assume a more wave-like form, and in this way they are separated from strips B.

In the daytime the circuit may be opened by a switch to prevent the sounding of an alarm when the device is walked on.

This apparatus is the invention of Mr. Homer T. Wilson, of Harrodsburg, Ky., and any further information concerning the same may be had of Dr. Frank Duffy, Newbern, N. C.

NEW BOOKS.

THE STANDARD ELECTRICAL DICTIONARY, by T. C. O'Conor Sloane, A.M., E.M., Ph.D. Norman W. Henley & Co., New York. Price, $3.00.

The appearance of this book has been looked forward to for some time. It is a popular dictionary of words and terms used in the practice of electrical engineering. The author is a well-known authority in scientific matters, and this latest production from his pen bears evidence of conscientious painstaking. The book has 624 pages and 350 illustrations, and wherever it was necessary to elucidate some difficult point an illustration has been inserted. On the whole, the illustrations are quite clear and effective. The print is of good size and the index words or phrases are set in heavy-faced type so as to readily catch the eye. The broad field of electrical engineering seems to be pretty well covered by this book, and it would seem that its reasonable price should insure a large sale.

DYNAMOMETERS AND THE MEASUREMENT OF POWER, by John J. Flather. 12mo. John Wiley & Sons, New York. Price, $2.00.

This is a treatise on the construction and application of dynamometers, and contains a description of the methods and apparatus employed in measuring water-power.

EXPERIMENTAL ENGINEERING, by Rolla C. Carpenter. 8vo. John Wiley & Sons, New York. Price, $6.00.

This is a text-book for engineers and for students in engineering laboratories.

SPON & CHAMBERLAIN, 12 Cortlandt street, New York, publish a vest-pocket book of engineers' tables. It is full of valuable information for engineers. Its actual size is 1¾ by 2¾ inches. The price is 40c.; with cloth case, 50c.

ENORMOUS GROWTH OF MECHANICAL AND ELECTRICAL INDUSTRIES DUE TO MODERN STREET-RAILWAY CONSTRUCTION.

BY J. M. BATCHELOR.

THE future promises to develop a distinct feature of street-railway business which is calculated to absorb a good deal of attention. The business of creating reorganizations in mercantile and electrical industries has now become an established affair, and its application to street railways is gradually developing into prominence; for it is being discovered by promoters of such enterprises that the street-railway business offers even better inducements to the desired end than almost any other.

Of course the chief object and aim of this way of doing things is the making of money by means of the stock which any consolidation may create. Commonly the stock of the old company is doubled up; other companies are added at the same rate, and the whole undertaking is put upon the stock market at figures which sometimes surprises the old street-railway manager.

To bring about such results, promoters are now interviewing many street-railway and electric companies in various parts of the country, advising them, first, to adopt some one of the more modern methods of propulsion, then to reorganize on a new and larger basis, even, in some instances, advising that the roads of distant towns be included in the consolidation, to give weight and influence to the whole proceeding.

Some of these movements are already afoot, and are pretty well known to our readers; yet there are others which promise, if carried through, to dwarf previous attempts, and capitalize at figures which, in the aggregate, are very large. The stock-watering feature assumes a large rôle in this business, at the same time much of such stock-watering might more properly be termed "property," capitalized in the shape of a company's good-will, etc.

Aside from the enlarged features due to this increase of capital, which it is needless to comment upon at present, is the enormous business this way of doing things develops for the engine-builders, track constructors, electric motors, cables, and the extensive equipment necessary to construct a modern street railway. Outsiders have little conception of what the street railways and these promoters are doing at the present time in developing the mechanical industries of the country. Engine-builders are confessing that they have never seen anything like it in this country's history, and that for this purpose alone they are now building more equipments of the largest kind than for all the other industries of the country put together.

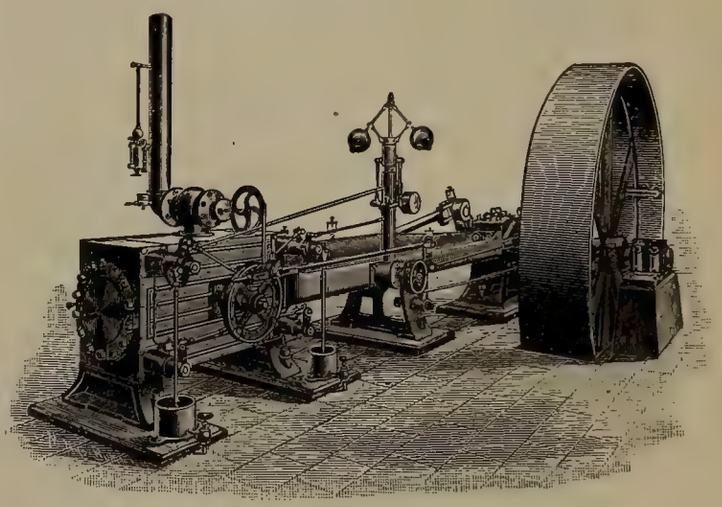
THE EICKEMEYER-FIELD CO.

The Eickemeyer-Field Company has been incorporated at Albany, N. Y., with a capital of $1,000,000. This incorporation represents the consolidation of the Eickemeyer-Field Company, the Eickemeyer Dynamo Company and the Yonkers Machine Company. The division of stock is $935,000 to the first-named company, $60,000 to the second and $5,000 to the third.

IMPROVED TIFFT-CORLISS ENGINE.

Wherever the electric current is to be generated on a large scale for lighting or power purposes, the steam plant plays a very prominent part. As much care must be exercised in the judicious selection of an engine calculated to give the best results in the service to which it is to be put as in the choice of the dynamo or motor. Where one particular style of engine would give most satisfactory results in one instance, it would utterly fail to do so in another. We must be guided altogether by circumstances and surroundings. Nowadays, when space is so valuable, the great idea is to secure an engine that, while occupying a minimum area, retains a high efficiency.

These very necessary requisites seem to be contained in a high degree by the new improved Corliss engines, manufactured by George W. Tifft Sons & Co., the well-known builders of engines and boilers, Buffalo, N. Y. Great pains have been taken in the construction of this



TIFFT-CORLISS ENGINE.

engine to make those parts subjected to strain very heavy, the supporting parts broad and long and the bearings large, with ample provision for keeping them well oiled.

The girder-bed is of a cylindrical shape, having a heavy flanged rib on the back, making a straight-line connection between the cylinder end and pillow-box stand. By this arrangement the metal is placed in the strongest possible form. The flange at cylinder end of the bed is bored so as to receive a ring cast on the stuffing-box cylinder head; the stud bolts are thus relieved from carrying any weight of the bed. The slides are bored, and are very wide, giving ample wearing surface. Two heavy stands, making a broad, rigid base, support the cylinder. The exhaust-chest is below the cylinder, an inch away, so as to prevent the escaping steam from chilling the working steam.

The shaft and crank are forged and of sufficient dimensions to insure long life. The wrist-pin is cast steel, very large, fitted with a tapered shank, and on the larger sides it is held in place with a key at the back. There is an oil-hole from the outer side, drilled at the axis of the pin to the centre of the wrist-bearing, where it meets another hole drilled radially with the crank. In this way the crank-pin can be oiled with a stationary oiler while the engine is in motion; the same principle is applied on the cross-head pin.

The arms of the steam-valve bonnets are turned eccentric with the valve-rods. On this is fitted a loose eccentric operated by the governor. To this outer eccentric is fitted the tripping-arm and through the double movement for shortening and lengthening the distance between the valve centre and tripping-toe, a very sensitive, posi-

tive valve-gear is obtained, and the springs on the latch are done away with, gravity only being depended upon as most reliable to replace it after the tripping-toe has been passed.

These engines are automatic, economical, of high efficiency, very durable, and will be found to render a most satisfactory service wherever used. The George W. Tifft Sons & Company also build a high grade of boilers.

PROPOSED CABLE BETWEEN THE UNITED STATES AND CHINA.

BY ROMYN HITCHCOCK.



A TELEGRAPH cable to China would make the United States a country brisk in the electric circuit of the globe. More than this, it would, in the control of an American company, render us independent of foreign interests, upon which all our telegraphic business with the far East now relies, and by its more direct and economical working enable us to fix the rates much below the profitable limits on the present British-Indian system. It would draw an immense business from China and Japan, to the benefit of the trans-continental lines, and it would give us a long-desired connection with the Hawaiian Islands.

The practicability of the scheme is already shown by the surveys just completed by the Navy Department as far as Honolulu. Few persons are aware of the wonderful development of the cable system of the world since the first submarine cable was laid, only two miles in length. The history of the ocean telegraph properly begins when the cable between Dover and Calais was laid in 1850. That cable was twenty-four miles in length and weighed seven tons to the mile, six times the weight of the first Atlantic cable. But it broke by chafing on the rocks and was replaced by a new and stronger one.

The first successful attempt to cross the Atlantic with a cable was consummated in 1858. Already twenty cables had been laid in various parts of the world. England and Holland were thus connected by a cable 115 miles long in 1853 ; the Black Sea was crossed in 1855, a distance of 400 miles; the Gulf of St. Lawrence in 1856, 74 miles, when, for the first time, a conductor of twisted wire was used.

It is needless to relate again the story of the first efforts to cross the Atlantic. The failures and disappointments and uncertainties of those days were enough to dampen the ardor of all but the most sanguine, and until the fact was actually accomplished the project was the subject of general ridicule.

To-day there are ten cables connecting Europe with Canada and Newfoundland, and seven extending these lines to the United States. Six of them start from Valentia and two from Brest. Two more lie parallel in the ocean depths between Lisbon and Pernambuco, in South America, with landings at Funchal (Madeira) and St. Vincent. Distant New Zealand and Australia, Japan and the China coast, Annam, Java and Sumatra, Formosa and the Philippine Islands, are all in electrical communication with Europe by way of Singapore, but by a very long and indirect course.

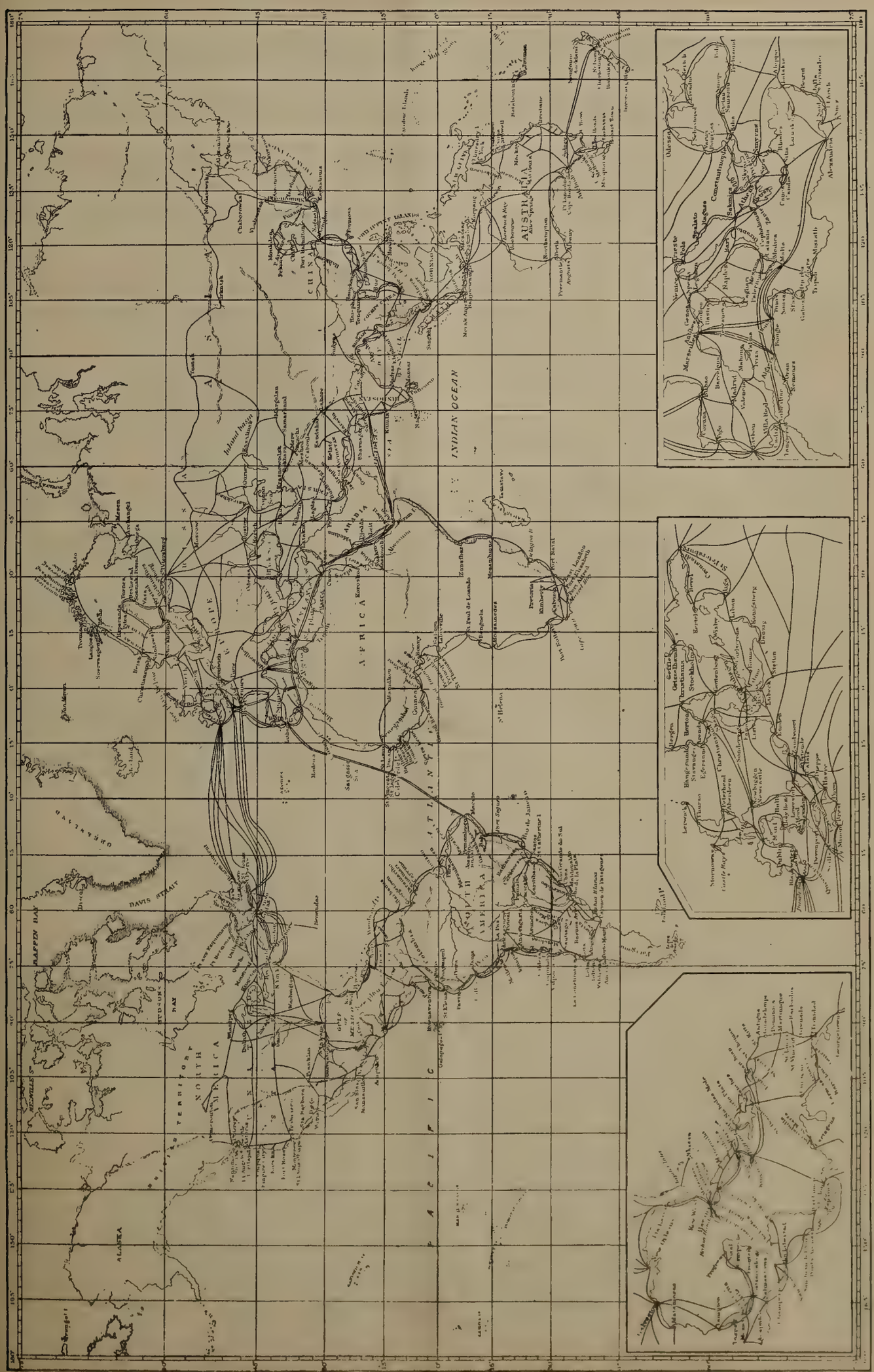
Let us trace the course of a message from New York to the far East. It crosses the Atlantic to Brest or Valentia, thence to Lisbon and Gibraltar, then on through the Mediterranean and the Red Sea to Aden, thence across the Arabian Sea to Bombay. There it comes up out of the briny seas and travels quickly across seven hundred miles of land telegraph to Madras. Ready for another plunge, it again dips under the waters of the Bay of Bengal, bound for Penang and Singapore. Here it may be forwarded either north, to the coast of Siberia, or south, to the remotest point of New Zealand. Most of this great system was established in 1870. A message from New York to China has to travel nearly twenty thousand statute miles, fourteen thousand miles under the seas.

If we examine a telegraph map of the world we are astonished at the number of smaller cable connections, running to places of which we have scarcely any knowledge, or whose very names are new to us. The telegraph cable has followed very closely upon commercial development. These shorter cables are too numerous to be mentioned. The coast of Africa is practically encircled with loops of cables running from port to port. From Gibraltar to Cape Town there is not a break in connections. A land line runs from Cape Town to Port Natal, just across the southern point of Africa, and another series of submarine loops runs up the coast touching at Delagoa Bay, Mozambique and Zanzibar to Aden. Another series of loops begins on the coast of Mexico and follows the west coast of Central and South America to the extreme southern end of Chili. On the eastern coast a similar connection is made northward from Montevideo to the coast of Guiana, then to the Barbadoes, the Windward and West India Islands to the Florida coast. Yet the story is not half told. Cables lie among the coral and ooze of the Gulf of Mexico, the Caribbean Sea, in the North Sea, the Finnish Gulf, the Bay of Biscay, the Baltic, the Caspian and the Black Seas. They creep along the shore of the Persian Gulf, the west coast of the Malay Peninsula; about a dozen cross the Mediterranean. There is no speech nor language where they are not found. The total length of the cables of the world is 140,344 miles. They would stretch more than half way to the moon.

Such has been the development of ocean telegraphy in forty years. That the business has been profitable no one can doubt. New lines are constantly being projected and laid. The last Congress was asked to authorize the landing of a cable on the shores of South Carolina. Another is to be laid from Senegal to Brazil, a distance of 2,165 miles. The weight of this cable is to be 4,946 tons. The longest cable is from Brest to St. Pierre, 2,585 nautical miles.

In spite of all this wonderful growth in every part of the world, not a single line crosses the Pacific Ocean. What a comment this is upon the enterprise for which the American people are famed. This great nation has no telegraphic connection with the Hawaiian Islands. As a naval station for our Pacific fleet at those islands would be of immense importance, our Government might well undertake to lay a cable there at its own cost. But there is no need of that. Let the cable be extended to Japan and China, and it becomes immediately a paying enterprise. Let the capitalists of this country come to realize the enormous business to be done over such a cable and they will have it in working order within two years.

There is no more promising field for investment now open than a cable to China. Take a map of the world and trace the course of a message to the far East, as already indicated here. Note the immense distance it has to travel and the number of retransmissions from point to point, each one increasing the risk of errors. Compare this with the more direct route across the Pacific. From Yokohama to San Francisco is only about 5,700 nautical miles via Honolulu. Then all the business from the far East coming across this continent would benefit the existing telegraph lines. The Atlantic cables would transmit the European business at a small fraction of the cost over the British Indian lines. Such an American cable would,



MAP OF SUBMARINE CABLES OF THE WORLD.

by reason of its shorter submarine course, greater speed and smaller capital invested, absolutely control the telegraph rates between Europe, America and the far East. It could operate at a profit on terms which the present companies could not afford to meet.

It may be questioned whether the business would be sufficient to make the undertaking profitable. No person in China would ever raise such a question. There is not a shadow of doubt of it. Moreover, the Hawaiian government will pay $25,000 a year for fifteen years to the company laying the cable. Japan will also make a generous payment. There are no obstacles to interfere with laying the cable. The water is deep, and a cable in deep water and on a good bottom will remain intact for a century. The operation of laying a cable is now comparatively a simple matter. The entire line can be put down in twelve months. Should a break occur at any time the cable can be grappled and repaired. Breaks are very accurately located by the electricians, and so wonderfully is the apparatus for picking up cables adjusted, that a cable has been raised from a depth of 2,700 fathoms.

The American people cannot fail to be sensitive to the fact that all our telegraphic business with the far East is dependent upon British lines. Not a single word can our government send to an eastern country to a diplomatic officer or to a consul; not an order can be transmitted to the naval officers on duty in China, Japan or anywhere in the far East, without making it known to British operators. Cipher messages may be secret, but the code may be discovered. Should complications arise we might be greatly embarrassed by this fact. Certainly we should take some pride in making this country an integral part of the great telegraphic system of the world, and render ourselves independent of lines of communication which may at any time become inimical to our interests. A message may easily be delayed en route, or wrongly transmitted for a purpose, and serious consequences result.

A movement has already been made to establish an American cable to China, and the near future will doubtless see the realization of the undertaking. The government has completed several lines of soundings between California and Honolulu for the first section of the cable.

The capital required to carry out the entire project as planned is $15,000,000, although practical work and profitable business can be done with only $10,000,000.

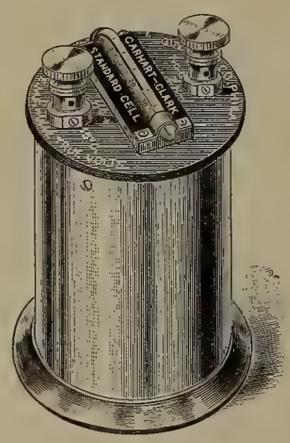
CARHART-CLARK STANDARD CELLS.

The accompanying illustration shows a new form of the Carhart-Clark cell with thermometer permanently attached. This type is well and favorably known to scientists both here and abroad, but for the benefit of those who may not remember all of its special features we give the following brief description:

The Carhart-Clark Standard Cell is the result of several years' study devoted to the subject of standard cells by H. S. Carhart, professor of physics and electrical engineering at the University of Michigan. Recognizing the fact that all known forms of standard cells had but small endurance, and could not in the least stand the jars and strains of transportation without permanently destroying both accuracy and constancy, Prof. Carhart about five years ago started out on a basis of Lord Rayleigh's experiments in standard cells, with a view to making a cell having no local action, perfectly sealed, giving a uniform and constant E. M. F. for all time, and which should not be injured by transportation.

After over two years' study and trial Prof. Carhart, in the early part of 1889, completely solved the problem. The Clark cell, as is well known, is composed of zinc and mercury as electrodes, and mercurous sulphate and zinc sulphate as salts. Great difficulty has always been found in securing the ingredients in a pure state, the smallest amount of foreign matter being sufficient to destroy the reliability of the cell. Another great trouble has been, that in transportation the mercury would be so shaken through the other salts as often to cause a short circuit. The first of those difficulties Prof. Carhart has overcome by making his own chemicals, the second by the use of a special device, so that any short circuit in transportation is practically impossible.

One of the chief points of the Carhart-Clark cell is its very low temperature co-efficient. By a method discovered only after long and laborious investigation, the temperature co-efficient has been reduced from 0.08 % per degree C. to about 0.03 or 0.00077 to 0.00039, thus making for all practical purposes the temperature change inappreciable. Each cell has inside of its mounting an



STANDARD CELL.

extra graphite resistance of about 10,000 ohms, so that no particular injury will result should it be accidentally short-circuited for a short time. The cells proper are prepared by Prof. Carhart at his laboratory in the University of Michigan, and are furnished with his own personal certificate of accuracy, which also states the exact E. M. F. at 15 degrees C. and the temperature co-efficient of the cell.

Queen & Co., of Philadelphia, who prepared the mountings for the above, have issued a descriptive pamphlet, No. 325, which, along with other information regarding the cells, contains reports of some exhaustive and very flattering tests. A copy can be obtained from them for the asking.

AN INTERESTING STATIC MACHINE.

At the recent convention in New York city of the American Electro-Therapeutical Association, the McIntosh Battery and Optical Co., of Chicago, had a static machine which had remarkable generating power. It was of the Toepler-Holtz type and was operated by an electric motor. Under very unfavorable atmospheric conditions this machine will give a spark over five inches in length, and under favorable conditions a spark 9½ inches is produced. During the convention a spark 8 inches in length was obtained.

IT is expected that the Wellesley & Needham Electric Light Company, of Wellesley, Mass., will have its plant completed and running in the early part of November.

A POWERFUL electric light was recently installed on the flambeau of the Statue of Liberty, in New York harbor, and a line of red and white lights across the vizor of the statue's cap. This arrangement is a pronounced success and when lit up the whole statue can be seen from all parts of the bay.

AN EFFICIENT NUT LOCK.

Since the introduction of electricity as a motive-power on street railroads, the weight of the track and the manner of constructing the same has been greatly changed. To meet the demands of heavy traffic, street roads are being constructed quite as substantially as the steam roads, and much attention is given to securing a tight joint. A device of this character which is now commanding a large attention from railroad men is the Posi-

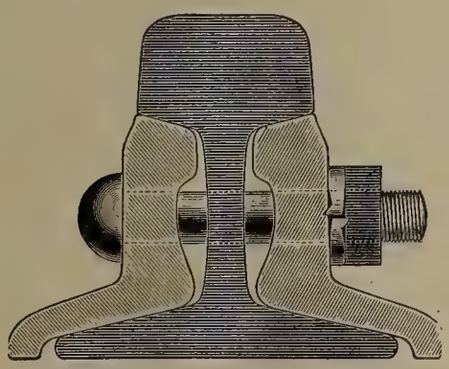


FIG. 1.

tive Lock Washer. It is claimed to be an ideal nut lock for railroad track, frogs, crossings, locomotive and car frames, trucks, bridges and machinery in general.

The Positive Lock Washer is an oil-tempered spring-steel lock washer, provided with tapering ends, themselves permanent springs, carrying sharp barbs which embed themselves in the face of the nut and in the splice-bar or metal next to the washer. Upon vibration the tapering ends, which are free to move (see Fig. 1. Points embedded by resiliency of washer), force the barbs deeper into the metal in contact with them. (See Fig. 2. Points deeply embedded by vibration.) Permanent set or loss of elasticity is avoided by the tapering ends which admit of motion even though the nut is "screwed home."

This washer is reversible and can be used many times. Does not injure the nut, its threads or the threads of the bolt.

Exhaustive tests covering a period of nearly four years on railroad track, drop presses and machinery sub-

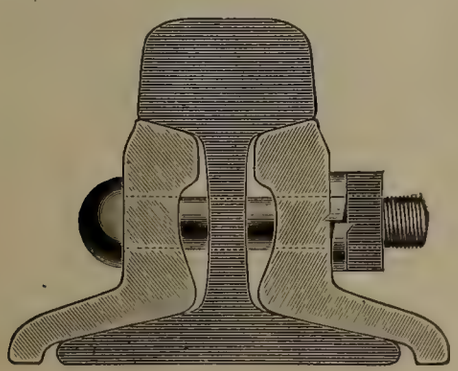


FIG. 2.

ject to vibration, have, it is claimed, proven its superiority over every nut lock manufactured. It is made at Newark, N. J., by The Positive Lock Washer Co.

A MUCH-SOUGHT-FOR BOOK.

"Is there a book published, of recent date, giving information regarding electric-railway construction, operation, machinery and appliances, and describing the various systems?"

Yes; "RECENT PROGRESS IN ELECTRIC RAILWAYS," by Carl Hering, is just what you want. Besides the above it tells all about the strong and weak points of the overhead, conduit, surface-conductor and storage-battery systems, and gives valuable data concerning them. The book, as its name implies, records progress in electric-railway development up to a very recent date.

The price of the book is $1.00, and it can be obtained of the Electrical Age Publishing Co., World Building, New York city.

THE NUTTALL RAILWAY SUPPLY COMPANY.

This new company was organized lately in Illinois, and promises to become a strong competitor of existing concerns. The gentlemen composing the firm are all young and energetic, and bring with them an extensive experience with the largest electric-railway manufacturing companies. The names of these gentlemen are: P. H. Carey, R. D. Nuttall, N. C. Groetzinger, E. H. Harrison and C. J. Mayer. They have already established themselves in Chicago, and will shortly open their new salesrooms with a full line of electric street-railway appliances. They will also show their superior knowledge of the needs of street-railway companies by introducing some valuable improvements into old ideas of specialties.

STREET-RAILWAY EMPLOYES' ASSOCIATION.

We have received a copy of the proceedings of the first annual convention of the Amalgamated Association of Street-Railway Employés of America, which was held at Indianapolis, Ind., September 12, 13, 14 and 15 last. Mayor Sullivan, of Indianapolis, welcomed the delegates to the city. The next meeting will be held in Cleveland, Ohio, on the second Monday in October, 1893.

GENERAL NOTES OF INTEREST.

THE streets of Roanoke and Leesburg, Va., are to be lighted with electricity.

IT is reported that an electric-light plant will be established at West Buxton, Me.

ELECTRICITY will be employed in lighting the new high school at Uxbridge, Mass.

IT is quite likely that an electric-light plant will soon be under way at Flushing, Mich.

A NEW telephone system is being put in at Roanoke, Va., by the Bell Telephone Company.

A NEW electric-light station will be erected at Toledo, Ohio, by Sheeley & Dirkman, contractors.

THE residents of Chesaning, Mich., are very anxious to have the streets of their place lighted with electricity.

THE electric street-railway company, of Vicksburg, Miss., will erect an electric-light plant for commercial purposes.

AN enlargement of its plant has been decided upon by the Citizens' Electric Light and Power Company, of Wichita, Kan.

THE residents of Hampton, Ia., have voted in favor of putting in an electric-light plant and lighting the streets of the city with that system of illumination.

A CONSOLIDATION has been effected between the Grafton Electric Light, Heat and Power Company and the Grafton Gas and Electric Company, of Grafton, W. Va.

It is the intention of the Pocatello Electric Light and Telephone Company, of Pocatello, Idaho, to increase the capacity of its plant by the addition of a 2,000-light alternating dynamo.

The Pittsfield Electric Company, of Naperville, Ill., has been organized for the purpose of furnishing both arc and incandescent lights, and also to furnish power for pumping the city water.

A vote will be taken some time during the present month by the citizens of Reading, O., on the question of expending $40,000 on the establishment of a water-works system and electric-light plant.

It is said to be the intention of the City Street Car Company, of Staunton, Va., to operate an electric-light plant in connection with its street-railway system at the new power station recently erected.

The Redlands Electric Light and Power Company, of Redlands, San Bernardino county, Cal., has been incorporated with a capital of $200,000. Incorporators: George B. Ellis, H. H. Sinclair, George H. Crafts, F. J. Ferand, G. A. Cook, R. J. Waters, James F. Drake.

The Benson Electric Belt Company has been incorporated at Ottawa, O., with a capital of $50,000, for the purpose of manufacturing and dealing in electric belts and appliances, mechanical and medical electric machines, etc. Incorporators: Allen Smalley, M. A. Smalley, A. Billhardt, Hattie T. Smalley, Chas. N. Haskell.

The electric-light plant recently installed in Sonora, Cal., by the Pacific Electric Storage Company is said to be giving entire satisfaction. Water-power conducted from Bald Mountain through a line of pipe to a 50 H. P. Dodd water-wheel is used for generating the electric current in a 600-light Westinghouse dynamo. About 400 lights are used throughout the city.

The town of Middletown, Pa., has awarded the contract for the lighting of the township to the Pennsylvania General Electric Company, of Philadelphia, for $11,715, the plant to consist of Thomson-Houston incandescent and Wood arc systems. The contract for the steam plant was secured by the Stearns Manufacturing Company, of Philadelphia, for $7,798, to consist of 300 H. P. boilers and 225 H. P. engines.

Work has been commenced by the Nevada County Electric Power Company, of Grass Valley, Cal., on the construction of its power plant. When completed, it will have a capacity of 3,000 horse-power, which will be transmitted to any part of the county at from $75 to $100 per year per horse-power. The plant is situated at a point on the South Yuba river in the vicinity of the Purdon bridge. Valuable water rights, commencing from a point two miles above the bridge to the Excelsior dam, a distance of three miles, are owned by the company. About a mile above the bridge the water will be diverted and carried through a flume eight feet wide and five feet high and two and a half miles in length. Its capacity will be about 8,000 inches. Every effort will be made to have the plant completed and in working order by March, 1893. Power will be supplied for electric lighting, operation of street railways and general purposes. H. H. Clark is general manager of the company.

ELECTRICAL SOCIETIES.

CALIFORNIA ELECTRICAL SOCIETY.

At the regular meeting of the California Electrical Society held at Room 55, Academy of Science Building, San Francisco, on the evening of October 17, Mr. George P. Low, electrical inspector of the Pacific Insurance Union, read a paper entitled "What the Electrician Finds on the Northern Pacific, from Spokane to Portland." Mr. Low has recently returned from an investigating trip throughout the Northwestern country, and his paper treated of what he had seen. The subject was illustrated with photographic views.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

Mr. Wm. Finn, of the Western Union Telegraph Co., New York, will, on Nov. 4, deliver a lecture before the department of electricity of this institute, on "The Phenomena of Earth-Currents," showing the relations between magnetic storms and sunspots. The lecture will be illustrated by lantern slides and experiments, and will be held in the large lecture-room, 502 Fulton street, at 8 P.M. On November 18, Prof. Wm. Main, of the Union Electric Co., New York, will deliver a lecture before the same department on the subject of the "Application of Storage Batteries as Motive-Power on Electric Railways." The lecture will be illustrated by apparatus and lantern photographs, and will be held at the same place as the one last mentioned, and at the same hour in the evening.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the monthly meeting of council held at 12 West Thirty-first street, New York City, October 25, the following associate members were elected: Bion J. Arnold, Consulting Engineer, General Electric Co., Chicago, Ill.; D. Herbert Jeffery, Secretary and Treasurer, Crocker-Wheeler Electric Co., New York City; Julius Meyer, Consulting Engineer, North American Co., New York City; F. S. Pearson, Chief Engineer, West End Street Railway Co., Boston, Mass.; George Jarvis Spencer, Electrician, The Yale & Towne Mfg. Co., Stamford, Conn.; Walter H. Tapley, Electrician in Government Printing Office, Washington, D. C.; Gurdon C. Van Buren, Electrician, Albany, N. Y.; George S. Wallace, Telegraph Office Manager, Chesapeake & Ohio Ry. Co., Clifton Forge, Va.; Norman R. Weaver, Supt. of Repair Department, General Electric Co., Chicago, Ill.

The following associate members were transferred to full membership: Clayton W. Pike, Jas. W. Queen & Co., Philadelphia, Pa.; Jas. D. Bishop, Electrical Expert, J. A. Roeblings' Sons Co., New York City; E. T. Barberie, Electrician, Safety Insulated Wire Co., New York City; Richard O. Heinrich, Electrical Engineer, Weston Electrical Instrument Co., Newark, N. J.; Frank B. Rae, Electrical Engineer, Detroit, Mich.

At the meeting of the institute in the evening, the three electric-railway papers read at the general meeting in Chicago last June were discussed. The titles of the papers are as follows: "Series Electric Traction," by Mr. Nelson W. Perry; "A New System of Electric Propulsion," by Mr. H. Ward Leonard; "Electric Railway and Motor Tests," by Prof. George D. Shepardson and Mr. E. P. Burch. The discussion was opened by Dr. Cary T. Hutchinson, and continued by Messrs. Sprague, Mailloux, Emery, Crocker and Henshaw.

The report of the committee on units and standards was accepted and referred to the sub-committee on provisional programme for the International Electrical Congress of 1893.

ALUMINUM.

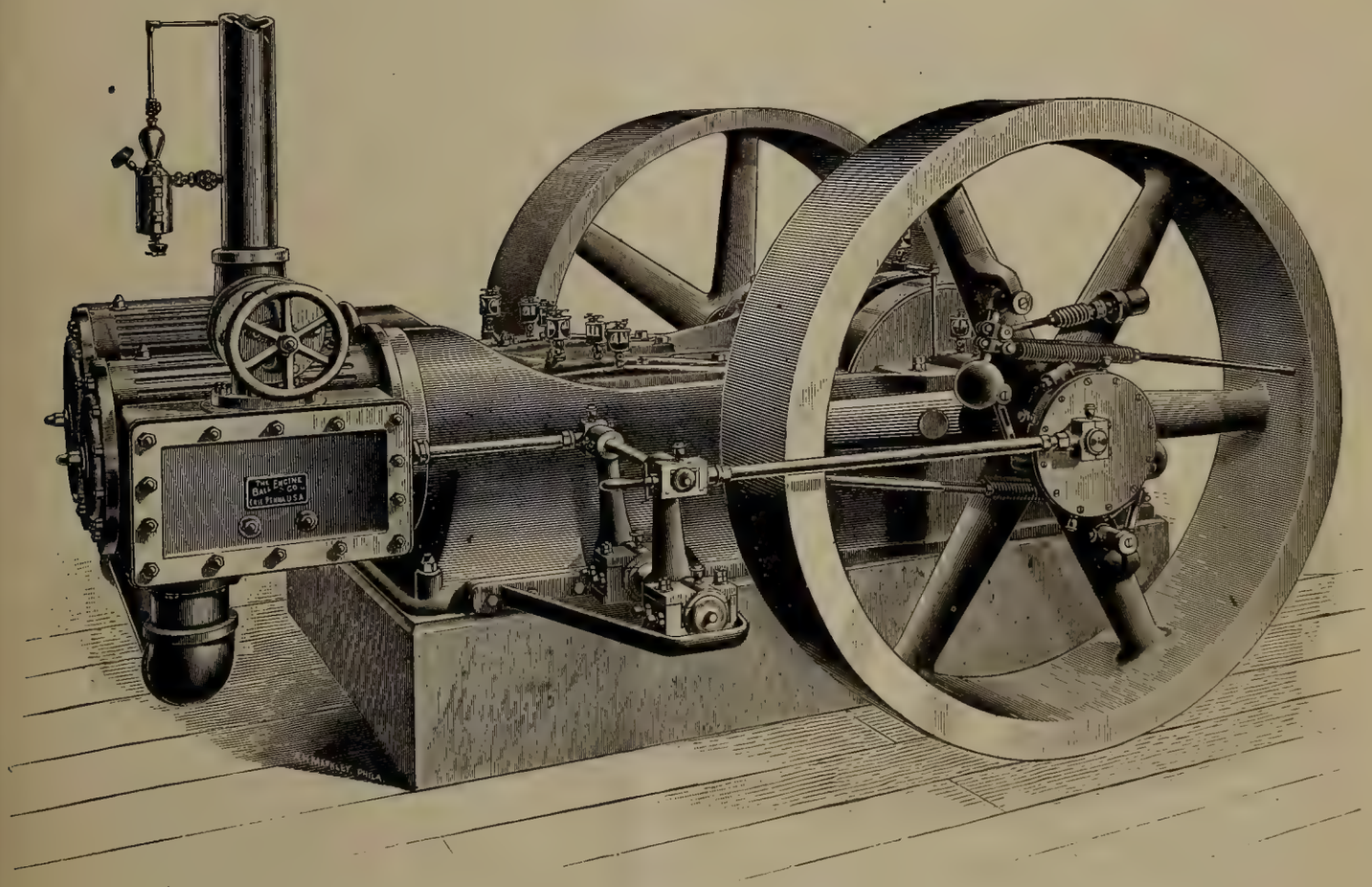
A new process for making aluminum has been invented by one Col. Wm. Frishmuth, in Philadelphia, who recently gave a private exhibition of the method to a few interested capitalists. It is said the process is partly chemical and partly electrical, the aluminum

oxide being extracted from clay and dissolved. The solution is then exposed to the electric current, which causes the pure metal to be thrown down on brass plates. From this it is removed by an ingenious but very simple chemical process in a state of almost perfect purity and in the form of a silvery impalable powder. It only remains to smelt it into ingots. Col. Frishmuth estimates that the aluminum can be extracted at a price far below its present market value and in any desired quantity. A singular circumstance connected with it is that the by-product or residue from the chemical treatment of the clay possesses high value as a fertilizer, and this, it is claimed, will be sufficient to pay all the expenses of the operation. An analysis of the byproduct, made by an expert chemist without knowledge of how it was produced, was submitted. He estimated its value as a fertilizer at from $3 to $10 per ton.

A charter has been procured and a company formed which will immediately proceed to manufacture the metal commercially.

found several engines being tested. The company keeps on hand a good supply of the standard sizes of engines ready for immediate shipment and is prepared to build larger sizes at short notice. Ten of each size of engine are made at a time. The offices of the company are well lighted and appointed. The company is now installing a new 200 H. P. high-pressure boiler of the Erie Iron Works' make. This boiler is a newly constructed special one and is the first one of this particular make with guarantee of economical production. The officers of the Ball Engine Company are: James McBrier, president; E. D. Carter, vice-president; D. N. McBrier, secretary and treasurer; C. W. Laurie, mechanical engineer.

The Mitchell-Brant Copper Company, manufacturer of tempered copper specialties for dynamos, motors, etc., occupies a building 50 x 150 feet. Mr. Mitchell is the practical man of the company, and Mr. T. Brown, the president and general manager, looks after the business affairs.



BALL CROSS-COMPOUND HEAVY-DUTY ENGINE.

ERIE'S INDUSTRIES.

One of Erie's foremost industries is the Ball Engine Company's establishment. The works of this company are 150 x 400 feet, not including a large foundry where the casting is done. The main machine-shop is 150 x 60 feet, with a wing at the end 145 x 45 feet, and has two galleries on either side with two travelling-cranes, each having a lifting capacity of 10 tons. All of the buildings are three stories high, including the basement. In the storerooms different parts of the engines, from piston-rod to large 500 H. P. cylinder-head, cross-heads, pins, crank-pins, etc., are always kept on hand. There are two places for testing engines in which will always be

The Lovell Manufacturing Company, Limited, manufacturer of dynamos and motors, has a four-story factory 100 x 50 feet. The first floor is used for assembling and wiring; the second as a machine department in which additional machinery will be placed to enable the company to more readily handle its rapidly increasing business; the third floor is used for painting the dynamos and motors. The company has also two warehouses. When visited by an Electrical Age representative a 10 H. P. motor was being finished to go to Texas, and was called a hurry-up order. The company lately installed a 350-light dynamo in the White Sewing Machine Factory, Cleveland, Ohio, and a 750-light dynamo and 16 C. P. lamps in the Erie Malleable Works. Forty

"Ward" arc lamps are also operated on this circuit. The Lovell Company is now manufacturing the well-known Mayo dynamos and motors. The company's factories are at the corner of French and 13th streets, and are very conveniently located as regards facilities for shipment of goods. W. T. H.

PITTSBURG NOTES.

J. L. Hays & Co., 830 Liberty avenue, Pittsburg, Pa., do electrical repairing and shop work. They rewind armatures, refill commutators and make a specialty of street-railway work. They also manufacture tablet-boards and cut-outs. Their works are run by a 2 H. P. Shipman engine, gas being used for fuel. Two large lathes for general purposes, wood-turning lathes, a grinding-machine, etc., are operated by this engine. Messrs. Hays & Co. turn out a superior quality of work and solicit correspondence.

Mr. H. A. King represents the Phœnix Iron Works of Meadville, manufacturers of the Phœnix automatic electric-light and power engines from 30 to 500 H. P. They make a specialty of automatic and compound engines. Mr. King has closed contracts within the last six weeks for equipment for four electric-railway power plants where they will use 125 to 200 H. P. engines, representing altogether nearly 1,000 H. P. Mr. King's contracts included boilers and complete steam plants. He has already placed 2,000 H. P. in boilers in this city and vicinity and has plenty more in sight.

Mr. N. A. Byam, as manager, ably represents the Charles Munson Belting Company, of Chicago. The company has its tanning works at Allegheny. Mr. Byam has his belts running in every electric-light and railway power-house in the city, with the one exception of the West End Street Railway Company's plant, where Schieren and Jewell belts are used. The Duquesne Traction Company uses the Munson belting throughout its entire plant, including two 48 and sixteen 14 inch belts. The Birmingham Traction Company has three 48 and six 42 inch belts, and seven 48-inch belts are distributed among other railway companies.

The R. D. Nuttall Co., 179–189 Grant avenue, Allegheny, Pa., C. J. Mayer, manager, has several cars on the Duquesne Traction lines, Pittsburg, equipped with its T.-H. F 30 rawhide intermediate gear. The conditions of grades and curves on the Duquesne lines are particularly severe, and these gears have borne the strains with remarkable success. They were first put in during the Pittsburg convention, in October, 1891. The periphery and cogs of these gears are composed of rawhide, and run in mesh with steel-tempered pinions. These gears are absolutely noiseless, require no lubrication and have great tensile strength. It is claimed that they will outwear the best cast-steel gear that can be made. The company furnishes them for all systems. The fire which recently destroyed part of the Nuttall Company's plant proved to be "a blessing in disguise." The company intended to enlarge its plant and put in more machinery, and the fire, while unfortunate and damaging, provided the company a good opportunity to make the needed changes and improvements.

The Pittsburg Electric Club is a very successful institution, and is conducted along lines that other similar clubs might follow with profit. Its financial condition is satisfactory. It now has 130 members, and the membership is continually growing. All electrical interests in Pittsburg contribute some of their substance free to the club. Thus the Allegheny County Electric Light Co. supplies current on the Westinghouse alternating system for 50 lamps used in the club-house, and the General Electric Company furnishes the lamps. A year ago some of the members wired the building themselves, the Okonite Company doing its part liberally by supplying the insulated wire necessary free of cost, and Mr. Eugene Ingold furnished the handsome newel-post fixture with 4 lamps and three fan motors to keep the members cool. The switches were supplied by the Robbin's Electric Co., and the Iron City Electric Co. furnished the fixtures for the parlor and reception-room. Natural gas is used entirely for heating purposes, and is supplied free of cost also. Mr. Morris Mead, city electrician, is president of the club. He has a fire-alarm box in the club-house. The telephone is also furnished free of cost to the club by the Central District and Printing Co. of Pittsburg. The club-house is at No. 802 Penn avenue, and is centrally located, being very convenient for the trade. Mr. Eugene Ingold, formerly manager of the Fort Wayne Electric Co., Pittsburg, is vice-president of the club, and Mr. John Hall is secretary. The club's library is well stocked with electrical books and journals, all of which are contributed by members. The club is desirous of instituting a system whereby the courtesy of the various electric clubs throughout the U. S. may be extended to visiting members from other clubs upon the presentation by such members of a membership card which will be generally recognized among the electric clubs.

W. T. H.

CHICAGO NOTES.

Although the Electric Appliance Company commenced business at 242 Madison street but a few months ago, it has established a solid trade and enviable reputation. This is due to energy and enterprise combined with strict attention to business and careful looking after the interests of its patrons.

A contract for what is said to be the largest isolated electric plant in the world is that accepted by the Chicago house of the firm of Siemens & Halske for the complete installation of an electric-light plant for the Auditorium Building in Chicago, and its new annex across the street, Congress Hall. Originally the Edison system was used in the building, but it is to be supplanted by that of the above firm.

Clark & Marshall, Room 413, "The Rookery," have recently secured the general Western agency for a large line of high-grade specialties, which include the Arnold flexible brackets, Boston incandescent lamps, Cope automatic Come-Along, and the Dow adjustable hanger. The firm is pushing its specialties to the front and is meeting with grand success. They have issued a neat little pamphlet which gives a full description of their goods.

B. S. Terry, manager of the A. W. Harris Oil Co., 55 South Canal street, reports business as being very good. This is a branch house of the A. W. Harris Oil Co., of Providence, R. I., and while having been opened but about twenty months, has already secured a large number of patrons and friends. The fine quality and uniformity of the oils manufactured by this company are fast becoming recognized by consumers in the West, as has long been the case with Eastern users. Mr. Terry is always delighted to entertain all his friends, old or new, who can find time to call and smoke a cigar with him.

Ever since the reorganization of the Mosher Arc Lamp Co., under the title of the Mosher Electric Co.,

business has been booming at a great rate. Many improvements have been made in the lamp manufactured by this company, and it is reported that the sales are many times greater now than they were for the corresponding period last year. The company will in the near future manufacture Mosher dynamos and motors for lighting and power purposes. The officers of the company are: G. L. Reimann, president; J. A. Mosher, vice-president; J. A. Sheriffs, secretary and manager. The offices are at 125–127 East Ontario street.

A. E. K.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, October 29, 1892.

MR. J. W. MACKAY, president, and G. G. Ward, vice-president and general manager of the Commercial Cable Co., have returned from Europe.

THE officers of the *Electrical Engineer*, of this city, on Wednesday, Oct. 26, entertained a very large crowd of their friends, who had called in response to an invitation to help warm the new business home of the paper. Many prominent electrical people were present, and Messrs. Phelps, Martin, Wetzler and their associates performed the functions of hosts in an admirable manner. The *Engineer's* new quarters were thoroughly inspected by those present, and the excellent arrangements favorably commented on.

MR. JAMES H. MASON, 366 Myrtle avenue, Brooklyn, manufacturer of primary batteries for light and power, on October 20 installed a temporary battery plant for lighting a piazza and garden of a Brooklyn residence. The plant was furnished on very short notice, and a 25 C. P. lamp was used. The lamp gave a very brilliant light. The current was supplied by 14 No. 9 Mason cells, and every one was delighted with the result. It created such a favorable impression that Mr. Mason has since received some good-sized orders for his battery.

IN our issue of October 22 announcement was made that the Postal Telegraph Company had contracted with Sprague, Duncan & Hutchinson, 15 Wall street, for the installation of six electric elevators in its new building, corner Broadway and Murray street. This statement is partly erroneous. The contract was given to the Sprague Electric Elevator Company, of 15 Wall street, and not to the above-named firm. The Sprague Elevator Company has no connection with the firm of Sprague, Duncan & Hutchinson, whose functions are entirely those incidental to consultation work in connection with high-class electrical installations.

MR. E. W. APPLEGATE, the inventor of the new incandescent lamp that is rapidly coming to the front, is in this city, stopping at the Grand Union Hotel. Mr. Applegate is here in the interest of his company, the Applegate Electric Light and Power Company, manufacturer of the Applegate incandescent and arc lamps, Chicago, Ill. He is purchasing a full line of apparatus and machinery necessary for the production of 25,000 lamps per day. The Applegate lamps are fully covered by United States patents, and it is claimed that they can be made 25 per cent. cheaper than any existing lamp on the market. There are three of these lamps burning in New York that were used 1,400 hours in the Western Union Building, Chicago, under special supervision and protection, so that the evidence of their operations could not be questioned. These lamps are of simple construction and guaranteed not to infringe the Edison patents. Mr. Applegate informs us that his company has secured legal opinions from the highest authorities in Chicago and New York on this point, such as Barton & Brown, Chicago, and C. J. Kintner, New York.

A STRIKE occurred last week among the electric wiremen who were engaged in putting in wires in the steamer *Seminole*, of the Clyde line, lying at her dock in this city. It seems that the work had to be hurried so as to be finished by the time the steamer was to sail, and the contractor employed three non-union men, because he could not get enough union men. A walking delegate ordered a strike on account of the employment of the non-union men, and the steamer had to go to sea with her electrical outfit unfinished. There have been so many unreasonable strikes lately that electrical contractors have combined and will hereafter employ whom they please. It is stated that it is a rule of the Wire-men's Association that if union men cannot be found the contractors must let their work stand idle. The trouble now threatens to assume large proportions. At this writing several strikes are in progress and work upon 150 buildings is involved; and the Electric Wiremen's Union has given the Electrical Contractors' Association notice to the effect that if the non-union wiremen were not discharged a general strike of the building trades against the contractors employing non-union men would be inaugurated. Such sympathetic strikes would likely precipitate a general lockout by the United Building Trades, with which the Electrical Contractors' Association is affiliated. The Electrical Contractors' Association is preparing for a long fight if it is necessary. The trouble began a few weeks ago, when about twenty of the most prominent Electrical Contracting firms, finding that the union could not supply all the men required, formed themselves into the Electrical Contractors' Association, and put up a notice in their workshops to the effect that on and after Oct. 15 they would make no discrimination between union and non-union men. The association is affiliated with the United Building Trades, formed after the last housesmiths' strike, to protect employers against capricious strikes, and of which J. M. Cornell, of J. B. & J. M. Cornell, iron manufacturers, is president. Its officers are: E. S. Keifer, of the Western Electric Company, president; Augustus Noll, of the New York Electrical Equipment Company, treasurer; Charles L. Eidlitz, secretary, and James R. Strong, of the Tucker Electric Construction Company, delegate to the United Building Trades.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	97 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Chicago Gas			92 75
Commercial Cable Co	7,716,000	100 00	169 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	119 50
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*108
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	107 00
Edison Electric Light Co., Phil.	1,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00

Names of Companies.	Capital.	Par.	Price
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co	50,000,000	100 00	115 75
General Electric Co., 5s	4,000,000		*106
General Electric pref		100 00	118 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y	50,000	50 00	40 00
Hickory Electric Co., N. C	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 00
Laclede Gas pref	2,500,000	100 00	66 00
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			137 00
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	20,000		*170
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	62 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*90
Sawyer-Man Elec. Light Co., N. Y	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Stuttgart Imp. Co. 6s., Ark	50,000		*97
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co	750,000	100 00	100 00
The Hall Signal Co., N. Y	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	115 00
The Ongley Electric Co., N. Y	250,000	100 00	85 00
The Siemens & Halske Co., Ill	500,000	100 00	par
The Washington Wat. Pow., Wash	1,500,000	100 00	90
The Wells & French Co., Ill	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y	1,250,000	100 00	26 00
Western Union	100,000,000	100 00	99 25
Westinghouse Elec. & Manf. Co	7,000,000	50 00	39 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 50
West Point W. Lt. & P. Co., Va	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The feeling of the market was conclusively shown on the morning after the Columbus holidays, nearly every stock on the list in which there were dealings bringing higher prices, with a good volume of business transacted. With the exception of a few railways in which there are desperate attempts to obtain control, the industrials, as usual of late, took the lead and on the rising scale. A late failure of considerable magnitude in the grocery trade may upset for a time the calculations of investors in that particular branch; but on the other hand new combinations are being successfully exploited, the latest being the Michigan-Peninsular Car Company which offers what is, no doubt, a perfectly safe 8 per cent. cumulative preferred stock. It is expected that the common stock will pay 12 per cent. The car building and furnishing business has assumed enormous proportions and the end is nowhere in sight. There seems to be a disposition among all new street-railroad people to have absolutely new vehicles instead of changing or adding the motors to their old affairs. All of this means dividends to the investors, and constantly increasing at that. The people, the source of the dividends, without a murmur stand all sorts of inconveniences. A car seating wenty-two comfortably usually, in rush hours starts from the business end with over fifty passengers. Now that the car-builders have got their systems and patterns settled and the electric current is economically capable of conveying the heavier load while the curves will accommodate the longer cars, why is it not in order to use greater conveniences for the greater traffic and increase the earnings? Thousands of people walk rather than endure the torture of overcrowded cars; pickpockets and vain bald-heads alone favor the present condition of things. The Ohio Falls Car Manufacturing Company (Indiana), another new applicant for capital, offers $600,000 six per cent. 30-year gold bonds, $800,000 eight per cent. cumulative preferred stock, and $400,000 common stock. This corporation is controlled and managed by strong Western men. Since the exploitation of the Pullman Car Company there has never been so much activity in this line or such an opportunity for the profitable employment of capital in considerable amounts as at present, and there are no clouds in sight.

Beside these large corporations there are a fair quantity of lesser opportunities for investment where at least 12 % may be counted on with some degree of certainty, besides the chance of substantial improvement in the business itself. In many cases a few hundred dollars gives a quarter, third or half interest in the undertaking, and introduces it. One must not expect these to be all Bell Telephones, but they are capable of landing the investor in his own house in a few years with a hundred thousand dollars standing to his credit. There are blanks among these prizes, as is seen by the present condition of an automatic phonograph machine company whose visible assets no doubt consist of a lot of cabinets, absolutely useless, with the phonographs returned to their owners. All of these enterprises offer every necessary opportunity to the investor to examine for himself and ascertain his own ability to carry to success, or otherwise.

The Western Union Telegraph Company has officially passed the resolution increasing the capital stock to the round and pretty sounding sum of $100,000,000. It is asserted that the 138,000 new shares will be used as a stock dividend to absorb the surplus which has accumulated in the strong box of the corporation—to the tune of 10 per cent., the rest will be offered to the present shareholders at a slight premium, and the proceeds used to extend the service which now amounts in volume to about one-third of the entire telegraph business in the world. The Western Union is to-day without a peer in the electrical art, and when the condition of the telephone settlement is made public and the company assumes a position in its business, it looms up as one of the great unknown quantities soon to be facts. Electrical investment carefully made is the best medium in existence.

TRADE NOTES.

Among the recent sales made by the C. & C. Electric Motor Co., New York, through its New York, Chicago and Boston offices, are the following: Menominee Electrical and Mechanical Co., Menominee, Mich., a 15 H. P. and a 3½ H.P. motor; a 6, 4 and 3 K.W. dynamo. Baydenoquet Co., Nahma, Mich., a 12 K.W. dynamo. Armour Packing Co., a 25 H.P. motor and two 5 H.P. motors. De La Vergne Refrigerating Machine Co., New York, a 15 H.P. motor. Laclede Power Co., St. Louis Mo., three 25 H.P. motors and two 10 H.P. motors. Heidt & Son, Jersey City, N. J., a 20 H.P. motor. H. R. Worthington, Brooklyn, N. Y., a 10 and 3 H.P. motor. Harvey Street Car Works, Harvey, Ill., a 30 K. W. plant, including lights and installation. Midvale Steel Co., Nicetown, Philadelphia, Pa., an 80 K.W. dynamo and Ball engine, including installation. Boston and Maine Elevator (Messrs Simpson & Robinson), Charlestown, Mass., 20 K.W. dynamo, lamps and installation. Home

for Paupers, Long Island, Boston Harbor, three 12 K.W. dynamos, three 5 H.P. and two 2 H.P. motors. The company has orders filled and unfilled from a single crane co. for over fifty machines, consisting of one 20 H.P. motor, nineteen 16 H.P. motors, thirteen 12 H.P. motors, nine 8 H.P. motors, the balance being in sizes below 8 H.P.

The Akron Belting Co., Akron, Ohio, whose Cleveland office, 15 Michigan street, is managed by J. W. Philpott, reports a large demand for its dynamo and generator belts. Among the recent orders for dynamo belting is one from the Brightman Machine Co., of Cleveland, for its new electric-light plant. This order was taken while a new man was in the Cleveland office. A Fisher dynamo is used in this installation. The Everhard Mfg. Co. has also given an order for a large power belt.

The Colburn Electric Mfg. Co., Fitchburg, Mass., has just issued a neat little pamphlet describing and illustrating its electric generators and motors. Some directions for the care and operation of dynamos are also included.

The Ball Engine Co., of Erie, Pa., reports that it is having the largest amount of business in its existence, and has enough orders to carry them well through the winter. Among some of its recent orders are the following: Brockton Street Railway Co., Brockton, Mass., one 600 H. P. cross-compound; Calumet Street Railway Co., Chicago, Ill., four 300 H. P. cross-compound; San Leandro Street Railway Co., San Francisco, one 500 H. P. tandem-compound; East Oakland Street Railway Co., San Francisco, one 400 H. P. tandem compound; Englewood Electric Light Co., Chicago, Ill., one 600 H. P. cross-compound; Binghamton Electric Light Co., Binghamton, N. Y., two 250 H. P. tandem-compound; Wheeling Street Railway Co., Wheeling, W. Va., three 250 H. P. cross-compound; Pottstown Electric Light Co., Pottstown, Pa., one 250 H. P. cross-compound; Erie Electric Motor Co., Erie, Pa., three 150 H. P. tandem-compound; General Electric Co., Atlanta, Ga., one 150 H. P. engine; Excelsior Elec. Co., Port Huron, Mich., one 400 H. P. engine; General Elec. Co., N. Y. city, two 100 H. P. engines.

AKRON, OHIO, Oct. 1.

THE AKRON BELTING CO., AKRON O.

Gentlemen: We have used in several factories for the past six years your Akron brand of belting, and absolutely know that you furnish just what you agree to furnish, and do not accept a lower price in competition with other belt manufacturers, and then send a cheaper grade. We have just finished the Linoleum factory here from top to bottom with the above brand of belting and defy any concern to beat it, and to say that it is perfectly satisfactory in every way is putting it mild. We are

Truly yours,

THE WESTERN LINOLEUM CO.,
A. M. COLE, *Pres.*

PEPPERELL MANUFACTURING COMPANY,
BIDDEFORD, MAINE, July 5, 1892.

FORREST SILVER BRONZE PACKING CO.,
115 LIBERTY STREET, N. Y.

Dear Sirs: I am very happy to state that the Silver Bronze Packing that you furnished this company is doing very well, but it is contrary to our custom to furnish testimonials for publication. If there were any exceptions to this rule your packing would call for one. I shall be pleased at any time to answer inquiries by letters that you may refer to me. I shall send an order for three packings as soon as I can take the dimensions.

Truly yours,

(Signed) C. D. THURBER, *Chief Engr.*

The Electrical Age's Illustrated Patent Record.

Issued October 25, 1892.

484,778. Telephonic Transmitter. Arthur T. Collier St. Albans, England. Filed Dec. 8, 1891. Patented, in England.

484,785. Magneto-Electric Generator. Sidney Evershed, London, England. Filed Jan. 8, 1892.

484,822. Thermal Circuit-Changer and Protective Appliance. Harry A. Rhodes, Denver, Col. Filed March 11, 1892.

484,825. Incandescent Lamp. Frank S. Smith, Pittsburg, Pa. Filed Feb. 29, 1892.

484,865. Automatic Cut-Out. Charles E. Sanford, Brooklyn, N. Y. Filed May 17, 1890.

484,867. Test-Circuit for Multiple-Switchboard Systems. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 1, 1890.

THE "CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our new prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



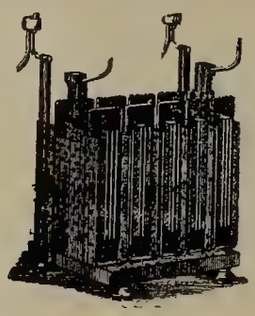
EASTERN ELECTRIC CABLE CO.,
61 to 65 Hampshire Street, Boston, Mass.
HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

484,919. Electric-Railway System. John H. Pendleton, Brooklyn, N. Y. Filed Aug 1, 1891.

484,924. Closed Conduit for Electric Railways. Benjamin F. Sutton, Brooklyn, N. Y., assignor to Parker, Sterns & Sutton, New York, N. Y. Filed July 7, 1891.

484,959. Electric Converter. Ludwig Gutmann, Fort Wayne, Ind. Filed Feb. 5, 1889.



485,013.—SECONDARY BATTERY.

484,964. Electric Search-Light. Louis Hills, New York, N. Y. Filed Sept. 24, 1891.

484,990. Electrolytic Process and Apparatus. Henry Blackman, New York, N. Y. Filed Jan. 15, 1892.

485,013. Secondary Battery. William Main, Brooklyn, N. Y. Filed Feb. 15, 1892.

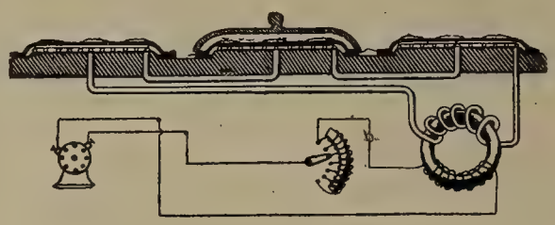
485,017. Electric Soldering. Elias E. Ries, Baltimore, Md., assignor to Ries & Henderson, same place. Filed July 17, 1891.

485,027. Telephone-Support. Geo. V. Benjamin, Ithaca, N. Y. Filed March 19, 1892.

485,028. Electrical Switch. Gustav Binswanger, London, England. Filed May 6, 1892. Patented in England.

485,054. Regulation of Alternating-Current Generators Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed Nov. 30 1887.

485,089. Standard Cell for Electric Batteries. Henry S. Carhart, Ann Arbor, Mich. Filed July 11, 1892.



485,017.—ELECTRIC SOLDERING.

485,105. Insulator for Electric-Railway Conductors. Charles T. Lee, Boston, Mass., assignor to the Johns-Pratt Company, Hartford, Conn. Filed March 17, 1892.

485,106. Insulator. Charles T. Lee, Boston, Mass., assignor to the Johns-Pratt Company, Hartford, Conn. Filed March 17, 1892.



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(ELECTRIC BRAND)
For Electrical Purposes
Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by
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Sole Manufacturers of HARD VULCANIZED FIBRE,
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Write for Prices.



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RODS AND PLATES FOR BATTERIES.
H. LAMARCHE'S SONS,
83 John St., N. Y.

ELECTRICAL AGE

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CONVENTION IN ZANESVILLE, OHIO.

The little city of Zanesville, Ohio, will on Nov. 16 be practically in possession of street-railway men. The Ohio State Tramway Association will hold its annual convention, and it is stated that the meeting will be of unusual interest. Several papers will be read, and, although we have no hint as to their purport, we dare say that electricity will again put the horse so far into the shadow that he will be entirely undistinguishable. The Ohio association is an enterprising one; all its members are wide awake and they learn a good deal for their own good at these annual meetings. The meeting was postponed from November 9.

THE LAMP SITUATION.

There is every promise that the situation in incandescent electric lighting will before long become an interesting one. In our issue of October 15 last we made the announcement that the Westinghouse Company would in the near future put an incandescent lamp upon the market that would in nowise infringe the Edison patents. We now hear that the General Electric Company thinks otherwise regarding the matter of non-interference, but what action the company proposes to take of course it is yet too early to learn. The Westinghouse Company evidently in all confidence made its claim public that it had an independent lamp, and if the General Electric Company claims that it is not an independent lamp, and that it infringes the Edison patents, there will likely be a legal war between the two corporations. The whole country will be interested in the outcome, which will be eagerly looked for.

LOW-COST MEASURING APPARATUS.

It will be gratifying to many worthy but not over-rich educational institutions, and to individuals as well, to know that a firm in this country has rendered it possible to possess electrical measuring apparatus at a low cost. Such apparatus for the laboratory includes instruments that we do not see in every-day use on account of their cost, which is, in many instances, a bar to possession. In most schools and colleges more or less time is devoted to the study of the elements of electricity and magnetism, but as the delicate instruments necessary to practically demonstrate the laws and actions of these forces are so expensive many such institutions are compelled to go without. This enterprising firm, however, appreciating the disadvantages thus suffered, has produced instruments of this class at low cost, and it will be a poor institution that cannot afford to own a set of these valuable instruments.

HYMEN AND ELECTRICITY.

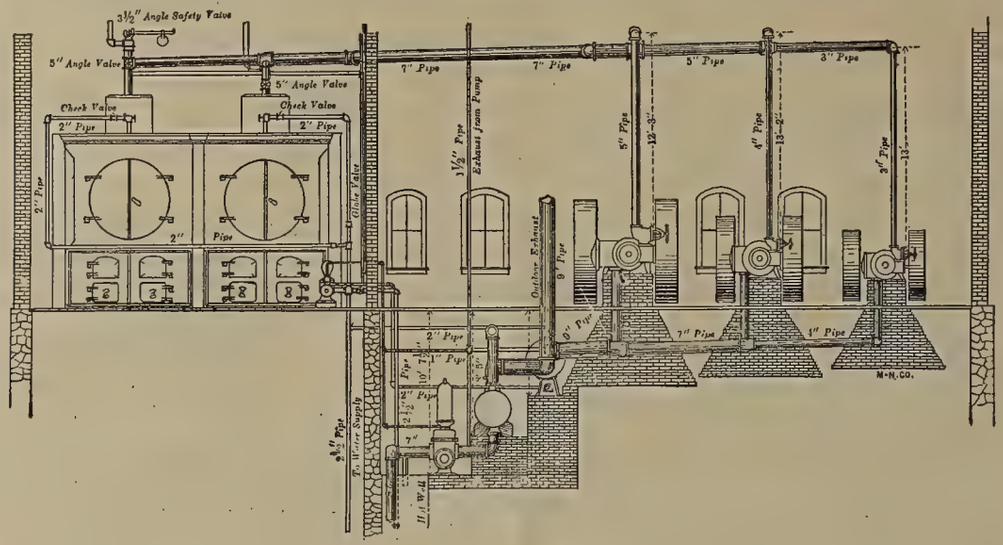
Some genius in Baltimore is deserving of the approbation of the community for his effort to relieve the marriage ceremony and its attending festivities of much of their prosaic character. At a recent wedding in that city electric lamps played a very conspicuous part in the ceremonies, and the guests were entertained beyond expectation by the electrical effects produced on every hand—as a Baltimore paper states, "the feast was one long-continued series of electrical surprises." Attendance at the weddings of friends is getting to be looked upon as a duty from which one would rather be relieved, simply because it is practically the same old story over and over again. The idea, therefore, of rendering marriage ceremonies attractive and entertaining, so that the guests will want to come again, or go to others, is a good one. People will marry; so if we invite our friends to witness such ceremonies we should provide for their delectation. Electricity has solved the problem, as it has others, and the man in whose fertile brain the idea of this application of electricity was conceived should be rewarded. He is in touch with humanity, and he has probably been to weddings before.

ELECTRIC LIGHT IN KEY WEST.

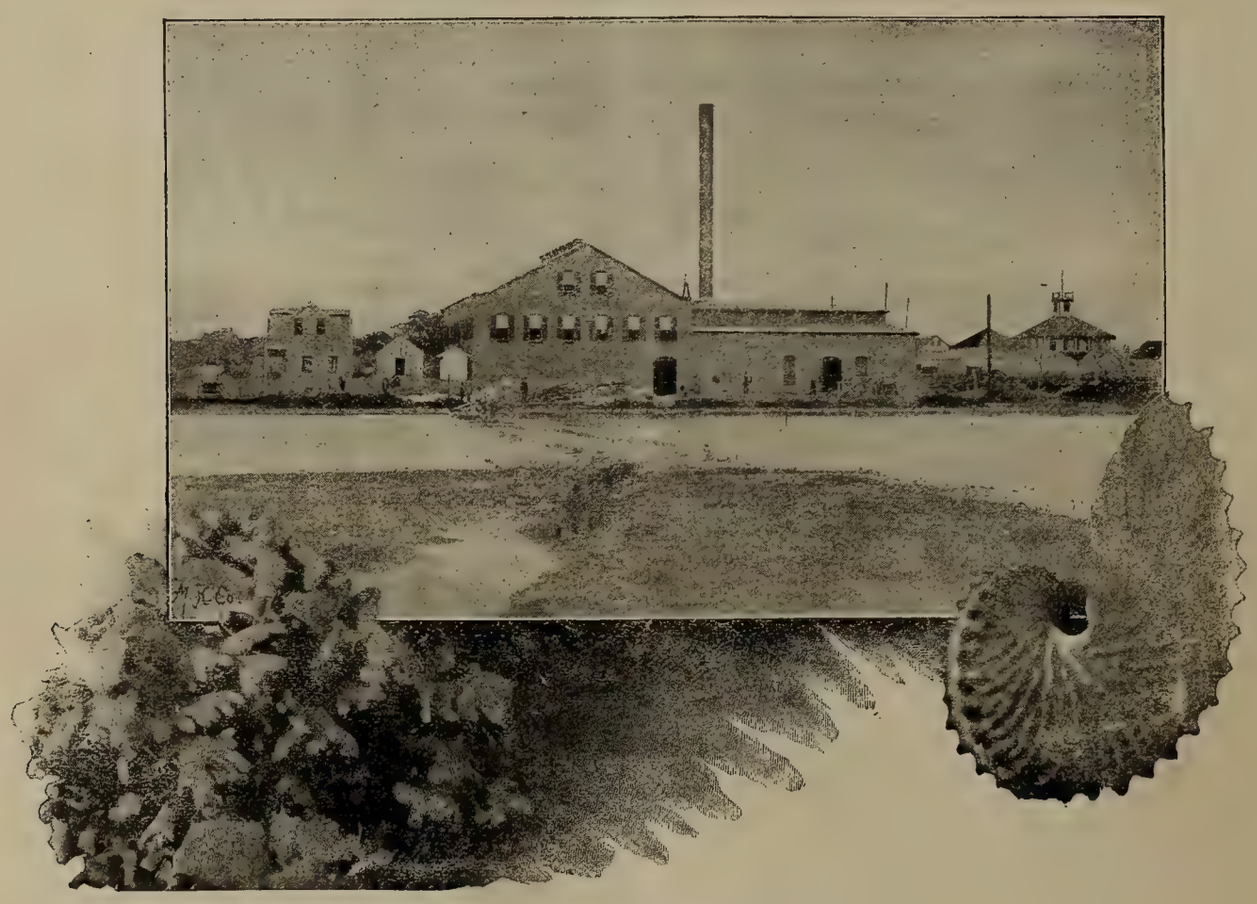
On Christmas eve last, Key West witnessed one of the greatest events in her history, and amid much enthusiasm mingled with curiosity on the part of the people the electric light was turned on for the first time, according to agreement. The switch was thrown and in an instant the station was a blaze of light, and cheer after cheer arose from the gathered crowd.

The Key West station can legitimately lay claim to being the most southerly in the United States, also the only one built on a coral reef, for such is the foundation of Key West.

The Key West Gas and Electric Co. was granted a franchise to light the place, and to do this a small gas plant was erected and petroleum used from which the gas was manufactured. This was in 1884. Soon after that some progressive spirits thought that electric light would be better suited to their tastes and at once began to mould public sentiment in its favor. Finally it came. In the early part of 1891, the then Thomson-Houston Electric Co., through its Atlanta agent, Mr. Hiram Ogle, received the order for the electric plant, and the Ball Engine Company, of Erie, Pa., for the steam plant. The lighting plant called for was one 50-light 10-ampère arc dynamo, with lamps of 2,000 C. P.; one 650-light, and one 1,500-



ELEVATION KEY WEST ELECTRIC-LIGHT STATION.



KEY WEST ELECTRIC-LIGHT STATION.

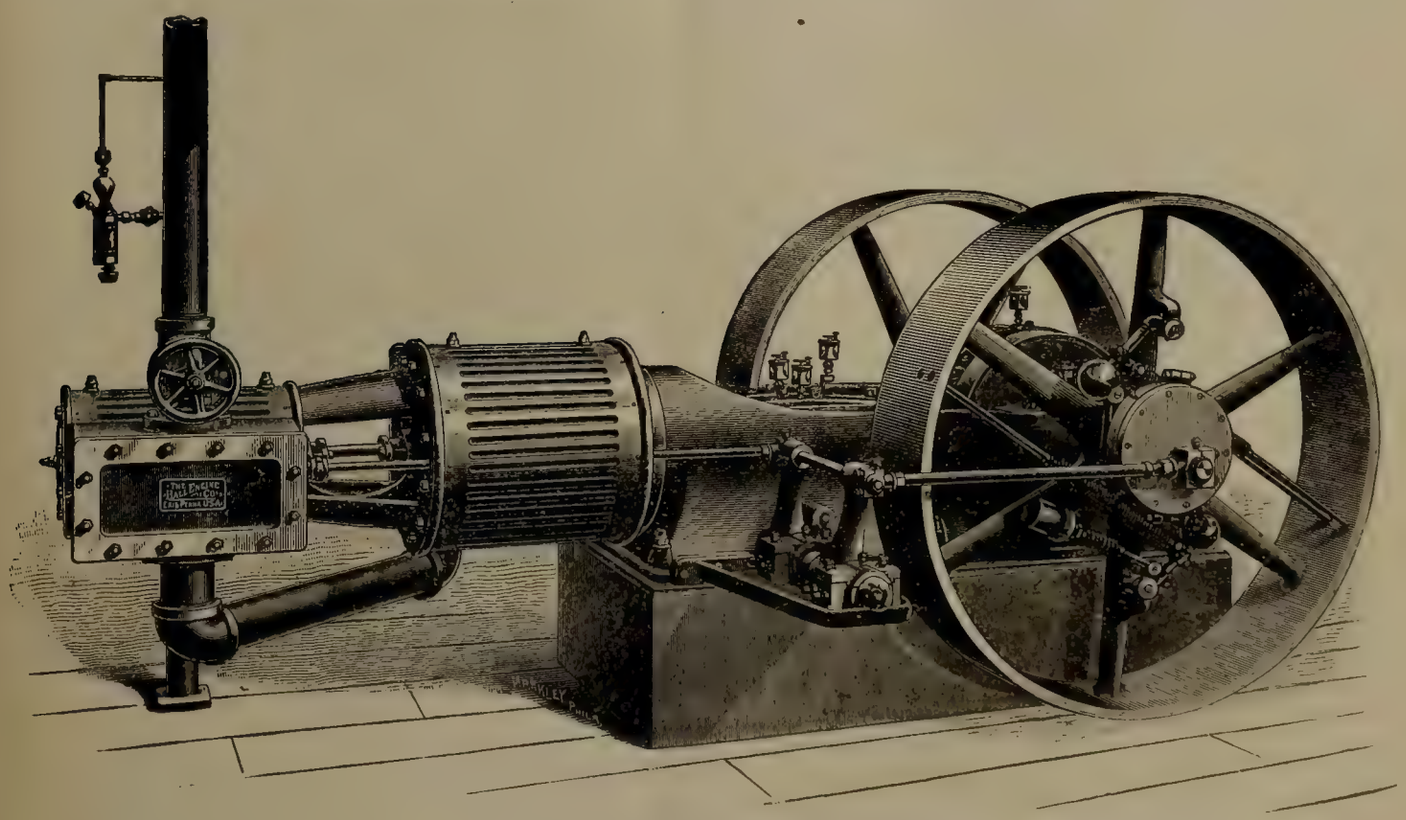
light compound-wound alternating dynamo for lamps of 16 C. P., with all the necessary appliances and fixtures.

The steam plant consists of three Ball condensing tandem-compound engines of the latest improved pattern, one of 65 H. P., one of 110 H. P. and one of 165 H. P., one Otis heater of 300 H. P., one Wheeler surface condenser of 300 H. P., one Davidson air-pump and fresh-water pump, one Korting injector, two steel boilers 150 H. P. each. A brick building, 62 x 45 feet, was erected in which to place the machinery. But here the first difficulty presented itself. A pit 10 feet deep was required for the heater, condenser and pumps, but this was found impracticable on account of the friable nature of the coral rock, through which the water bubbled up without interruption. So the plans were changed.



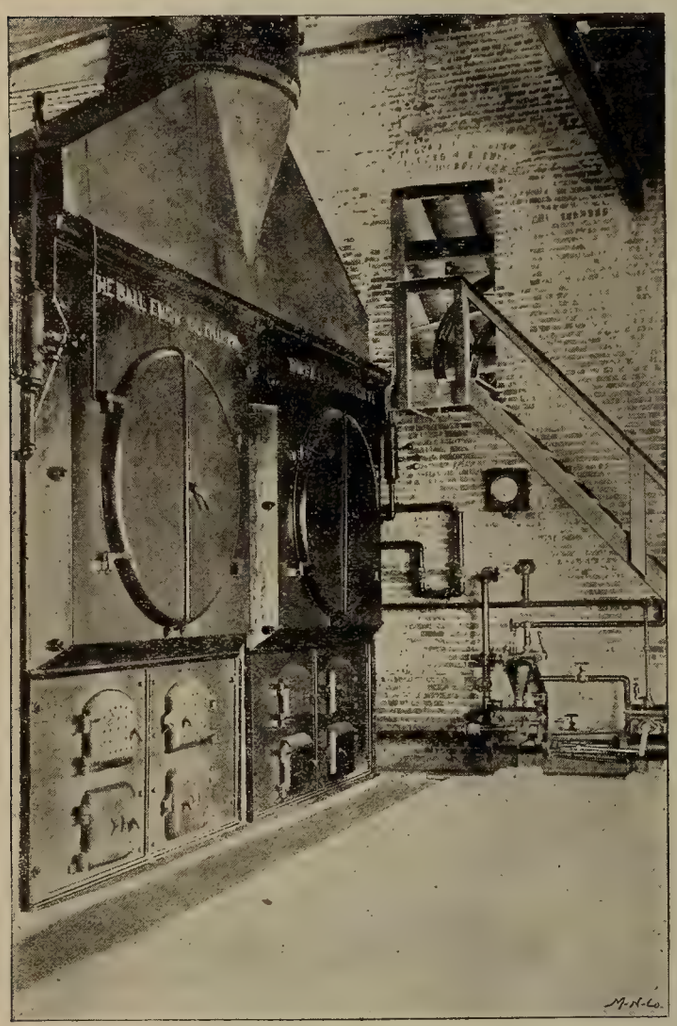
ENGINES KEY WEST ELECTRIC-LIGHT STATION.

An additional brick building, 80 x 60 feet, was built, in which the engines and dynamos were placed on foundations 10 feet high, of hard brick, resting on the coral rock, and with a small amount of earth filling, making a solid mass of masonry 36 x 40 feet and 10 feet high. On the top of this mass of masonry and earth filling was spread grouting of broken stone and cement six inches thick, and finished with a graniteoid floor 1¼ inch



BALL TANDEM-COMPOUND ENGINE.

thick. This brought the heater, condenser, pumps and hot-well on a level with the floor of the first building (which was used for a boiler-house) between the engine foundation and partition wall. In front of the condenser a salt well, 18 x 18 feet and 5 feet deep, was dug in the rock, from which the water supply for the circulating pump was drawn. From this to a salt-water pond, on Government land 100 feet west of the station, a canal was dug through the rock to the pond, which covered about three acres and was connected with the sea. The depth of water in the pond was 13 inches at low tide. Spread over the bottom of the pond was 23 inches of silt. A channel 10 feet wide was dredged through the pond and the inlet from the sea deepened. A tide-gate placed in the inlet allowed the tide to enter the pond and closed on the ebb, giving a depth of about 25 inches of water



BOILERS, KEY WEST ELECTRIC-LIGHT STATION.

at low tide, an ample supply for condensing purposes. The top of the boiler-house floor was but 23 inches above the high-water mark located on the beach.

There is no fresh water on the island except what is collected from the roofs, stored in stone cisterns and sold at one and a half cents per gallon. A well four inches in diameter was drilled into the rock and the water tested for salt every foot. At a depth of 20 feet a slight change was noted and the drill stopped. A pipe 18 feet long was dropped in for suction and the boilers fed from this when occasion required. A trace of salt was perceptible in the water, but on the whole it was superior to water used at many places on the main land for boilers. Although a small quantity of this water was used for boiler fuel each day, some scale was looked for, but after twenty-one days' run the boiler was opened and found perfectly free of all earthy deposit, and with the exception of a small amount of oily matter along the water line, as clean as when put in service. The fuel was Cumberland coal.

The poles used for the line are cypress. As the island is a mass of coral rock, all holes for the poles, with the exception of places once a salt marsh, and now filled in, were dug with steel-pointed bars, costing from seventy-five cents to two dollars each, according to the hardness of the rock. Layers of flint were often struck, and where this occurred an entire day was consumed in getting one hole down to the required depth. In the lower part of the town, which was at one time a salt marsh and filled in, the earth was too soft to hold the poles, and the tide flowing in the gutters of the streets, kept the ground soaked. Barrels were sunk in which the poles were placed, and broken stone was tamped in. The lower end of the poles was coated with asphaltum, and the remainder painted. Twenty-five lightning-arresters were placed in different parts of the lines.

The light at once became popular, and orders came in so rapidly that the line force was increased, and lines were extended as fast as possible. The street lighting has been done by private subscription. The price for arc lights is $4.50 and incandescent lamps are fifty cents per week, all-night lighting. The plant has cost about $70,000. It was installed by Mr. H. P. Loring for the Thomson-Houston Co. and Mr. C. W. Hansen for the Ball Engine Co., Erie, Pa. Almost the entire expense has been borne by Mr. John Jay Philbrick, a local merchant, through whose efforts Key West has one of the finest electric plants in the South.

ELECTRICAL EFFECTS AT A WEDDING.

At a recent wedding in Baltimore electrical decorations were used with beautiful effect and on a scale that has seldom been attempted before. The Baltimore *Sun* in giving an account of the affair says that tiny incandescent lamps were concealed in the foliage of the screen, and glowed and disappeared irregularly like fireflies in among the trees. Electrical butterflies and birds perched among the leaves and flowers. Overhead was a crown of Chinese lanterns, each containing a sixteen-candle-power lamp. The bridal arch of evergreen under which the newly married pair stood to receive their friends was provided with a row of electric lamps in red, white and blue. On top of the arch was perched an American eagle, and on the shield of pink velvet, which formed the keystone of the arch, was outlined in incandescent lights the figure of a heart, the initials of bride and groom, and the date, 1892. Two bronze statues stood guard at the entrance of the room, and their helmets were illuminated by incandescent lamps.

The electrical wonders did not stop here. The most ingenious feature of this unique wedding reception followed in the scattering of a shower of rice and imitation snow-flakes by two electric fan motors placed in the gallery overhead. As the guests entered the supper-room there was a sudden outburst of electrical bells and musical entertainments. As the guests were seated there was a blaze of light, and at the completion of the first course the words "Good Luck" appeared over the heads of the newly married couple, and an electric hair-pin, a gift to the bride, became incandescent and surrounded her head with a halo of light. Wine bottles were suddenly transformed into glowing candelabra. The feast was one long-continued series of electrical surprises.

IMPORTANT NEW MEASURING APPARATUS.

The study of applied electricity is now so universal that high schools as well as colleges devote considerable time to the subject. Apparatus adapted for research work is quite too costly for elementary instruction, and in consequence until recently many schools have not been able to treat this important branch as fully as was desirable. Instrument-makers are appreciating the need for first-class elementary instruments, and we give below a brief description of a few important pieces which are being placed upon the market by Queen & Co., of Philadelphia. We are informed that the different pieces have been designed in their laboratory, and are constructed substantially, but without the same degree of finish which is placed on the finer apparatus which this firm makes.

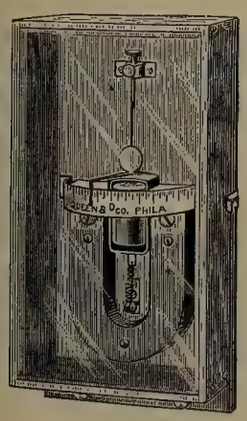


FIG. 1.

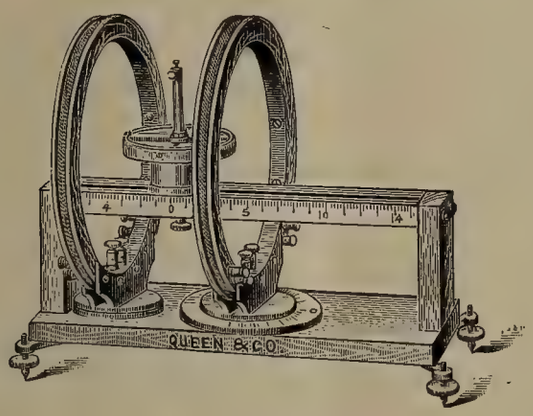


FIG. 2.

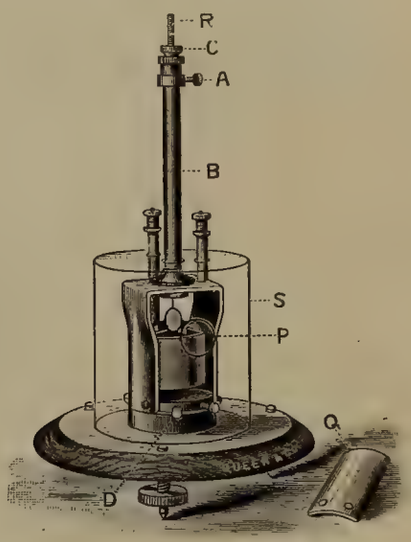


FIG. 3.

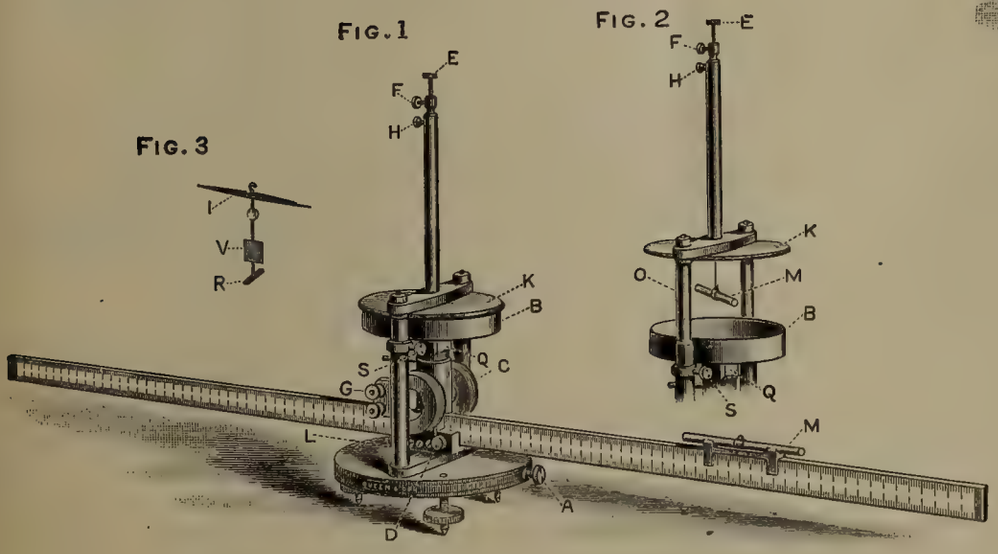


FIG. 5.

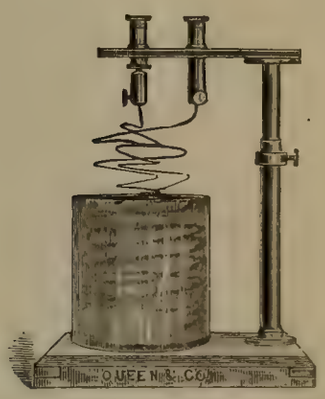


FIG. 7.

Fig. 1 shows a D'Arsonval galvanometer intended to be placed against the wall of a laboratory. It has a graduated scale with pointer, and also a mirror, so that readings may be taken directly or by means of a telescope or lamp and scale. This instrument is extremely dead-beat, and is adapted for general work where quick measurements are desired.

Fig. 2 represents a Universal Tangent Galvanometer which is especially designed for determining current in absolute measure and for showing the effects of variation in the different quantities contained in the tangent galvanometer equation. It has two mahogany rings, built up of a number of pieces to prevent warping. One ring is wound so as to rotate freely on a vertical axis, with a pointer and scale graduated to degrees for use in sine measurements. The compass-box slides along the horizontal graduated bar, so that the needle may be placed in the plane of either coil as a tangent galvanometer; midway between them, as in a Helmholtz Gaugain galvanometer, or at any point upon the axis outside the planes of both coils, as in the Weidemann type. The instrument can thus be used for a great variety of purposes.

The Quadrant Electrometer, Fig. 3, is intended for use by the beginner, and is of simple construction, while capable of a high degree of accuracy. The quadrants are fastened to a circular block of hard rubber, two of them being made of one piece of metal bent so as to have a level surface on top, to which the brass suspension-tube and one binding-post are attached. The aluminum needle, provided with mirror for reading deflections, and vanes for damping the system, is suspended from an adjustable torsion head, thus connecting it with one pair of quadrants. In this way the Leyden jar arrangement, otherwise necessary for maintaining the needle at a high potential, is avoided. A metal case encloses the apparatus, leaving room inside for a small dish of sulphuric acid and pumice-stone for drying purposes.

Fig. 4 represents a Coulomb Electrometer which differs from other types in that the suspension-tube is free to rotate, and at the bottom carries a pointer which moves over a scale graduated on top of the glass case. A mirror is placed in the bottom of the case to avoid parallax.

Fig. 5 represents a very convenient form of magneto-

meter which will prove invaluable for laboratory work. The illustration is very clear, so that it is not necessary to give details of construction. Observations may be taken either directly by aid of pointer deflections or by the telescope and scale method, a mirror being attached to the magnet system. Results almost as accurate can be obtained with this apparatus as with the well-known "Kew" pattern, which is very much more expensive.

The Earth-Inductor, Fig. 6, is arranged for exact measurements, and a certificate of constants is supplied as with more elaborate forms. The coil form is built in four sections to prevent warping, and the coil is wound in layers, the diameter of each being carefully determined.

Fig. 7 shows a voltameter suggested by Prof. Ryan,

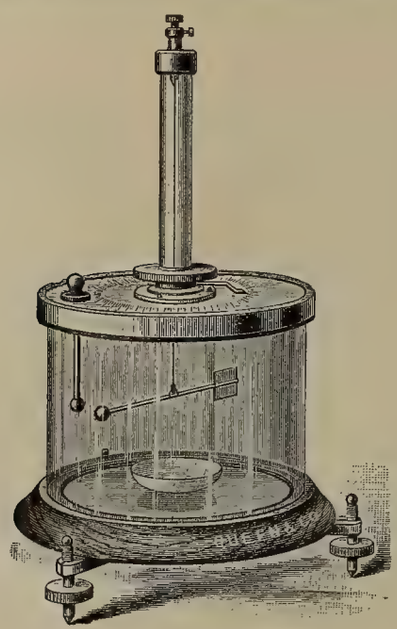


FIG. 4.

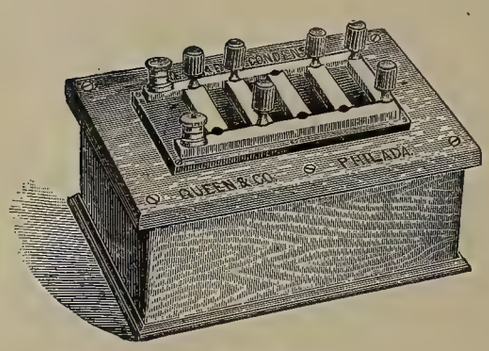


FIG. 8.

of Cornell University. It is of simple construction, and possesses important features, such as freedom of electrodes from angles and sharp corners, easy removal of the electrodes, facility for cleansing and greater homogeneity of deposit. The electrodes may be lowered or raised to give corresponding changes of resistance.

Fig. 8 is a subdivided condenser, capacity one microfarad. It is constructed with great care, and while much less costly than regular forms for laboratory work is quite accurate.

Fig. 9 shows a Rumford Dispersion Photometer, similar to that described in Prof. Ayrton's "Practical Electricity." It has a range of measurements up to 1,000 candles.

Queen & Co. are issuing a special circular containing prices and full particulars in referenee to these instruments. A copy will be forwarded by them to interested parties upon application.

ELECTRIC-LIGHT CARBONS.

One of the chief industries of Nuremberg, Germany, is the manufacture of electric-light carbons, and the process of making these is described by the French vice-consul at that place in a recent report. The following extracts from this report will be of interest to our readers :

The manufacture of electric-light carbons occupies six large factories, belonging respectively to C. Conradty, Ch. Shmelzer, Carl Braun, J. G. Meier, Emile Mahla and Jules Fuchs. To these may, perhaps, be added a seventh, namely, that of Dr. Albert Lessing, though the latter does not produce carbons for electric lighting, but only battery carbons.

The raw material employed in this manufacture is

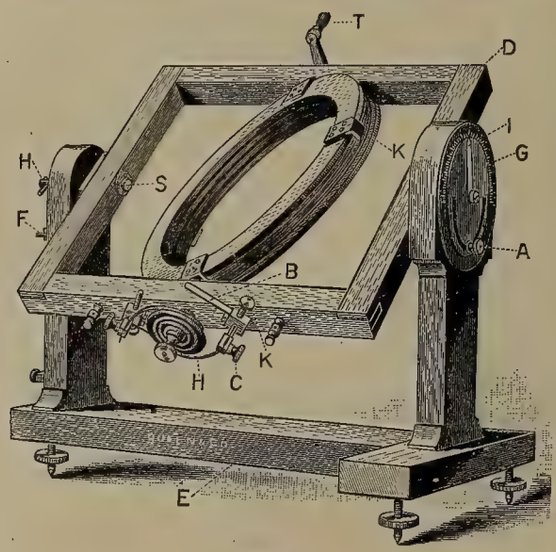


FIG. 6.

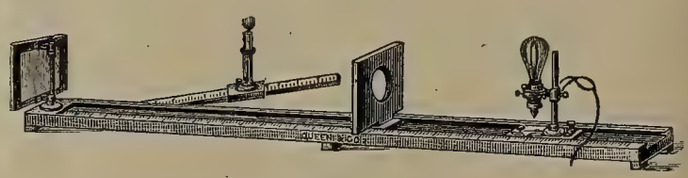


FIG. 9.

"retort graphite." As far as the vice-consul was able to discover, this material only is used when homogeneous carbons are required ; but when cored carbons are to be made a softer substance is added. Before they are ready for use, homogeneous carbons pass through twelve, and cored carbons through sixteen, different processes. The first operation is to break the graphite into small nuts. For this purpose a three-stamp mill is used. The stamps, in falling, crush the graphite placed over movable steel gratings that allow the broken material to pass between their bars. These bars are placed nearer to one another, or farther apart, according to the size of the pieces required. Having passed this grating the pieces are collected by hand and passed through a sieve. The coarse particles are submitted to a vertical crushing, and the fine are passed on to a rolling-mill. The vertical crushing is intended to reduce the pieces of graphite to about the size of semolina grains. The graphite thus treated is directed a second time into a sifting machine. Then follows more rolling. The sixth operation is to damp and mix the graphite obtained from the rolling-mill, as well as the powder gathered in the sifting machines, with a binding substance. The mass delivered from this machine being too soft, it is necessary to render it plastic and capable of taking a shape, and with this object it is consigned to a sort of puddling machine which produces a species of paste. This paste is pressed through a

machine fitted with dies. These produce coarse rods or other pencils, according to the diameter of the cylinders. The rods so prepared are introduced into steel hydraulic cylinders and submitted to a pressure of about 25 atmospheres. Some of these hydraulic presses—the construction of which the Nuremberg manufacturers have only attained by successive steps—can deliver 500 metres of carbon per hour, or from 2,000 to 3,000 arc-light carbons of average size. All these operations terminated, the carbons obtained are baked in a blast-furnace where the temperature occasionally attains as much as 2,000° centigrade. When homogeneous carbons are withdrawn from the furnace they have only to be passed on to an automatic cutting machine. This machine is in direct communication with a ventilator which draws off the powdered carbon produced in cutting.

The construction of machines employed in the manufacture of electric-light carbons is also a Nuremberg specialty, and the house of Justus-Christian Braun has a monopoly of the business, and supplies machines in Europe and America. The cost of an outfit for a factory is put at 20,435 marks, irrespective of packing, transport and customs charges.

THE JOHNSON ELECTRIC CO.

The accompanying illustration shows the exhibit of the Johnson Electric Co., of Cleveland, in Army and Navy Hall during the Cleveland convention of the American Street-Railway Association last month. The company had a very full display of gears for electric street cars, bearings, commutators for all makes of street-car motors, line material, etc. It also had a line of trolley wheels and an improved trolley base.

The exhibit was on the second floor, and the fine finish of the goods, especially the commutators, attracted much attention.

The company does a large trade in rewinding fields and armatures of all machines, and with its large facilities can do this work in a most satisfactory manner.

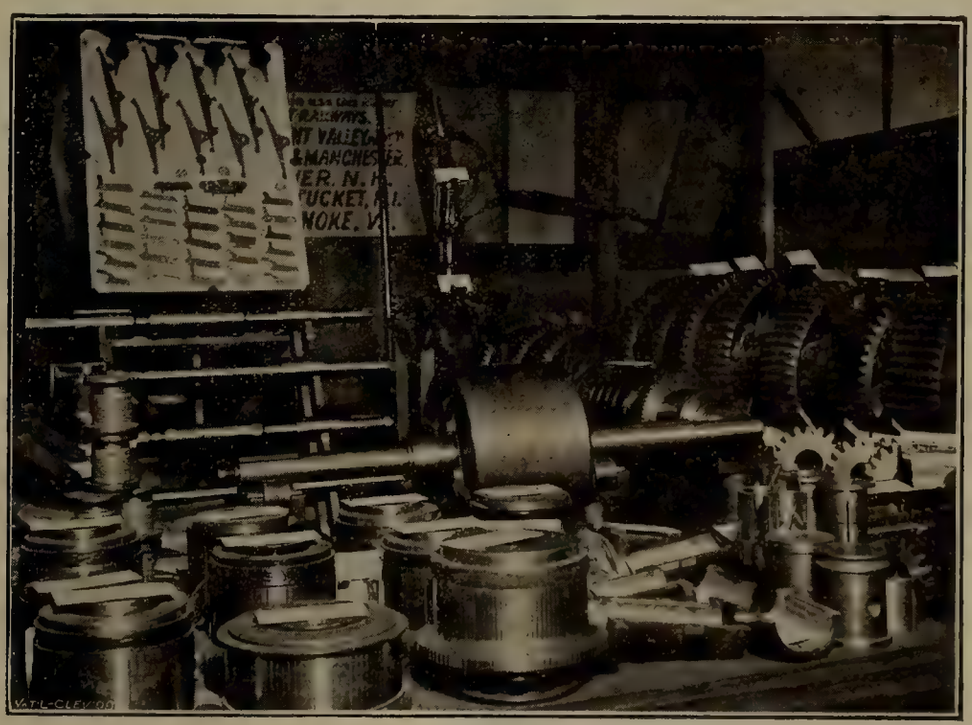
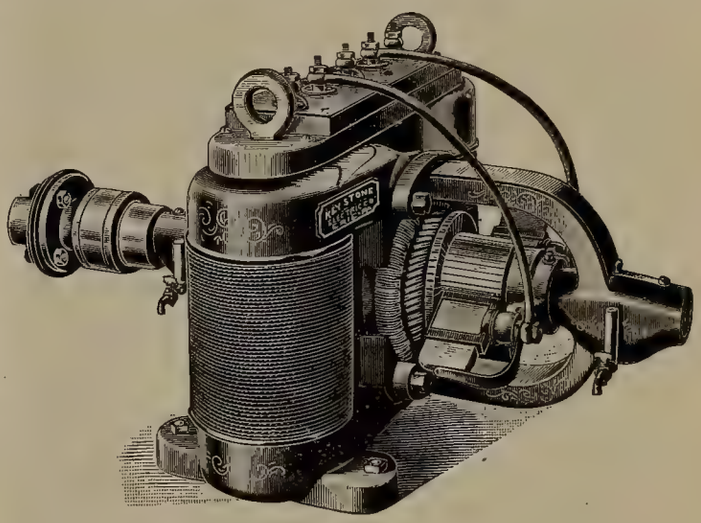


EXHIBIT OF JOHNSON ELECTRIC CO., AT CLEVELAND CONVENTION.

SHORT circuiting of continuous-current dynamos causes more current to flow in the machine and the consequent heat destroys the insulation of the wires.

KEYSTONE DYNAMOS AND MOTORS.

A representative of the ELECTRICAL AGE recently visited the works of the Keystone Electric Company, at Erie, Pa., and found them exceedingly busy turning out motors and dynamos. This company makes a specialty



KEYSTONE LOW-SPEED MOTOR.

of reversible elevator motors. One of the company's 3 H. P. continuous-current motors is used for running the works, and one of its 5 H. P. reversible motors for operating the elevator. The elevator motor takes 500 volts and is run from the street-railway circuit of the Erie Electric Motor Company. These reversible elevator motors are very popular, and the company has continually a large number of orders on hand. A particular feature of the reversible motor is that it can be stopped and the armature reversed instantly without injury to the winding on the field or armature coils. They are compound wound, and no resistance is interposed when the motor is reversed, except in the case of very high-speed elevators when it is desirable to start them at a low speed increasing to high speed after a distance of 2 or 3 feet has been passed.

The Keystone Company has lately built a low type of machine of slow speed, designed for connecting direct to worm-shaft of winding-machine, being bolted to the same base-frame. All parts of the motor-frame are insulated from the winding-machine, an insulated coupling being used on the armature-shaft.

These machines have been tested under very severe loads; one of them lately carried 4,000 pounds on an elevator. The motor was of 5 H. P. and the speed of the armature 600 revolutions per minute. It lifted 1,500 pounds at a rate of 60 feet a minute; finally the weight was increased to 4,000 pounds and the armature speed reduced to 300 revolutions per minute, the 4,000 pounds being lifted at a rate of 30 feet per minute, the change in the load having no effect whatever on the motor. The O'Donnell Elevator Company, of Cleveland, Ohio, placed one of the Keystone Company's 10 H. P. reversible motors to run a high-speed passenger elevator in the dry-goods establishment of The H. B. Brown Co., of that city. This motor runs at a speed of 600 revolutions per minute, and uses a starting apparatus which starts the elevator at a very low speed without the slightest sign of a jar or jerk for a distance of 2 or 3 feet, when the full speed of 180 feet a minute is attained.

The company has a large number of orders on hand for its motors and dynamos which are being rapidly filled. In fact so great is the demand for Keystone machines, that the company will soon be compelled to enlarge its works. The present quarters have been occupied three years and consists of a building 25 x 100 feet, three stories high and a basement. The basement is used for cleaning castings; the first floor contains machines, the second floor is used for finishing, assembling, winding and ornamenting dynamos and motors, and the third floor for storage.

All of the elegant scroll-work on the machines is done in gold by hand, the artist having been secured from the large organ works in Erie, Pa., where he was engaged in ornamenting organ pipes. It is said of the Keystone Company that it sends out the finest finished machines in the world.

The accompanying illustration represents the new low-speed type of motor made of any horse-power from 3 to 30. The armature is of the Gramme ring type; the bearings are self-oiling; the shaft is of large diameter and short length with wide, strong bearings; the windings are of the company's special compounding, are patented, and the brushes are of carbon with an excellent style of holder that will never loosen.

STORAGE-BATTERY CARS.

The Electrical Power Storage Company, of London, England, has recently issued a circular calling attention to the fact that the company is now prepared to enter into negotiations for the working and maintenance of approved tram lines equipped with self-contained electric cars. The terms under which such working and maintenance could be contracted for necessarily vary with local conditions, but the maximum charge would be 66 per cent. of the gross traffic receipts. This circular is considered by the company to be the best possible answer to the criticism which has lately been made on the expense for upkeep of batteries and electrical gear of tram cars. Mr. F. King, the manager of the company, explains, further, that the above working proposals cover the supply of drivers, conductors, engineering staff and supervision, coals, repairs of steam-engines and dynamos and of machinery on cars, and maintenance of the batteries in satisfactory working order; but the company would not provide any capital expenditure for the first supply of batteries.

The circular does not state who shall provide the steam engines and dynamos, but it is assumed that the electrical company will cover this also.

THE FIRST ELECTROLIER.

We give herewith an illustration of the first electrolier ever made.

It is now an historical object, and it would be a good idea for some one to make arrangements to secure it for exhibition at the World's Fair in Chicago next year.

This electrolier was made by the well-known electric-light engineering firm of B. Verity & Sons, London, for Mr. T. A. Edison, and was used in the now celebrated Edison exhibit, at the Crystal Palace, in 1882. It has recently come into the firm's possession for sale. It is said to be one of the largest pieces of hand-wrought floral work that has ever been manufactured, and it is the first fixture to which the word "Electrolier" was



THE FIRST ELECTROLIER.

ever applied. It stands about 16 feet high, is 10 feet broad, and has 99 incandescent lamps in three circuits. Its original cost was $1,750, and the metal alone in it is of considerable value.

The electrolier is now a noteworthy curiosity, and should it be exhibited at the World's Fair it would undoubtedly attract much attention.

EDDY CURRENTS.

Eddy currents are useless and wasteless currents in the iron core of the armature of dynamos and motors. In the dynamos they flow in the same direction as those induced in the coils, consequently they tend to weaken each other; but as they flow in the opposite direction in the motor, they strengthen each other. Any eddy currents induced in either armature, no matter how perfectly they may be laminated, become more prominent in that of the motor. As these wasteful currents are regarded as the principal cause of loss of energy in motors, the importance of reducing them as much as possible

by complete lamination and perfect insulation is apparent.

These currents were considered by Foucault as magnetic, but are now usually considered as electric. As they cannot combine with the currents in the coils, they serve no useful purpose; circulating as eddies in the iron, wasting energy and generating heat.

EARTH-CURRENTS.*

BY WILLIAM FINN.

It has been noticed during the past half century that at intervals of 11 years, or thereabouts, the working of telegraph lines is always seriously impaired by a series of electric or magnetic storms which extend over periods varying from about three to eight months. They only occur, however, at intervals more or less irregular and seldom last for more than a few hours at a time. The disturbances at such times do not appear to be confined to any particular locality or country, but are found to exist simultaneously in nearly all parts of the world. It appears moreover that these periodical interruptions take place whenever the sun's photosphere becomes unduly excited, which happens most frequently during the periods of maximum sun-spots—that is, at intervals averaging about eleven years. We are passing through one of those periods now, and thus far the year 1892 has been quite remarkable for the number and severity of its magnetic storm disturbances. It is evident, therefore, that an intimate relationship exists between the two

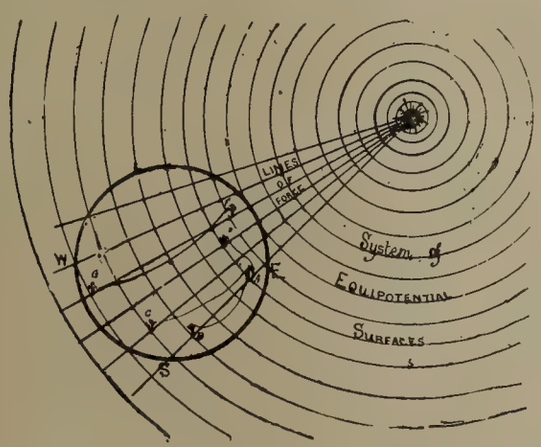


FIG. 1.

phenomena, and the natural inference is that the solar perturbations are in some way responsible for the terrestrial effects observed.

It will be interesting to discuss the subject with a view to discovering as far as possible the nature of this relationship and to ascertain the principles involved or laws concerned in connection therewith.

Magnetic or electric storms are so called because of the sudden appearance in the ground of natural currents of electricity of great volume and intensity, which act directly by induction upon compass needless and magnetographs, and indirectly affect telegraphic apparatus through the coils of their main-line instruments. These natural currents are known as abnormal earth currents, which do not differ materially from the manufactured currents of electricity except in their singular characteristics and vagaries which render them unsuitable for commercial purposes since they can neither be utilized nor controlled.

Artificial currents of electricity are always produced whenever electricity is set in motion under the action of an electrical force, just as water currents are established under the action of gravitating force. In order, therefore, that the earth's electricity may flow as natural currents from one place to another over the surface of the globe, a difference of electrical level or potential must first be created between such places. Let us see in what particular manner this primary electrical condition is brought about so as to give rise to earth currents.

It is a well-known fact that our globe is surrounded with what may be regarded as an atmosphere of electricity, which acts inductively upon the combined electricities in the earth, and attracts or *raises towards its surface* the electricity of opposite name to that contained in the atmosphere. The aerial electricity is reacted upon by the opposite charge in the ground, and so long as this condition of stress is maintained between them the opposing electricities remain quiescent and impotent like the electrical charges in a condenser. But when from any cause this strain is removed, the earth's electricity, which had been previously lifted to a higher level, as it were, rushes back to its original level in the form of an earth current.

Whenever, therefore, the aerial charge becomes electrically excited, corresponding effects take place in the ground, through which currents of electricity flow, whose magnitude and intensity will depend upon the nature and extent of the original inductive disturbance.

Now, imagine one of those tremendous convulsions to be taking place in the sun with its accompanying electrical manifestations which, judging from terrestrial analogies, may be properly assumed to be one of the characteristics of solar eruptions. The disturbance produced would be communicated to the ether and by it transmitted like the waves of light, and at about the same velocity, until it reached our electrically enveloped sphere. Undulations or waves would then be started in the electrical atmosphere, which would induce corresponding impulses in the electricity of the earth, causing electrical waves or earth currents to travel through the earth and to enter the telegraph wires by means of their ground connections.

During the prevalance of earth currents the surface of the globe is found to be divided up into a series of equipotential planes or surfaces, which may be roughly likened in appearance to the meridian lines drawn upon a map. Along any one of these planes the electric pressure or potential is always the same at the same time, but between neighboring planes a difference of potential always exists.

It is along the lines of force running across these planes that the greatest interruptions are invariably felt.

This diagram (Fig. 1) is intended to roughly illustrate the manner in which an electrical disturbance is propagated from the sun to the earth.

The disturbing force you will notice gives rise to a number of electrical impulses which are transmitted in all directions through space in the form of spherical waves. These waves develop upon the surface of the earth those lines of equal pressure or potential represented in the drawing as circles or portions thereof.

The electric force, like many other forces, diminishes with the distance according to the law of inverse squares; but the value of the force at a given point on any one of these circles is the same as at all other points on the same circle, because they are all equally distant from the centre of disturbance. Hence such a circle represents an equipotential surface along which the natural forces are inactive. All other surfaces, however, will necessarily have different values, and therefore an inequality of pressure or electric potential exists which tends to create an electromotive force in any telegraph wire connecting the various circles. It is this electromotive force or difference of potential which drives the electricity through

* Paper read before the Brooklyn Institute of Arts and Sciences, Friday, Nov. 4, 1892.

the wire from the point where the potential is high to where it is low.

The straight lines radiating from the sun represent the lines of electric force along which the earth currents are impelled with the greatest velocity, as it were. Telegraph circuits that run along these lines of force, such as A.B. and F.G., are the ones mostly affected.

Circuits that cut the equipotential circles at other than a right angle, as A.C., are not so seriously troubled; while those wires terminating on any part of an equipotential surface, as A.D., are absolutely free from interference.

If we know the direction in which the circuits are entirely destitute of earth currents, we can deduce therefrom the line of maximum force, for that line is always at right angles to the system of equipotential surfaces.

You will have less difficulty perhaps in comprehending the principles involved if you consider for a moment the somewhat analogous case of a liquid disturbance. You all know that when the surface of water is agitated by dropping a stone into it, there is generated a series of concentric circular waves which extend outward from the centre of disturbance. Now the direction in which such a disturbance propagates itself across these ring waves corresponds exactly with the direction of propagation of an electric disturbance across equipotential spheres or surfaces.

At times of violent solar excitement the disturbing elements give rise to those ever-widening spherical impulses which are propagated through the ether of space, and finally reach the earth where the distribution of the equipotential planes is effected in the manner described.

These planes generally run about north and south in this country, and it is on that account that telegraph lines extending in this direction are found comparatively free from interference during abnormal earth-current visitations.

On the other hand, as previously remarked, those wires running across, or at right angles, to the equipotential planes, experience the maximum disturbing effects, which accounts for our easterly and westerly circuits being the greatest sufferers at such times.

The magnitude of the forces developed in the wires evidently bear some relation to the length of the circuit as might be naturally supposed, and experience shows that the maximum potential difference exists as a rule between the terminal grounds of our longest wires.

(*To be continued.*)

THINGS WORTH REMEMBERING.

The following abstracts from the report of the committee on "A Model Electric Street-Railway Roadbed and Underground Wiring," which was made at the Cleveland convention last month, contains valuable information worth keeping for reference.

"We have heard of instances being cited where copper wire laid underground was more susceptible to electrolysis than that of galvanized iron or steel; but after a thorough trial of upwards of three years, during which time we have used both, the conclusion reached is that copper, being not only a better conductor but less liable to corrode and break, is therefore the best wire to use for underground work. Galvanized soft steel or iron wire used for this purpose has not proved durable, and we have found the same to be entirely eaten away by electrolysis where it had come in contact with the cross-tie, and in perfect condition elsewhere."

* * * * * * *

"By a careful examination of the ampère meter at the power-house during dry weather, compared with that of rainy weather, it will be noticed that there is a marked decrease in the amount of current used in favor of the latter; hence it follows that the more connections to the rail and the opposite poles of the generator with the moist earth the more economically is the system operated. It must also be remembered that the increased saving in current in wet weather over that of dry weather is not attributable to the increased moisture of the earth alone, but to the fact that the dust and dirt, which readily finds lodgment on the rail, is washed off, and many roads now in operation by electricity have found the use of a car equipped with a tank having one down-spout, about ⅝ inch in diameter, on each side, so arranged as to permit a stream to flow over the head of each rail, most advantageous. These down-spouts should be located as near the wheel as possible, in order to insure the same being directly over the rail at all curves, as well as the straight track."

* * * * * * *

"The mistake is sometimes made in designing and equipping a new road, or in changing from animal traction to electricity, of neglecting the track construction by apportioning the amount to be thus expended to such a sum that, in order to make both ends meet, it becomes necessary to weaken that portion of the investment where, above all others, strength and permanency are required."

* * * * * * *

"The switches, or cross-overs, should be located at such points along the route as will best provide for the following contingencies: bunching cars for large gatherings, and to insure the constant operation of cars during fires, parades and all other blockades when, from any cause, the terminus of the road cannot be reached. They should never be placed with the switch point against the traffic, and, preferably, on up grades, thus enabling cars to cross to the opposite track by gravity."

* * * * * * *

"The fact should be borne in mind in the selection of cross-ties, not only to keep in view the selection of such timber as is calculated to insure the longest life, but due consideration should be given to the particular kind that will best hold the spike; and for this reason the white oak possesses advantages that should merit its consideration."

* * * * * * *

"The requirements of a rail for electric traction are strength, joint connections, durability. In some localities there are municipal requirements specifying what the head of the rail shall be.

"For strength we rely chiefly on the weight of the rail and the thickness and depth of the web.

"For joint connections that rail which affords the best method of keeping both ends of the rail in perfect alignment is the best, and as the girder rail possesses peculiar advantages in this respect its almost universal adoption is due to that fact.

"For durability we depend on the height of the head of the rail at the gauge-line over the lower flange, and the quality of the metal."

CALCULATION OF ELECTRIC HEAT.

The transmission of electricity is always attended by the evolution of heat, which cannot be considered as a mere adjunct but as a legitimate part of the work done, whether useful or otherwise.

By experiments Joule determined the relations between the electric current and the heat developed by it to be:

The heat developed in a conductor by an electric current passing through it varies as the conductor's resistance, the square of the current's strength, and the time the current lasts.

The heat is always in direct proportion to the resistance the electricity encounters; hence to produce heat, or its associate, light, resistance is placed at the point where the heat or light is required; if a different class of

work is to be accomplished the heat is suppressed by reducing the electric resistance as required.

The heat developed in any electric circuit can be easily ascertained from the above law. If the heat is represented by H, the current by C, the resistance by R, and the time by t, according to Joule's law the heat would equal the product of the square of the current, the resistance and the time, or in algebraical formula $H=C^2Rt$.

ELECTRIC SNOW-PLOW.

Snow-plows are an indispensable part of the equipment of street railroads in this latitude. This is particularly true in the case of electric roads, where a good contact between the car-wheels and track is important.

We describe and illustrate a snow-plow made by Smith & Wallace, 6 Oliver street, Boston, Mass., which is said to be a very efficient machine. Its compactness is one of its most prominent features. The deck is 12 feet 6 inches long and 6 feet wide. It is made entirely of the best yellow pine, and a full set of trap-doors are provided for easy access to the motors. The motors are hung directly upon the axles of 30-inch wheels, the latter being mounted on Bemis boxes.

The nature of the work which a snow-plow is required to do renders necessary the use of extra heavy materials in the construction of the machine, the truck especially. The truck in this plow is made with extra heavy pedestals and other parts, and it has a wheel base of 5½ feet.

The house on the deck is made of white pine sheathing and in five sections, which are screwed together, forming the house complete, and upon the roof is the trolley board of extra strong quality.

Within the house are located the trap-doors in the floor for the examination of the motors, the rheostat, switches, etc., and in each corner a sand-tube is placed.

The plow has a nose at each end. Each nose is constructed of lower-piece timbers of birch, 12 inches wide and 3½ inches thick, and the ground-piece is protected by a piece of refined iron, 3½ inches by ½ inch, securely riveted on. The noses of double-track plows extend 18 inches over the rails, and attached to the same are two 3½-foot wings at each end.

The nose is controlled by a ratchet lever, which raises it from zero, by half inches, up to 5 inches, and behind it a set of scrapers follow, which remove the snow from the rails when the paving is such as to prevent the nose from wholly removing it. A grounding-brush is placed between the two wheels on each side for the purpose of increasing the traction.



ELECTRIC SNOW-PLOW.

VALUABLE BOOKS.

ELECTRIC LIGHTING.

Elements of Electric Lighting, by Atkinson	$1.50
Electric-Light Arithmetic, by Day	.50
Electric Lighting, by Gordon	4.50
Incandescent Electric Lighting, by Latimer	.50
Edison and his Inventions, by McClure	1.00
A B C of Electricity, by Meadowcroft	.50
Elementary Principles of Electric Lighting, by Swinton	.60
Electric-Light Fitting, by Urquhart	2.00
A Guide to Electric Lighting, by Bottone	.75
Electric-Light Specifications for the Use of Architects and Engineers, by Merrill	1.50
Evolution of the Incandescent Light, by Pope	1.00
Practical Treatise on the Incandescent Lamp, by Randall	.50

ELECTRIC RAILWAY.

The Electric Railway of To-Day, by Prindle	.50
Street Railways—Their Construction, Operation and Maintenance, by Fairchild	4.00
Electric Railway Engineering, by Trevert	2.00
The Electric Railway in Theory and Practice, by Crosby & Bell	2.50
The Electric Motor and Its Application, by Martin & Wetzler	3.00

SUDDEN DEATH.

Mr. Moses F. Hatch, of New Bedford, Mass., general manager of the Southern Massachusetts Telephone Co, dropped dead in the Park Square station of the Old Colony R. R., Boston, on October 29.

PERSONAL.

Mr. J. A. McLure has resigned his position as superintendent of construction of the Short Electric Railway Company, of Cleveland, Ohio, and accepted a position with the Siemens-Halske Company of America, with headquarters in Chicago.

Chas. E. Rowe, electrical contractor and dealer in supplies, is also Eastern agent for the Railway Equipment Co., of Chicago. Although quite a young man, Mr. Rowe has made a host of friends in the electrical line; he is a hustler, and we wish him the success he so richly deserves. Mr. Rowe's office is 412 Shoe and Leather Exchange Building, Boston. He is known as the "theatrical" electrician.

NEW BOOKS.

"Poor's Directory of Railway Officials and Manual of American Street Railways" is a book published by H. V. & H. W. Poor, 70 Wall street, New York.

The work lays no claim to particularly original matter but it is surprising how much detail it covers. It is invaluable to every one interested in steam or street railways.

How to Make and Use Induction Coils. By Edward Trevert. Bubier Publishing Co., Lynn, Mass. Price 50 c.

This little book is gotten up for the especial benefit of amateur electricians, and it gives clear directions for the construction of induction coils and how to conduct some experiments therewith. The book contains three chapters, viz.: Intensity Coils, Medical Coils and Electric Batteries. It has 36 illustrations and 81 pages, and is worth having.

This and all other books on electrical and kindred subjects can be had at the office of the Electrical Age Publishing Co., World Building, New York city.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 71st meeting will be held at the headquarters of the institute, Tuesday, November 15, at 8 P.M.

The paper presented by Dr. J. B. Williams, at Chicago, in June, will be brought up for discussion as announced at that meeting. The title of this paper is: "Oil *vs.* Air as an Insulating Medium." The paper is printed in the July and August issue of the transactions, p. 601, and copies will be distributed at the meeting. The author will make actual tests, showing the relative merits of the insulating qualities of air and oil, after which the paper will be discussed.

Tests will also be made of samples of various kinds of insulated wire. As the object of these tests is to show the comparative merits of all kinds of insulations, members are especially requested to send to the secretary in advance of the meeting, and as soon as possible, such samples of all the kinds of insulated wire they can procure, also samples of insulating materials, such as mica, vulcanized fibre, ebonite, etc., for comparison with oil and paraffin. These samples will be designated by numbers, and no names of manufacturers will be used in connection with these tests. The samples of wire should be about four feet in length, small sizes preferred, and the insulating materials in sheets about two inches square and $\frac{1}{16}$ inch thick if possible.

RELATIVE COST OF GAS AND ELECTRICITY.*

BY C. J. RUSSELL.

The question now arises, How can we compare the relative cost of gas and electric light? We must reduce our figures to a common standard, which will be sixteen-candle light, and then consider the relative amount of capital required in each business per unit of light, and the percentage of gross receipts in each case required to pay the expense of manufacture and distribution. We may then inquire which light will produce to the company the larger gross revenue per standard of light, which is merely another way of saying whether the public are willing to pay more for one light than the other.

It is safe to say, we think, that the capital required by an electric-light company engaged in central-station lighting—that is, supplying light to a large number of customers from a central station—will approximate $30 per unit of light capacity of the station, or $30 per dynamo capacity of the station reckoned on a basis of a sixteen-candle light.

This, however, does not afford at once an opportunity to compare the relative capital required by the two industries. It is customary to figure the capital in the gas business at so much per thousand feet of gas annually sent out, and when we assume this figure to be $6, we are not yet in a position to make any comparisons, as in one case we have merely the dynamo capacity of the station, and in the other the total output from the gas-works. We must, therefore, reduce our figures to the basis of a lamp-hour—that is, the light of sixteen candles for one hour—which means, in the case of electricity, that we must determine about how many lamp-hours, on the average, will be sent out by an electric-light station for each sixteen-candle light capacity thereof. And in constructing an average daily load-card, we must remember that up to date it does not seem feasible to store electricity, and that therefore the capacity of the station must be equal (and still have a proper margin for reserve) to the maximum demand for light in any hour—as for instance during the busy hours of a Saturday evening in winter. A gas-works, with proper storage capacity, can lay up during the week enough gas to meet the heavy requirements of Saturday evening, but not so in the electric station; here the plant must be equal to the maximum call, and further there must be a fair reserve then, for that is just the time that an accident resulting in the shutting off of a portion of the lights of a city would be borne with the poorest grace. So we will assume a reserve of never less than 25 per cent., and on that basis construct a load-card for the average day of the year, thus arriving at the average lamp-hour output per sixteen-candle lamp capacity of the station.

Number of hours.	Output in per c't of dynamo capacity.	Output per 16 c. p. lamp capacity of station.
One.....	.45	.45
Three.....	.25	.75
Two.....	.10	.20
Eighteen.....	.05	.90
Total output.....		2 30

This is an average output per hour, per sixteen-candle-power lamp capacity of station, of $\frac{2}{24}\frac{3}{0} = .090$ lamp-hour, which would give us 839.5—or say 840—lamp-hours per year for each sixteen-candle-power lamp capacity. From this we find the capital required per unit adopted for comparison—3.6 cents. In the case of gas we will assume that $6 is the capital per thousand feet of yearly output, and that the gas is eighteen-candle-power, which

* Abstract from *Engineering Magazine* for November, 1892.

would of course be low for New York city, but would hold as a good average, and we find in this case the capital required is 2.6 cents per standard of comparison. In different language, the capital required per sixteen-candle lamp-hour output is as follows:

For electric light	3.6 cents
For gas, on the same basis	2.6 cents

according to which the electric lighting plant requires 40 per cent. more capital for doing a given amount of business.

When we come to compare the relative cost of manufacture of gas and electricity, and express the same in percentage of gross receipts, we find a further difficulty of comparison from the fact that the gross receipts from electric light per unit lamp-hour are greater than in the case of gas by about 28 per cent.; therefore to compare the cost of the two lights we must make the comparison in percentage of the gross receipts of gas. When we reduce the receipts and expenditures to our common standard—a sixteen-candle lamp-hour—and express the relative cost of the two systems in percentage of gas gross earnings, we find the following result:

Cost of gas in percentage of gross earnings	71 per cent.
Cost of electric light in percentage of gross earnings of gas from equal unit of light	91 per cent.

or, otherwise expressed, the unit of light costs by electricity 20 per cent. more than by gas.

We thus find that in order to obtain the unit of light from gas or electricity we must invest 40 per cent. more capital in the electric business than in gas, and the cost of making the unit of light will cost by electricity 20 per cent. more than by gas, as expressed in percentage of gross receipts of the latter. And, as the earning of a 6-per-cent. dividend on the capital invested requires in the case of gas an amount equal to 26 per cent. of the gross earnings, and as the capital required in the electric business per unit of light is 40 per cent. greater than in the gas industry, it follows that in order to obtain a profitable investment from the electric business we must obtain for a dividend an amount equal to 36 per cent. of the gross earnings from gas. That is, if A = gross receipts from gas per unit of light, then we must obtain for electric light: (A+91 %)+(A+36 %) or 127 per cent. of the price of gas, which simply means that, if gas sells for $1 per thousand feet, the selling price of electricity for an equivalent light must be $1.25.

That this is the practical result so far is evident from the fact that, as before noted, the receipts from electricity per unit of light are about 28 per cent. greater than from gas.

It avails nothing to say that this statement is disproved by the operation of electric companies in certain cities, where they are selling electricity at the same price as gas and paying dividends, for we are not concerned with individual cases, but dealing with average results. Such exceptions to the rule might be explained by an abnormally high price for gas in those cities, or by the fact that the electric companies have confined their operations to the thickly-settled portions of the cities and have taken only the best-paying customers—those of long-burning hours. But these cases offer no suitable basis for comparisons.

We have based our figures on a sixteen-candle-power unit, not forgetting the claim of the advocates of gas-lighting that what purports to be a sixteen-candle electric light fails to net the consumer any such amount of illumination, because the incandescent lamp falls off in efficiency so soon. While conscious of this fact, we have disregarded it in our calculations because we are dealing with comparative results. Besides, this loss is pretty well balanced by that which the gas-consumer suffers from poor burners; the loss in efficiency in the former case may be more rapid than in the latter, but as it is darkest before dawn, so the incandescent, as it approaches its period of lowest results, nears the time when it will be replaced by a new lamp, thus giving the customer the dawn of better things in the shape of the original strength of the incandescent. But the gas customer, while perhaps suffering a lesser proportional loss through a defective gas-burner, is apt, through ignorance of his loss, to bear it for a longer period of time; hence these losses may be held to balance each other.

ELEGANT COMBINATION FIXTURE.

For beauty in design and elegance in appearance it would be hard to find a combination gas and electric fixture to surpass the one illustrated herewith. It is one style of the many produced by the W. C. Vosburgh Mfg. Co., Limited, 269 to 281 State street, Brooklyn, whose goods are known everywhere for fineness of quality and durability of finish.

The company has recently opened its new building, adjoining its factory, which is used for show-room and



COMBINATION FIXTURE.

office purposes, and the show-room on the ground floor is one of the finest that can be found anywhere. Here fixtures of all designs and finish are displayed to the very best advantage, and the finish of the room itself is in perfect harmony with the elegant goods displayed.

The goods of this company are said to be first-class in every particular.

WATER-GAUGE AND GAUGE-COCK.

Fig. 1 in the accompanying illustrations shows a new style of automatic water-gauge for which many points of excellence are claimed. In the sectional view of the gauge, a round plug or valve, having on its outer radius spiral wings or flanges will be observed. While the glass in the gauge remains unbroken, the water on the lower end of the gauge is kept balanced at the water line by the steam in the upper part of the gauge. Directly, however, the glass breaks, from any cause, the steam and water rushes to the atmosphere, carrying the sliding valve to the seat as is shown. If any sediment becomes lodged in the pipes by the valve, it can be instantly removed by partially closing the valve that governs the entrance of water to the glass and opening the pet-cock at the bottom of the gauge. This starts the revolving valve for its seat, but as the face of the valve comes in contact with

the pin before reaching the seat and the steam having a vent through the pet-cock to the atmosphere, the valve is rapidly revolved and cuts loose any sediment which may have lodged there, blowing it through the gauge into the air.

By the employment of these gauges all danger from being scalded by hot water or steam is removed. If during the night the glass should break, as is very often the case, the steam and water is instantly shut off, and the boilers cannot be burned by the water being blown out, with the fires banked, as would be the case with the ordinary gauge. These gauges are made in all sizes and of the best material. Containing as they do so many advantages over the ordinary style of gauges should favorably commend them to all users of steam.

Fig. 2 represents a self-grinding gauge-cock constructed on a principle said to be superior to those of other makes

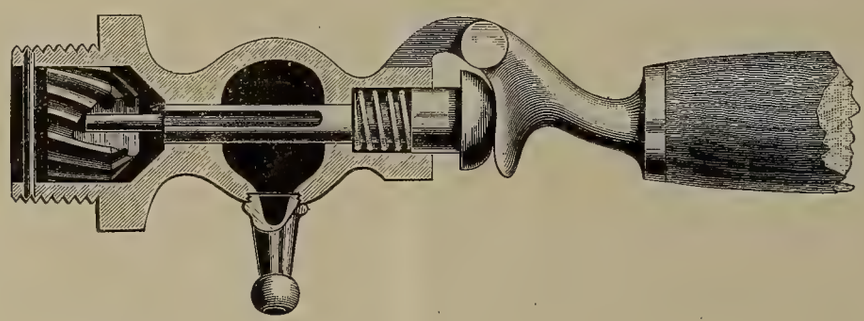


FIG. 2.

owing to the fact that every time the cock is tried it regrinds the valve-seat.

The advantages claimed for the self-grinding gauge-cocks over those of other makes are: They never leak;

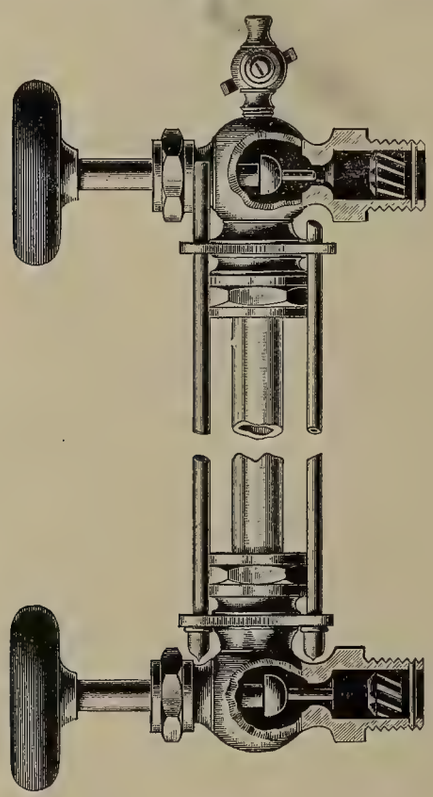


FIG. 1.

can be tried instantly; regrind the valve slightly each time they are tried; are made of the best steam metal and in the best possible manner; will last longer than any others; can be tried on a high boiler without climbing up to them, by simply pulling the wire; are handsome in design and reasonable in price.

Both the automatic water-gauge and the self-grinding gauge-cocks are manufactured and sold by the Ashley Manufacturing Company, 136 Liberty street, New York. The factory of the company is at Hawthorne, N. J.

These goods are already being extensively used and give entire satisfaction.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, November 5, 1892.

MR. J. E. HAM is general agent for the celebrated Day's Kerite electric wires and cables, manufactured by W. R. Brixey, 203 Broadway. Mr. Ham is a well-known hustler, and is bound to capture plenty of orders.

THE BRUSH ELECTRIC COMPANY has just completed the installation of a 30-arc-light plant at the factory of Benedict & Burnham, Waterbury, Conn., and a 60,000-watt Brush alternating plant at Cornwall-on-Hudson, N. Y., both of which plants were recently sold by Mr. A. D. Dorman, of the New York office of the Brush Company.

THE WILDER DUPLEX ELECTRIC BURGLAR-ALARM AND MESSENGER CO., 165 and 167 Broadway, has just finished a complete installation of its electric system, including fire-alarm, burglar-alarm and messenger service, in Wichita, Kan. There are now in operation 150 call-boxes and many burglar-alarms, including several of the largest stores in the city. It is calculated that the company will eventually put in 1,000 boxes throughout the city.

A 10 H. P. Perret motor, made by the Elektron Mfg. Co., Springfield, Mass., is used in the composing-room of the New York *Recorder* to run the Linotype machines in case of emergency—that is, when the steam-power fails. Under the same circumstances and with the same power the machinery in the art department, including routing machines, etc., is also operated. A friction clutch made by the Akron Iron Co. is used on the shafting to effect the change from steam to electric power.

T. J. MURPHY, of 136 Liberty street, New York, still claims that all slate quarried in the State of Pennsylvania and neighboring counties contains more iron than that quarried in Vermont. He says it is also harder to drill, for the same reason, which fact can be verified by several people who have used the Pennsylvania slate with bad results. Mr. Murphy is selling Philadelphia concerns Vermont slate, owing to the amount of iron found in slate of their own State.

MR. CHARLES E. MANNING, consulting engineer, 121 Liberty street, is New York agent for the Belmont double-valve high-speed engines. He has closed a contract with Messrs. Weil and Haskell for a 50 H. P. Belmont automatic high-speed engine to be soon installed in their factory to run a Mather dynamo of 450 lights capacity.

The electrical installation will be done by the New York branch of the Mather Electric Company, Bennett Building. The Belmont engine was illustrated and described in the ELECTRICAL AGE of September 10.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	61 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Chicago Gas	25,000,000	100 00	96 75
Commercial Cable Co	7,716,000	100 00	168 00
Cons. Elec. Co., Ltd., St. John N. B. 5s	450,000		*95
Cons. Elec. Co., Ltd., St. John N.B. Pref.	250,000	100 00	70 00
Cons. Gas Co., N. Y.	35,430,000	100 00	123 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*108
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	106 50
Edison Electric Light Co., Phil	1,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	115 25
General Electric Co., 5s	4,000,000		*106
General Electric pref.	4,223,700	100 00	118 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	107 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	25 50
Laclede Gas pref.	2,500,000	100 00	68 75
Laclede Gas 5s	10,000,000		*83
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			135 00
Montclair Elec. Lt. Co., Denver	50,000	100 00	94 00
Montclair E. Lt. Co., Denver, 8s	26,000		*170
Morristown L. H. &P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N.Y.	50,000	100 00	101 00
New England Butt Co	100,000	1,000 00	1,000 00
N. E. Tel. & Tel. Co	10,394,600	100 00	61 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Rockaway Elec. Lt. Co. 6s	75,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	26 00
Western Union	100,000,000	100 00	98 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	39 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 50
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

I hope the solid investors who have followed my advice for the past few months, and placed their surplus in electric securities, discounted, as I requested they should, the possible strike which would momentarily affect their income. It has come in New York and vicinity, and may extend a slight distance into the interior, but the general result will not be by any means lasting. The electric linemen not only cease current work but many other building industries join, showing conclusively the extensive ramifications the electric circuit has and is gaining in all directions. This strike more particularly concerns the construction corporations of this immediate locality than any other interests; therefore very few shareholders will suffer any loss. Capital will lose little or nothing by affording labor a short recreation; on the other hand labor, feeling it can live comfortably without work for a time, equalizes the controversy. The sufferers are the stockholders in the score of construction companies, and my convictions are that when the balance is struck at the end of the contract they will not have lost any conspicuous amount. The strike is the one particular item which every investor must take into consideration in connection with every dollar he ventures; it is the speculator's picnic, as he is bull or bear, while the other is always bull. Meantime the main work of improvement goes on, as will be seen by the prices quoted and the dividends paid.

The estimate for November in interest and dividends is $27,000,000 as against $25,000,000 in New York for the same month of last year. I feel sure that $2,000,000 will easily be doubled next year, we shall have so many new electric jobs completed and on a paying basis—water-power, electric passenger and freight, long-distance traction, electric street-car service, underground circuits, storage battery, elevated-railroad traction and a legion of other prominent incidents in the science will no doubt be achieved, adopted and assist in the grand race after the almighty dollar. Capital is still being called for to carry out enterprises which will earn more money than it is possible for labor to, as its income is compounded and tireless. The natural growth of the country insures a gradual increase of earnings. With $20,000 to-day a man can secure full and absolute control of an exclusive thirty-year franchise for all electric business for a growing city, railroads, banks, etc., established and doing a paying business, finest climate in America; and who can predict what thirty years will increase it to? He will be a prince during the time his wealth increases. Another call is from a construction company well established for $20,000 on first mortgage gold bonds, six per cent., on light plant to be constructed, consisting of 200 arc, 2,000 C. P., 3,000 incandescent, 16 C. P. five-year city contract, and over 2,000 commercial incandescent lights, the plant to cost about $50,000. These are good investments. There are also several lots of shares in good corporations offering from 100 shares up to 5,000, par $10, $25, $50 and $100 per share; plants running several years and giving general satisfaction, earning more than interest on their bonds; cause of sale—the eternal rest-

lessness of the American citizen, who sees, as soon as he has a few thousands invested, and paying legal interest, chances where he can sacrifice a little and employ his capital in a more lucrative manner. For the next six weeks hard labor among the financial element not overburdened with wealth will be incessant, and the campaign will be shadowed for next year, which will be the brightest and most remunerative in our history. The strikes and other discords will only tend to give the thrifty investor better opportunities and more of them. The ELECTRICAL AGE in its line will point out many of these as they crop up, the very best of which is $3 invested in a year's subscription. The United States Rubber Co., another industrial consolidation with $50,000,000 capital, of which $26,947,000 is issued, 34,735 preferred and 134,735 common shares of $100 each has been incorporated, and offers to the public for subscription at $102.50 per share $10,500,000 preferred stock bearing 8 per cent. interest. I notice the name of Charles A. Coffin, president of the General Electric Co., among the list of directors. Rubber is a considerable factor in all electric circuits, and this consolidation of interests will serve to enhance the value of every share of electric stock where insulation is used. The stock will be applied for, allotted, and on 'Change in a very short time. It is a good, sound, safe, permanent investment.

AN ENTERPRISING CONCERN.

The Manufacturers' Advertising Bureau and Press Agency, 111 Liberty street, New York, presided over by Mr. Benj. R. Western, approaches as nearly as it would seem possible the ideal enterprise of its character in the country.

It is not an advertising agency in the general sense of the term, but becomes, upon employment, the counsellor and general literary handy newspaper bureau of the manufacturing advertiser. Mr. Western, the proprietor, has been connected with newspaper work and advertising for twenty years, during which time he has acquired naturally a large stock of valuable information pertaining thereto, which is always at the service and for the benefit of his clients. The Manufacturers' Advertising Bureau and Press Agency does not furnish prospective advertisers with lists or estimates, and does not cut advertising rates. It is true to both advertiser and advertising medium, and in this way might be said to differ materially from the generally understood "advertising agency." The Manufacturers' Advertising Bureau and Press Agency is in the field to take entire charge of the newspaper work and advertising department of progressive manufacturing concerns, relieving them entirely of this onerous charge, and will agree to make the advertising done by it *pay*. In addition to the designing, outlining and placing of the advertising proper, there is a press department connected with the concern. It is an original idea and evidently a popular one. In this department is prepared and disseminated for gratuitous publication among the various trade journals strongly written "write-ups" and trade notes bearing upon the article advertised. These are given careful and systematic attention, and aid greatly in making the general results of the advertising department placed in the care of the Manufacturers' Advertising Bureau and Press Agency profitable. Several little pamphlets, giving a detailed explanation of his business and intended for gratuitous distribution, are issued by Mr. Western.

TRADE NOTES.

That the motors and dynamos manufactured by the Keystone Electric Company, of Erie, Pa., are popular and give every satisfaction is amply proven by the following list of sales made during the past three months, when there was a general stagnation throughout the electrical trade: Buffalo Forge Co., Columbus, Ohio, 215 H. P. motors to run ventilating fans; H. Ward Leonard & Co., New York, N. Y., 3 H. P. motor to run printing establishment; H. J. Reedy Elevator Co., Cincinnati, Ohio, 7½ H. P. motor (reversible) to run elevator; St. Mary's Catholic Church, Erie, Pa., 1 H. P. motor to run church organ; Marshall Bros., Pittsburg, Pa., 5 H. P. motor (reversible) to run passenger elevator; J. H. Link, Norfolk, Va., 25-light dynamo; J. H. Link, Norfolk, Va., 12-light dynamo; J. V. Yelgerhouse, Erie, Pa., ½ H. P. motor to run optician shop; E. A. Sarran & Co., Cincinnati, Ohio, ½ H. P. motor to run fans; E. A. Sarran & Co., Cincinnati, Ohio, 3 H. P. motor to run machine-shop; Jas. H. Link, Norfolk, Va., 10 H. P. motor to run machine-shop; D. A. Fessler, Williamsport, Pa., 1 H. P. motor to run ceiling fans; Heat, Light and Power Co., Muncie, Ind., two 5 H. P. motors to run printing establishment; Hazeltine Woollen Mills, Warren, Pa., 40-light incandescent dynamo; M. J. O'Donnell & Co., Cleveland, Ohio, 7½ H. P. motor to run elevator; E. A. Sarran & Co., Cincinnati, Ohio, ¼ H. P. motor to run fans; Whittier Machine Co., New York, N. Y., 5 H. P. motor (reversible) to run elevator; Birdinger, Seibert & Co., Cincinnati, Ohio, 10 H. P. motor (reversible) to run printing establishment; J. H. Link, Norfolk, Va., ¼ H. P. motor (reversible); Jamestown Electric Light Co., Jamestown, 2 H. P. motor to run printing establishment; J. Page & Son, Cohoes, N. Y., 25-light incandescent dynamo to light cotton mill; Smith Crawford, Youngstown, Ohio, 10 H. P. motor to run feed-mill; Youngstown Electric Light Co., Youngstown, Ohio, 1 H. P. motor to run fans; E. E. Johnson, Chicago, Ill., 3 H. P. dynamo; E. E. Johnson, Chicago, Ill., 1 H. P. motor to run triplex pump; H. M. Sutzinger, Wilkesbarre, Pa., 2 H. P. motor; A. K. Dysher, Reading, Pa., 5 H. P. motor (reversible) to run elevator; Genesee Hotel, Buffalo, N. Y., ¼ H. P. motor to run fan; Geo. Dun, Erie, Pa., ¼ H. P. motor to run ceiling fan; M. J. O'Donnell & Co., Cleveland, Ohio, 10 H. P. motor (reversible) to run passenger elevator; Youngstown Electric Light Co., Youngstown, Ohio, two 1 H. P. motors to run fans; 2 H. P. motor to run printing establishment; E. A. Sarran & Co., Cincinnati, Ohio, ¼ H. P. motor to run fans; E. A. Sarran & Co., Cincinnati, Ohio, 2 H. P. motor; Jas. Curney, Erie, Pa., ¼ H. P. motor to run fans; Jamestown Electric Light Co., Jamestown, ½ H. P. motor to run fans; Baker & Handley, Cincinnati, Ohio, 40-light dynamo; Youngstown Electric Light Co., Youngstown, Ohio, 5 H. P. motor; Rothchilds Bros., Ithaca, N. Y., 1 H. P. motor to run cash-carrier; Bigelow Elec. Supply Co., Lincoln, Neb., 1 H. P. motor; Stuart & Harper, Winnipeg, Manitoba, 60-light incandescent dynamo; Dunkirk Printing Co., Dunkirk, N. Y., 7½ H. P. motor to run printing establishment; Geo. F. Patterson & Co., Baltimore, Md., ¼ H. P. motor (reversible); Buffalo Forge Co., Buffalo, N. Y., 5 H. P. motor to run ventilating fan; Kirby-Carpenter Co., Menominee, Mich., 125-light incandescent dynamo to light saw-mill; F. W. Bacon & Co., Erie, Pa., 40-light incandescent dynamo to light fish-house; Ames & Walker, Fargo, N. Dak., 40-light incandescent dynamo to light store; E. A. Sarran & Co., Cincinnati, Ohio, ¼ H. P. motor to run fans; 3 H. P. motor and 40-light dynamo; Youngstown Electric Light Co., Youngstown, Ohio, two 1 H. P. motors to run fans; Hunt & Connell, Scranton, Pa., 1 H. P. motor to run fans; H. J. Reedy Elevator Co., Cincinnati, Ohio, 15 H. P. motor (reversible) to run elevator; McCreery Ventilating Co., Toledo, Ohio, 3 H. P. motor to run ventilating fan; Heat, Light and Power Co., Muncie, Ind., ½ H. P. motor to run ventilating fan; Heat, Light and Power Co., Muncie, Ind., 1 H. P. motor

to run ventilating fan. This company makes a specialty of reversible motors without rheostats.

COWLES ENGINEERING COMPANY,
BROOKLYN, N. Y., June 9, 1892.

FORREST SILVER BRONZE PACKING CO.,
No. 115 LIBERTY ST., NEW YORK CITY.

Gentlemen: Yours of June 29 was received during my absence. From our experience so far with your packing on the high-speed steamer, "Mary Bell," built for the Lake Keuka Navigation Company, we can say that your packing is a most excellent article. We shall undoubtedly use it on further high-speed engines, where we are using 200 lbs. steam pressure with Cowles Water-Tube Boiler.

Enclosed find extract from letter to Prentiss Tool and Supply Company, New York, concerning your bill.

Very truly yours,

(Signed) WM. COWLES, Pres.

LOUISVILLE, KY., Nov. 1, 1889.

AKRON BELTING CO.,
AKRON, O.

Gentlemen: We take pleasure in confirming our verbal statement to your superintendent when he was here some time ago, about the belt of your manufacture which we have in use. Our new works, into which we moved the early part of the year, were equipped throughout with belting of your manufacture, and we take pleasure in advising you that it has given us entire satisfaction. We expect to continue to place with you orders for such belting as we will require from time to time.

Yours truly,

KENTUCKY WAGON CO.
W. C. NONES, Gen. Mgr.

The Electrical Age's Illustrated Patent Record.

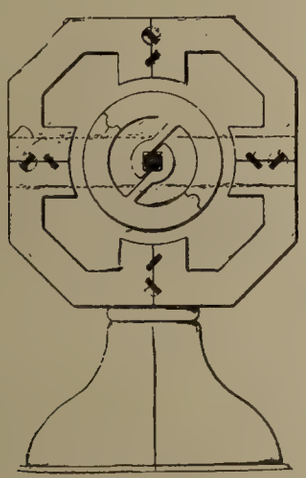
Issued November 1, 1892

485,181. Dynamo. William H. Elkins, Cambridge, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 7, 1891.

485,220. Dynamo-Electric Machine. David Pepper, Jr., Philadelphia, Pa. Filed March 28, 1892.

485,221. Automatic Governing Device for Electric Pumps. Francis A. Pocock, Lynn, Mass., assignor to the Thomson Van Depoele Electric Mining Company, of Maine. Filed March 20, 1891.

485,239. Regulator for Dynamo-Electric Machines. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 6, 1888.



485,220.—DYNAMO-ELECTRIC MACHINE.

485,252. Underground Electric Trolley System. Ruben B. Ayres, New York, N. Y. Filed March 23, 1892.

485,279. Combined Telegraphy and Telephony. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed April 8, 1892.

485,281. Incandescent Lighting. John Landin, Stockholm, Sweden. Filed June 10, 1891. Renewed Sept. 19, 1892. Patented in Belgium, in England, in France, in Spain and in Sweden.

485,284. Armature-Core for Electric Motors and Dynamos. Anton J. Leman, New York, N. Y. Filed Jan. 30, 1891.

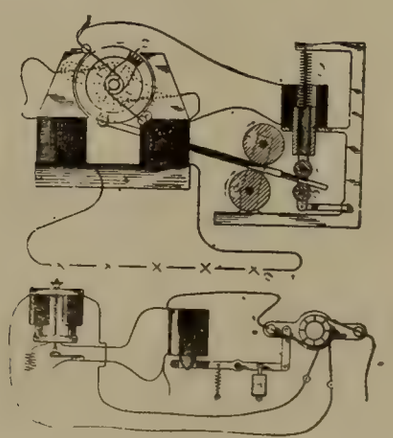
485,287. Electric-Lighting System. William H. MacKay, Roanoke, Va. Filed June 13, 1892.

485,293. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed Jan. 2, 1892.

485,311. Telephone. Anthony C. White, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 24, 1892.

485,319. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn., assignor to B. M. Stratton, same place. Filed Dec. 18, 1891.

485,321. Machine for Securing Incandescing Bodies for Gas-Burners in Their Holders. Otto B. Fahnehjelm, Stockholm, Sweden, and Carl Dellwik, Rogers Park, Ill. Filed June 21, 1890.



485,239.—REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

485,322. Machine for Manufacturing Lamellæ or Needles for Incandescent Gas-Burners. Otto B. Fahnehjelm, Stockholm, Sweden, and Carl Dellwik, Rogers Park, Ill. Filed June 21, 1890.

485,327. Electric-Arc Lamp. Edward R. Knowles, Middletown, Conn. Filed Nov. 24, 1891.

485,334. Electric-Magnetic Telegraphic Apparatus. Alfred G. Safford, Washington, D. C. Filed March 16, 1892.

485,336. Self-Induction Device. William Stanley, Jr., Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed April 10, 1891.

485,337. Circuit-Switch. Marvin E. Sullivan and John Doss, Denver, Col. Filed April 2, 1892.

PATENTS.—Continued.

485,343. Method of and Apparatus for Electro-Deposition of Metals. Charles R. Fletcher, Boston, Mass. Filed Oct. 5, 1891.

485,347. Electric Arc-Lamp Henri Japy, Beaucourt, and Oscar Helmer, Paris, France. Filed March 22, 1892. Patented in Belgium, in France, and in England.

485,351. District Alarm-Box. Charles W. McClellan, Chicago, Ill. Filed Aug. 1, 1891.

485,352. Electric Signal. George McIntosh, Stonington, Conn. Filed March 10, 1892.

485,367. Electrical Door-Trip for Engine-Houses. Adam Bosch, Newark, N. J. Filed March 14, 1892.

485,379. Electric Bell. John R. Hard, New York, N. Y. Filed June 7, 1892.

485,424. Electrical Heater. Henry G. O'Neill, Louisville, Ky., assignor, by direct and mesne assignments, to the Standard Electric Heat, Light and Power Company, of Maine. Filed Feb. 2, 1892.

485,425. Electric Intermutator. Henry G. O'Neill, Louisville, Ky., assignor, by direct and mesne assignments, to the Standard Electric Heat, Light and Power Company, of Maine. Filed Feb. 9, 1892.

485,473. Electric Danger-Signal for Moving Trains. James McCart and Arthur G. Judkins, Trenton, Mich. Filed Sept. 26, 1891.

485,478. Incandescent Electric Lamp. Edward Pollard, Cambridge, Mass.; Martha W. Pollard, administratrix of said Edward Pollard, deceased. Filed March 2, 1892.

485,537. Electric-Arc Lamp. Edgar A. Edwards, Cincinnati, Ohio. Filed Nov. 25, 1891.

485,555. Underground Electric Conduit and Trolley-Bar for Electric Railways. John S. Moss, Martinsburg, W. Va. Filed April 16, 1892.

485,558. Electric Switch. James C. O'Neil, Cleveland, Ohio. Filed Oct. 14, 1891.

485,559. Construction of Jails. David K. Osbourne, St. Paul, Minn. Filed Jan. 4, 1892.

485,587. Socket for Incandescent Electric Lamps. John S. Potter, Newton, and David J. Cartwright, Boston, Mass.; said Cartwright assignor to said Potter. Filed Oct. 6, 1890.

485,591. Watchman's Electric Time-Recorder. James A. Tilden, Hyde Park, assignor to the Hersey Manufacturing Company, Boston, Mass. Filed June 22, 1892.

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Consulting
Electrical and Mechanical Engineer and Expert,
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ELECTRICAL AGE

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TWO GREAT FORCES.

The two most conspicuous physical forces in the world to-day are electricity and the American people. The difference between the two is that electric force is practically continuous in its action while the other exerts itself once every four years, and in four years a tremendous amount of energy can be accumulated in this particular field. On November 8 a discharge of the latter class of energy took place with disastrous effect on the existing plant. On the 4th of March next an entirely new plant, constructed on different principles, will be put into operation, but it will require four years more to determine whether it is better suited to existing conditions.

What hit you?

AS TO CLOSING THE WORLD'S FAIR EVENINGS.

One of the greatest blunders that the World's Fair Commissioners could have possibly committed was the adoption of the rule providing for the closing of the gates to the fair grounds at 7 o'clock P.M. each day, and it is with much favor that we note the strong sentiment in the electrical trade at large against the proposition. Early closing concerns not only the electrical exhibitors, but all others. The former class, however, would be more affected for the reason that natural darkness is essential to obtain the best effects and results with electric-light displays. It would not make so much difference if power was the only manifestation of the electric force, because the applications of electric power can be just as well shown in the daytime as at night, but with the electric light it is quite different. The proper time, of course, to produce the best effects with the electric light is when the conditions exist which make light a necessity.

When the artist designs electroliers and other fixtures for electric lamps he takes into consideration the effect the combination of the light with the fixtures will produce, and he designs from this standpoint mainly. He knows that artistic merit lies in the degree to which these conditions are taken advantage of, and to get the best results he must work from a dark background, so to speak. Electric-light displays in the daytime would be dead and valueless as far as practical results are concerned.

Electric light is to be the universal artificial light, and we want to show the people from all parts of the world at Chicago next year what it is, and what we can do with it, but to do this we cannot produce the best effect and results when Nature's light occupies the field.

Electric-light displays at the Fair will be very numerous and extensive, and on that ground alone the keeping open of the Fair during a part of the night is imperative.

Another consideration which seems to have escaped the notice of the powers that be is that the working people would be practically barred out of the fair grounds. Thousands of them who cannot afford to lose even a single day's work would be glad to visit the fair in the evening when time is their own, but if the gates are to be closed at 7 o'clock they will be deprived of the pleasure and instruction they would thus receive. The welfare of the working classes was an important consideration during the committee's deliberations concerning the question of keeping the fair open on Sundays. It was finally decided to close the fair Sundays; hence the only ground left on which the demands of the working people can rest is in keeping the fair open during the first part of the night.

It will be decidedly advantageous—morally, mentally, physically, financially and commercially—to keep the fair open evenings, and all the power and influence we can command will be exerted in the direction of securing a modification of the rule.

ELECTRIC HEATERS.

A subject to which street-railway managers have devoted a great deal of attention is the supplanting of coal stoves for the heating of cars by some method that will give satisfaction and at the same time not encroach upon the seating capacity as does the coal stove. Many devices have appeared from time to time only to

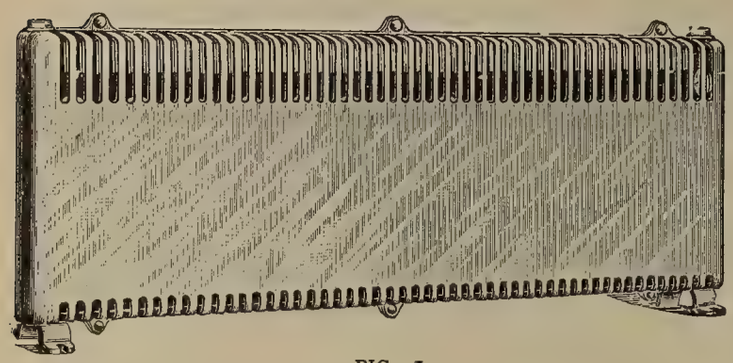


FIG. 1.

quickly disappear. It would seem, however, that the electric current has added another to its already many triumphs in the electrical-heating device illustrated and described herewith.

This device is known as the Dewey electric heater, special apparatus being constructed for specific purposes.

Figs. 1 and 2 show the car heater and method of connections respectively. Fig. 3 is a diagram of the system as applied to the heating of houses, and Fig. 4 is an electric cooking stove.

It is claimed that the superior advantages offered by this system of heating more than offset the slight extra expense incurred by its use where the cost of current is high. In many cases the cost has been found to be even less than that of coal and in others the same. The Dewey heater is the outcome of seven years' experimenting, and the promoters are so satisfied that it has been brought to a state of perfection that they have no hesi-

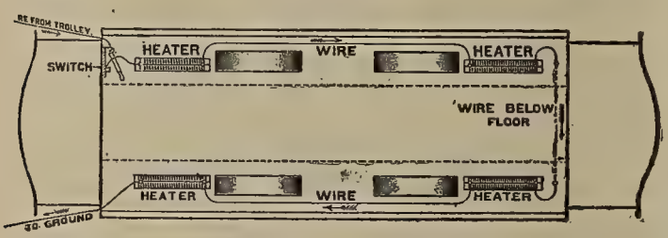


FIG. 2.

tancy in recommending its adoption by all electric street-car lines as a cheap and safe method of heating cars.

The heaters used for street-car purposes are 26 inches long, 2 inches wide, 10½ inches high, made of cast-iron, japanned, and weigh but 25 pounds. They cost no more than a coal stove and take but three ampères of current in a 500-volt circuit. One watt will heat nearly one cubic foot of air-space in a car. Being placed beneath the car-seat they do not interfere with the seating capacity and the heat is equally distributed throughout the car. A special feature is that there is no necessity for removing them in summer, and as the heater can be started or stopped in a moment, they can be used to warm the car in the early mornings and evenings of spring and fall to great advantage. No smoke or gases are thrown off as is the case with coal stoves, nor is the car burned, scorched or otherwise damaged, and no attention is required on the part of the conductor.

The Dewey electric car heater has been used with great success on a number of lines, among which is the Niagara Falls and Suspension Bridge Street Railway Company, where they have been given a thorough test as to economy and proved most satisfactory. The heaters for offices and dwellings, which are made in dif-

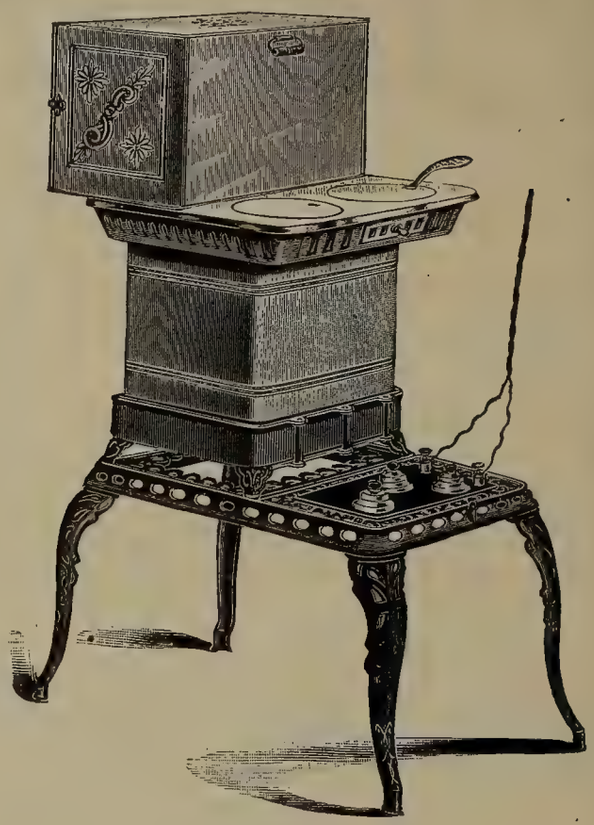


FIG. 4.

ferent sizes, are also meeting with great success wherever introduced.

These heaters are manufactured by the Dewey Electric Heating Company, 501, 502 and 514 Kirk Building, Syracuse, N. Y.

PRODUCTION OF CAUSTIC SODA BY ELECTRICITY.

A process for making caustic soda by electricity has recently been discovered in England. It is stated that caustic soda, chlorine and other chemical products can be produced directly from the brine by this process. The *Northwestern Daily Gazette*, of England, says that the most careful tests applied up to the present time show an economy of over 50 per cent. as compared with present methods. It is described as the simplest of all the known processes of soda making, the caustic soda being produced direct from the brine in one operation instead of two. At present carbonate of soda is first produced, and from that the caustic soda is made. The valuable chlorine is also saved and utilized for the production of bleaching powder and other lye products. Eminent chemists and electricians, it is said, have already pronounced the new method a complete success from a chemical point of view, and that there is every prospect of its being worked as a commercial success.

At a recent conference between the electrical committee of the common council and representatives of the Citizens' Light and Power Company, of Rochester, N. Y., a contract was formulated that will probably be agreed to by the company and ratified by the council. The company is to bury all of its wires as a condition under which it may operate. This company was organized but a short while ago.

THE TROLLEY IN BROOKLYN.

Along Fulton street, Brooklyn, the best possible support for the trolley wires is afforded by the elevated railroad structure. Attached to girders of the railroad at certain distances apart is an especially devised apparatus for holding the trolley wire in place. The accompanying illustration will give a clear idea of how this is accomplished.

The upper ends of the clamp-arms are made in the form of a hook which provides means of suspending the arms to the girder. The lower part of each arm is drilled with two holes, through which long iron screw-rods are passed. The clamps are tightened and held in place by means of the nuts on the screw-ends of the rods. The rods also pass through two blocks of wood to which insulators are fixed, and to these a third insulator, which holds the trolley clip, is attached as shown.

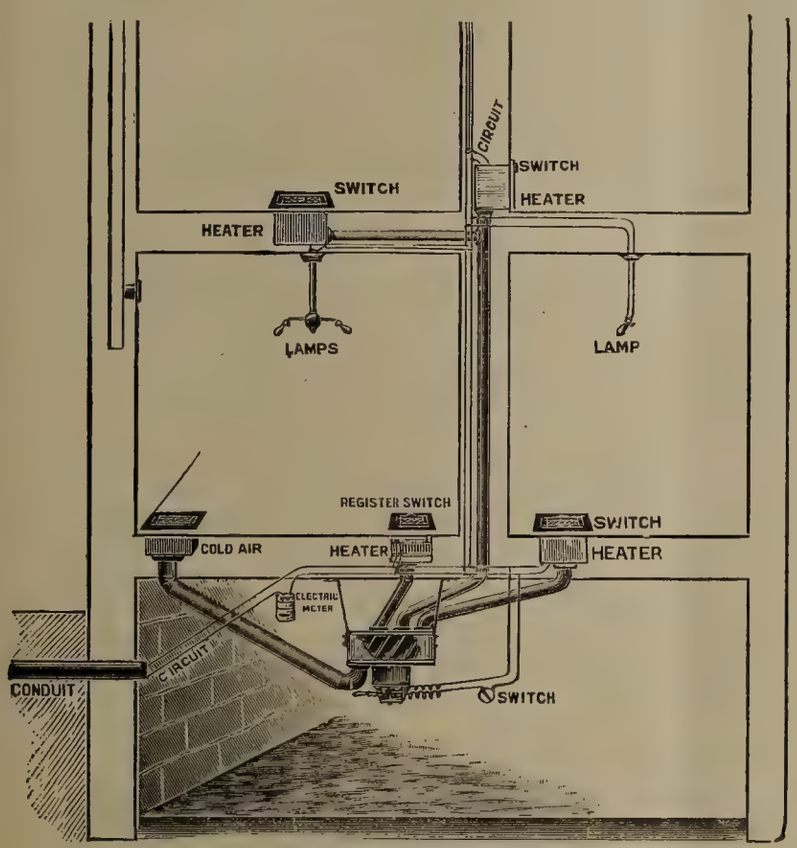


FIG. 3.—DEWEY ELECTRIC HEATING.

Excellent insulation is secured by this method of suspension. The points of support are practically protected from rain, and the trolley line, being protected by the railroad structure itself, is free from all the ordinary dangers that exposed lines are subject to.

SOME CURIOSITIES IN EARLY ELECTRO-THERAPEUTICS.*

BY PROF. EDWIN J. HOUSTON.

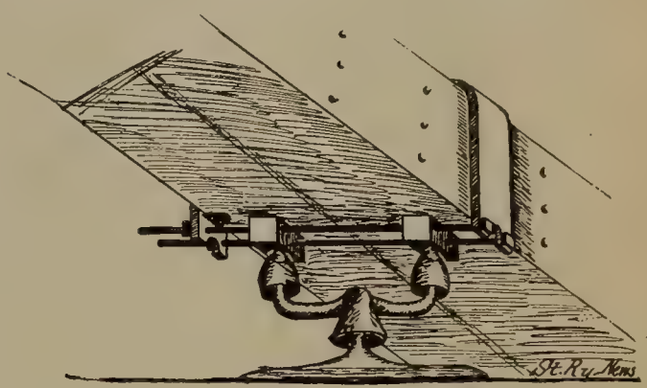
The astonishing physical effects produced by the discharge of the Leyden jar through the human body led not only the general public, but also the medical fraternity, shortly after its discovery in 1745, to form the most absurd ideas concerning the curative powers of electricity.

* * * * * *

I have thought that it might interest you if I brought before you a few curiosities in the way of the astonishingly absurd statements that were put forth about the time of the discovery of the Leyden jar, as to the ability of the electric force to cure.

* * * * * *

I once read in a circular letter issued, if my memory serves me correctly, some fifteen years ago, by a certain so-called medical doctor, in which he claimed among other advantages for the peculiar kind of electricity which he claimed his apparatus was capable of producing, that it was electricity of the corkscrew or gimlet type, and that it, therefore, had but little difficulty in insinuating itself into all parts of the body, so searching out the disease. Or, taking a time not so modern, when a certain inventor, I think, by the name of Edward Craddock Monckton, an exceedingly ingenious man by the way, who has taken out scores of electrical patents, and among others a method of electrically joining articles of jewelry, gravely proposes in a British patent, to so connect the body of a healthy animal, like a cow for example, with that of the patient to be treated,



TROLLEY HANGING DEVICE.

as to electrically convey the health and strength of the animal to the patient. To do this he places the body of the cow or other animal upon an insulating stool, and connecting it to that of the patient to be treated by electric conductors, passes the current of a battery through the animal and subsequently through the body of the patient and thereby, as he claims, conveys to the patient the vitality of the animal.

Passing these aside, however, I would call your attention to a few curiosities in early electro-therapeutics.

It was believed by many of the early practitioners that the virtues of a drug could be readily caused to pass through glass vessels by means of electric discharges. This belief was probably founded on the rather prevalent belief at this time as to the existence of effluvia. The attraction of a magnetic needle by a magnet, notwithstanding the interposition of a plate of glass, was at one time explained on the supposition of effluvia passing out of the magnet and through the glass into the iron. It is not, therefore, surprising to find such statements as that of a Dr. Bruni writing to Dr. Watson of a remarkable case in which, as he claims, medicine shut up in a tightly sealed glass globe produced its peculiar effect on a person who was electrified by the use of said globe. I mention this as a particular case, although the early records of electricity are filled with similar cases. What Dr. Watson has to say about these experiments will, I think, interest you, and I will, therefore, give you the following quotation :

"Dr. Bruni gives me next in his information from Rome, which is, that a gentleman there covered the internal surface of a glass cylinder (which some use instead of a globe) with a purgative medicine ; and that a man, electrified therewith, found on the spot the same

*Abstracts from paper read before the Electrical Section of the Franklin Institute, Philadelphia, September 27, 1892.

effect as if he had swallowed the medicine. He then recommended to us, in England, to try how far the electric power may be of service in distempers.

"These cases, and particularly the last, as it may to some appear extravagant and whimsical, I should have been cautious of bringing before the Royal Society, had you not judged it proper they should be added to those similar accounts from other places, which were read to us last meeting. I think neither myself nor Dr. Bruni answerable for the truth of these facts, as we relate no more than we have received. In truth, all the phenomena in electricity are so wonderful that it is scarcely prudent to deny the possibilities of any accounts concerning it till we have made experiments carefully ourselves. We are very sure it is possible to render a living body replete with electrical effluvia, or to transmit and send such effluvia through a living body, in a stream, as long as we think proper; we are not sure that it is impossible for these effluvia to convey with them into that living body the most subtile and active effluvia of other substances; and if they can do so, the effects suggested are not wholly improbable, for several experiments have proved that a very minute quantity of medicine, transfused directly into the blood and circulating fluids, will have the same effect as a large dose thereof taken into the stomach."

Somewhat similar to the effect just referred to was the belief that the odors of certain substances, placed in tightly sealed glass globes, could be detected by sending electric discharges across them; or the similar belief that highly poisonous substances, placed in such glass globes, could produce deleterious effects on people when electric discharges were sent through the glass globes.

Franklin made a study of the effects of the so-called medicated tubes. In his "Experiments and Discoveries in Electricity," published in London in 1769, he says on page 82:

"Hence we see the impossibility of success in the experiments proposed, to draw out the effluvial virtues of a non-electric, as cinnamon for instance, and mixing them with the electric fluid, to convey them with that into the body, by including it in the globe, and then applying friction, etc. For though the effluvia of cinnamon and the electric fluid should mix within the globe, they would never come out together through the pores of the glass, and so go to the prime conductor, for the electric fluid itself cannot come through; and the prime conductor is always supplied from the cushion, and that from the floor. And besides, when the globe is filled with cinnamon, or other non-electric, no electric fluid can be obtained from its outer surface, for the reason before mentioned."

Of a similar nature is a rather extended belief which existed at one time as to the effects produced by sending electric discharges through solutions of medicine prior to their being taken into the system.

In a British patent, 991 for 1862, Frederick William Breary describes improvements in medicated cups, which consist practically in sending electric currents through the medicines contained in such cups prior to their being taken into the body. I will quote from the specification of this patent:

"The third improvement of my said invention consists in the formation of similar cups or vessels in and by which the principle of galvanic action is obtained either in combination with the medicinal qualities above mentioned or otherwise. The drinking vessel formed upon this principle I denominate the improved medicated 'galvanic cup.'

"In applying the above-mentioned improvement to my said invention, I make a cup or other suitable vessel (for drinking or other purposes), also in two or more parts, and either form the same on either of the medicated principles above described, or otherwise, as may be required, and to fix or insert therein a voltaic or galvanic pile, and galvanize or medicate the water or other liquid placed therein by slightly acidulating the same. By preference, however, I form the foot, stem, and outer bowl of these cups or vessels of glass, china, or other non-conducting material; having three or more water-tight cells or compartments therein, separated one from the other. I make the centre compartment occupy nearly the whole of the internal space, and make the two side compartments small, but sufficiently large to contain the galvanic media. The latter compartments are closed at the top by means of movable stoppers; the central compartment is made open for containing the medicated water or other liquid to be galvanized. The internal surfaces of the central compartment I line with metal or mineral on one part, and with wood or vegetable, as before described. Extending across this compartment, and forming a metallic connection between the two side cells, I fix a bar or perforated plate of metal. When using this galvanic cup, the water or other liquid is first placed in the centre compartment, where it is medicated; then by filling the side compartments, one with granulated copper and fine sand, and the other with granulated zinc and fine sand, and adding to each a little acidulated liquid, the galvanic essence will pass or flow along and over the metal bar or perforated conductor through the medicated water or liquid, and will impart its medicinal virtues to the same, and thus a combined medicated and galvanized action will be obtained."

IMPROVED TROLLEY.

Some valuable improvements are embodied in the trolley illustrated herewith, chief of which are that it is self-oiling and dust-proof.

The frame of the fork is made with two hollow chambers, as shown in Fig. 1, through which pass the bushings. The bushings are lined with vulcanized fibre and are fastened to the brass bushings in such a manner that they cannot turn. The outer, or brass bushings, are screwed into the fork, and the wheel is fastened to the shaft with a steel pin. The hollow chambers in the fork

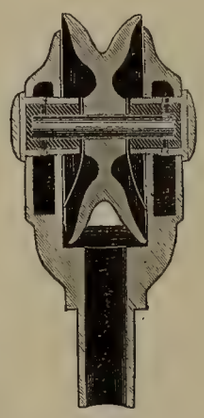


FIG. 1.

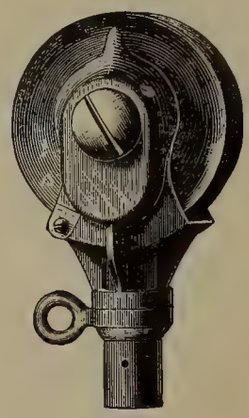


FIG. 2.

are packed with wool which is then saturated with oil. The bearings take the oil from the chambers through the oil-holes, and the wheel, it is said, will run two months without re-oiling.

Mr. E. M. Doig, 1729 Blake street, Denver, Col., is the inventor of this trolley, which is extensively used on the Denver lines and giving the best of satisfaction. It is claimed that the fork shaft and bushing will last from 6 to 8 months.

Fig. 2 shows a perspective view of the Doig Trolley. These trolleys are for sale by Dimon & Adams Mfg. Co., 1729 Blake street, Denver, and we understand that the inventor desires to make arrangements with some firm to manufacture them in the East.

SAFETY ADJUSTABLE CHINA CLEAT.

The use of wooden cleats for electrical purposes has always been considered unsafe, and this point was strongly emphasized at a meeting of the electrical insurance experts of the United States recently held in New York, who decided against the further use of them. A cleat free from all objectionable features and admirably suited for the purpose is the one shown in the accompanying illustration. It is made of a superior quality of imported clay, is thoroughly vitrified, strong and easily put up. Both parts are made identical so that there shall be no trouble or mistake in packing or breakage, and also to save time in putting up. The cross-section is so designed as to strengthen the cleat, and only requires one screw and the four small teats or lugs to hold it secure in its position when once in place, so that perfect alignment is secured. It is adjustable and made both glazed and unglazed. The trade is supplied through the Western Electric Company, The E. S Greeley & Company, and Alexander, Barney & Chapin, of New York. Even though the company has not solicited orders to any extent, over 100,000 of these cleats have already been placed. A practical test, it is claimed, will prove their worth. They are made by the E. G. Bernard Company, Troy, N. Y.

ELECTRIC LIGHT IN ENGLISH RAILWAY CARS.

English railway carriages are notoriously deficient in conveniences, and travel on English, and Continental lines too, is not as pleasant as on American railways, especially at night. English railway managers do not provide good light in the carriages at night, and to read newspaper or book print to make the time slip by quicker is out of the question.

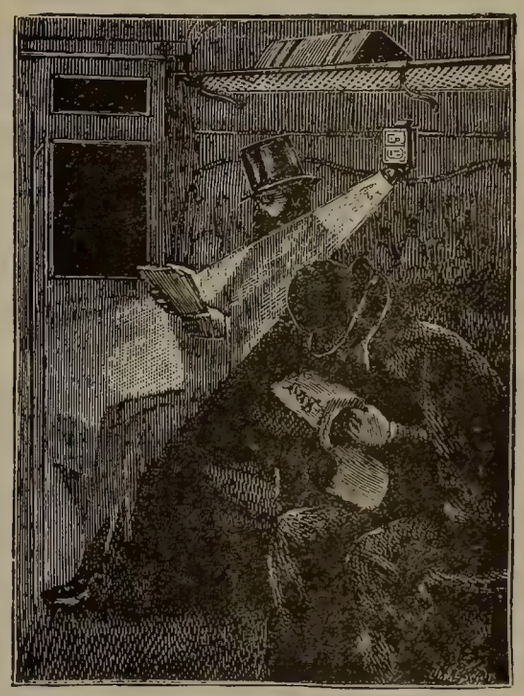
The nickel-in-the-slot principle in combination with a storage battery and an electric lamp is now quite extensively utilized on English roads, and for a penny a passenger may have electric light for half an hour whereby he can read in comfort.

The accompanying illustration, taken from an English contemporary, gives an excellent idea of the condition of things in the matter of light in railway cars in that country.

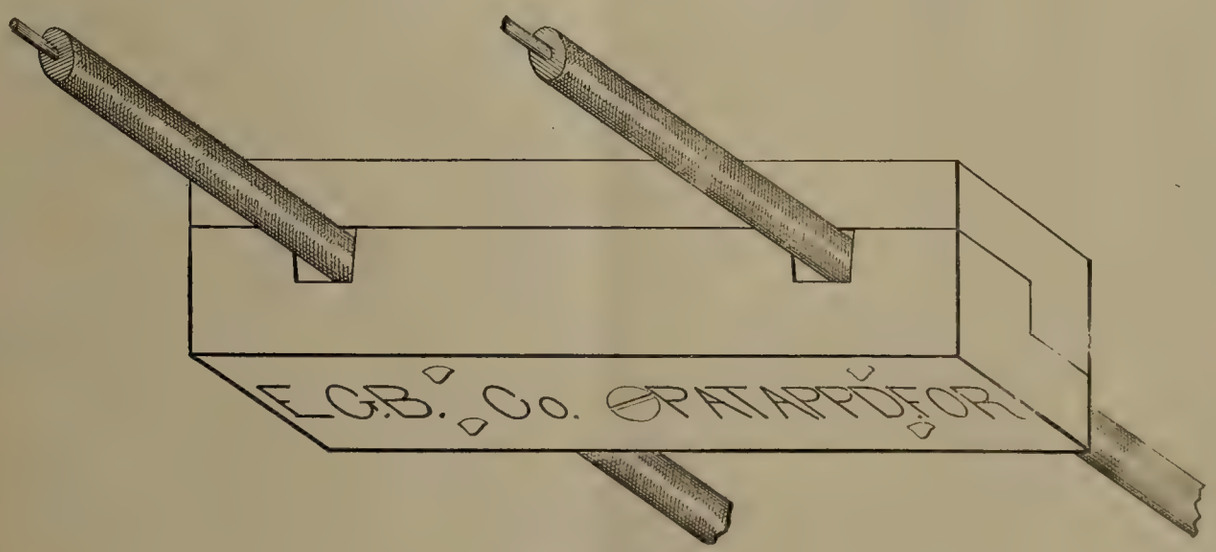
The lighting apparatus consists of a three-candle-power incandescent lamp, actuated by a small accumulator battery, and enclosed in a case with movable shade, enabling the user to direct the light to any desired spot.

The lamp is operated by inserting a penny into the slot at the top, and pressing a knob, which causes the light to shine. At the end of the half hour the light extinguishes automatically, but may be re-lighted by inserting another penny. The patent is owned by the Railway Electric Reading Lamp Co., Ltd.

With this apparatus in use on all trains there is no incentive to supply passengers with light free of cost.



PENNY-IN-THE-SLOT ELECTRIC LIGHT.



SAFETY CLEAT.

THE German lighthouse authorities have been making experiments with magnesium flash-light for use in lighthouses to take the place of other forms of light. It is claimed that the magnesium flash has very much greater penetrative power than electric light. To obtain a candle-power of from 200,000 to 400,000 it is said that only from 0.6 to 1.5 grains of magnesium are necessary. The power of this light to penetrate fog is said to be unrivalled.

EARTH CURRENTS.*

BY WILLIAM FINN.

(*Continued from page 726.*)

During the past list of storms, for instance, the circuits between New York and Buffalo, which vary from 450 to 482 miles in length, exhibited the highest electromotive forces, the value of which on several occasions exceeded 600 volts, and on Aug. 12 last reached the unprecedented magnitude of 768 volts. An idea of the intensity of this force may be judged from the fact that it is about equivalent to the electrical force developed by 720 gravity cells, and represents more than four times the actual value of the voltage regularly employed on the particular circuit affected.

There have been no fewer than thirteen magnetic storms that came under my own observation during the present year, three of which, viz., those of Feb. 13, July 16 and Aug. 12, were exceptionally severe, and almost completely disorganized the entire telegraphic service of the country during the time they lasted. The strength of the current on each of these occasions frequently exceeded 100 milliampères, and occasionally rose to between 200 and 300 milliampères. As the average strength of the working currents does not exceed 35 milliampères, it will be readily understood that any attempt to maintain the ordinary working conditions under such circumstances was simply out of the question.

It is sometimes possible, however, to do a little experimental operating by detaching the regular batteries from the wires and utilizing the natural forces alone for signalling purposes, but they are too capricious and unstable as a rule to be of much practical service in that way.

It was previously remarked that the distribution of the equipotential planes was usually found in a direction about north and south, but twice or thrice during the recent storm period there appeared to be a sudden shifting of the planes to an easterly and westerly direction, which is quite an unusual as well as remarkable circumstance, and one quite difficult to properly account for. At the times referred to the wires north and south, which had previously experienced little or no interruption, became totally unworkable; whereas the easterly and westerly route appeared to be more or less clear of the earth currents. There were times also when a number of wires between the same points would be influenced in such a manner that while one or two might be found perfectly workable the rest could not be operated at all. These curious anomalies, together with other strange inconsistencies that were noted at the time, can only be explained on the supposition that some of the equipotential lines, instead of forming portions of spherical surfaces, were more or less distorted by the action of other disturbing influences into highly irregular figures, such as the spectrum of one magnet would show in the presence of other magnets. Irregular curves formed in this way and passing through the various points noted—all being necessarily at the same potential—would render possible the maintenance of regular communication between such points.

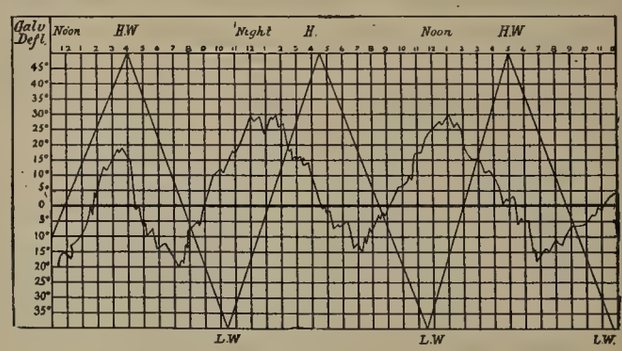
There are many other interesting details and important matters associated with sun-spot phenomena, such as the influence they exert on terrestrial magnetism, and the auroral displays, etc., that might be considered if time permitted; but I must leave that particular subject now in order to direct your attention to another class of earth current which differs in nearly every respect from that we have just been discussing.

I refer to those feeble normal earth currents which are always to be found traversing the earth's surface, and whose interesting features may be studied at any time by inserting a galvanometer in any telegraph circuit from which the regular battery has been removed.

Long and careful observations made in this way have established the fact that these currents have perfectly uniform motions, which appear to be controlled by some occult force and subject to some general law. The normal currents do not in any way disturb the working of the wires, for instead of being strong and fluctuating, like the abnormal currents of an electric storm, they are exceedingly weak, and vary with a sluggish, wavelike pulsation. These facts became known to electricians at a very early period in the history of telegraphy, and caused many inquiring minds to seek a cause for the results observed.

One of the earliest and most plausible explanations of the phenomena was based on the principle of the thermopile, viz.: that currents generated by heat were set up in the ground by the action of the sun, which kept opposite portions of the earth at different temperatures. It was a fact well known at the time that a current of electricity could be maintained in a closed circuit comprising any combination of dissimilar metals provided opposite parts of the system were kept in different thermal conditions.

Reasoning by analogy the earth was regarded as a huge heterogeneous conducting body whose opposite



Earth Current Readings on the Atlantic Cable 1857.

FIG. 2.

sides presented the thermal inequalities so necessary for the production and maintenance of thermo-electric currents.

Unfortunately for this very simple and beautiful theory it did not fully harmonize with all the peculiarities exhibited by the normal currents, so that other explanations and theories had to be sought more in accordance with the facts observed.

Now it had been noticed whenever a number of readings were simultaneously taken on different wires and reproduced in a graphical form, that there was usually a very remarkable correspondence in the contour of all the curves, which as a rule presented an undulatory or wavelike appearance.

It thus became evident that natural currents of electricity were regularly and continuously sweeping over the surface of the earth so that the fluctuations noted on any one wire afforded a sort of index of their features and variations on all other wires.

The characteristics exhibited partook somewhat of the nature of a regular rise and fall like the ebb and flow of ocean tides. This singular appearance suggested the idea of a lunar origin, and the experiments and observations that have been subsequently made appear to fully substantiate the correctness of that view.

It will not be difficult for you to form a sort of general idea as to the manner in which the differing positions of the moon in relation to the earth's surface affect our electrical atmosphere, inasmuch as the actions correspond in a manner with those of the tidal variations of the waters of the globe. Imagine for instance the electricity of the

* Paper read before the Brooklyn Institute of Arts and Sciences, Nov. 4, 1892.

air to be lifted up, so to speak, by the attraction of the moon, and dragged around by that body in its elliptical path around the earth.

Consider also that the earth by her rotation presents any given point on its surface to all parts of the lunar orbit during the course of a lunar day. Then, since the motions—either real or apparent—of the aerial electricity induce corresponding movements of electricity in the ground, it will be evident that places on the earth's surface directly opposite our satellite will experience high electrical tides, as well as all the other phases resulting from the circling motions and relative positions of the two bodies, and possibly also to the sun's position at any given time.

I shall presently show you a diagrammatic reproduction of some earth-current readings which were taken upon a portion of the Atlantic cable in 1857, and which very beautifully illustrate these electrical tidal effects. The submerged cable had parted in mid-ocean and was consequently useless for regular purposes, so the opportunity was seized to make tests of earth-current fluctuations and analyze the results. A galvanometer was inserted in the grounded cable at the Valentia end of the circuit where the direction and strength of the earth currents were noted about once every 15 minutes for a period of 36 hours. The readings thus obtained are reproduced in the form of curves in Fig. 2 which, when compared with the diagonal tidal curves for the corresponding period present coincidences so very significant as to leave little room for doubt that the same cause was concerned in both effects.

Not the least interesting feature of the normal currents is the fact that it is possible by a study of their variation and directive curves to discern the existence of temporary local disturbances, such as might be brought about by earthquakes, chemical action, compression or expansion, etc., and to define the area over which they extend and the time for which they last.

* * * * * * *

To what particular cause or series of causes these local disturbances may be due is a question to which at present no definite answer can be given.

I have tried, but not very successfully, to associate them with electric light and power currents.

They certainly do not arise from leakage or induction from neighboring wires, for just as soon as the distant ground is detached from the wire the earth currents vanish.

Is it possible that in addition to the chemical or physical agencies previously suggested, there may be earth currents generated from meteorological causes, such for example as might be supposed to result from the violent motion of immense bodies of water across the terrestrial lines of magnetic induction? It is well known that whenever a conducting body cuts across a field of force an electric current is set up in the conductor. In an electric-light system, for instance, the currents are generated in the dynamo machine in virtue of the electromotive forces induced in the moving armature during its passage across the lines of force produced by the field-magnets.

Now the earth is known to act very much as though a huge magnet were thrust through the centre of the earth.

Between the poles of this imaginary magnet a field of force extends whose magnetic lines of induction are indicated at any place on the earth's surface by the inclination of the dipping needle. Their direction through the atmosphere of this room, for instance, may be likened to a shower of rain falling at an angle of about 72 degrees. It is possible to generate a current in a coil of wire by simply moving it across this terrestrial field of force so as to vary the number of imaginary lines enclosed by the coil.

While in Buffalo some years ago I found that even the running water of the Niagara river which cuts the earth's lines of magnetic force at a certain angle, was capable of producing weak currents in one of the telegraph wires that spanned the river at the point of its greatest velocity.

You will have no difficulty therefore in conceiving the possibility of the waters of the ocean, during exceptionally stormy weather, giving rise to comparatively stronger currents.

In the distribution of these currents some would undoubtedly find their way into telegraph lines at remote points, and might thus serve as bad weather indicators.

In this connection I may mention that I have frequently noted exceptional variations in the value of earth currents at times when the weather was remarkably clear at the place of observation but unusually stormy at sea during corresponding periods, which information was subsequently acquired through the reports of captains of incoming vessels, etc.

There may of course be nothing more than mere coincidence in this, and I simply mention the circumstances to show the possibilities in the case; but there are undoubtedly many features about the study of earth-current phenomena that possess practical as well as theoretical points of importance if they could but be properly followed up. In certain volcanic regions, for instance, earth currents have been utilized to give warning of impending danger from subterranean outbreaks which manifest themselves by affecting telephonic or other electrical apparatus.

Through the agency of earth currents it is always possible to foretell the advent of the aurora borealis, and in this way they may become serviceable to science.

A systematic course of observation at places widely apart would render possible the construction of a map of the world, or any section thereof, showing the places through which the equipotential lines pass during times of periodic disturbances either of solar, lunar, or terrestrial origin.

The curves thus drawn might prove as advantageous in their way to telegraphy as the isobar and isothermal lines have proved useful to meteorology, or the isogonic curves in navigation.

The general phenomena of earth currents are but imperfectly understood at present; but their effects are so universal and so important to science that it does not require an extraordinary stretch of imagination to conceive the possibility of an extended application of these currents to useful purposes at some future time. With some such prospect before us, and in view of the many remarkable applications of electricity in recent times, why may we not indulge the hope that further study and investigation may yet evolve consequences that cannot even be suspected at the present time?

PRIZE OFFERED.

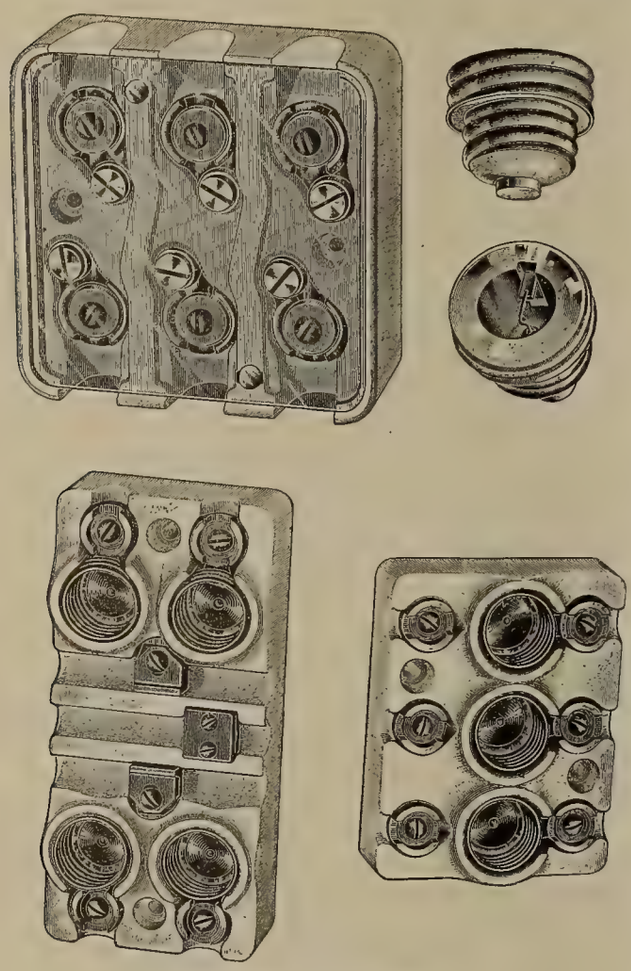
A prize of 3,000 francs has been offered by Baron Leon de Lerval, of Nice, to the inventor who shall produce the best portable apparatus for the use of deaf persons constructed on the principle of the microphone. Competitors must send their instruments to Prof. Adam Politzer or Prof. Victor Von Lane, Vienna, before December 31, 1892. The prize will be awarded at the Fifth International Otological Congress, at Florence, in September, 1893.

PERSONAL.

Mr. Frank R. Ford has been appointed agent in charge of the Chicago offices of the Short Electric Railway Company, of Cleveland, Ohio, with headquarters in the Monadnock Building, in place of Mr. Alex. Kempt, who has resigned.

IMPROVED CUT-OUTS.

Improvement in the manufacture of the smaller electrical appliances keeps pace with that of the larger and more important devices, each moving toward perfection. We here show some improved pieces of wiring apparatus, which the General Electric Company has just brought out. The old-style porcelain plug and link cut-outs have disappeared, and the new ones here shown take their places as substitutes of greater efficiency. They are made of hard, white, thoroughly vitrified porcelain, impervious to moisture, and impassible to the electric current, the metal parts possessing all the qualities necessary to render them electrically efficient. The plug cut-outs are designed to protect a circuit having a maximum current of 30 ampères at 125 volts. The fuse is carried in a small glass plug, cased and covered with brass, which



IMPROVED CUT-OUTS.

is screwed into a brass screw-socket in the body of the cut-out. Should the fuse blow, the defective plug can be instantaneously replaced without tools of any kind.

In the link cut-outs, the fuse is a safety-link with copper terminals. The binding screws and wire terminals are set well below the surface of the cut-out, and are protected by suitable sheet-mica covers.

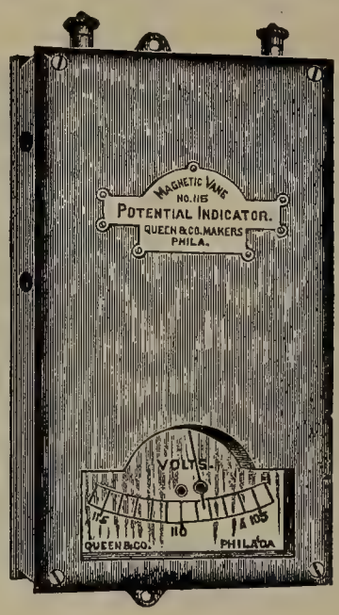
The porcelain of which these cut-outs are manufactured is itself made by the General Electric Company at its own porcelain factory at Schenectady, established in order that the quality of this important material should be of the highest possible standard.

We have received a copy of the report of the proceedings of the Convention of the National Electric Light Association, held at Providence, R. I., Feb. 17, 18 and 19, 1891. It is a very neat piece of work.

QUEEN'S POTENTIAL INDICATOR.

We illustrate herewith a new potential indicator which Queen & Co., of Philadelphia, are placing on the market. It is built upon the general plan of their Magnetic Vane Voltmeter, and is mounted in a handsome mahogany case with open scale divisions, so that very close readings can be made.

No permanent magnets or other parts which change with age are used in construction, so that constancy is assured. This is a very essential feature, as most instruments require frequent calibration—an item of considerable expense as well as annoyance.



POTENTIAL INDICATOR.

The indicators as kept in stock are adjusted for 110-volt circuits, but special ranges will be made to order. They are adapted for isolated plants and central stations.

Queen & Co. are just issuing circular No. 395, which contains prices and full particulars.

THINGS WORTH REMEMBERING.

The following abstracts from the report of the committee on "A Model Electric Street-Railway Roadbed and Underground Wiring," which was made at the Cleveland convention last month, contains valuable information worth keeping for reference.

"We have heard of instances being cited where copper wire laid underground was more susceptible to electrolysis than that of galvanized iron or steel; but after a thorough trial of upwards of three years, during which time we have used both, the conclusion reached is that copper, being not only a better conductor but less liable to corrode and break, is therefore the best wire to use for underground work. Galvanized soft steel or iron wire used for this purpose has not proved durable, and we have found the same to be entirely eaten away by electrolysis where it had come in contact with the cross-tie, and in perfect condition elsewhere."

* * * * * * *

"By a careful examination of the ampère meter at the power-house during dry weather, compared with that of rainy weather, it will be noticed that there is a marked decrease in the amount of current used in favor of the latter; hence it follows that the more connections to the rail and the opposite poles of the generator with the moist earth the more economically is the system operated. It must also be remembered that the increased saving in current in wet weather over that of dry

weather is not attributable to the increased moisture of the earth alone, but to the fact that the dust and dirt, which readily finds lodgment on the rail, is washed off, and many roads now in operation by electricity have found the use of a car equipped with a tank having one down-spout, about 5/8 inch in diameter, on each side, so arranged as to permit a stream to flow over the head of each rail, most advantageous. These down-spouts should be located as near the wheel as possible, in order to insure the same being directly over the rail at all curves, as well as the straight track."

* * * * * * *

"The mistake is sometimes made in designing and equipping a new road, or in changing from animal traction to electricity, of neglecting the track construction by apportioning the amount to be thus expended to such a sum that, in order to make both ends meet, it becomes necessary to weaken that portion of the investment where, above all others, strength and permanency are required."

* * * * * * *

"The switches, or cross-overs, should be located at such points along the route as will best provide for the following contingencies: bunching cars for large gatherings, and to insure the constant operation of cars during fires, parades and all other blockades when, from any cause, the terminus of the road cannot be reached. They should never be placed with the switch point against the traffic, and, preferably, on up grades, thus enabling cars to cross to the opposite track by gravity."

* * * * * * *

"The fact should be borne in mind in the selection of cross-ties, not only to keep in view the selection of such timber as is calculated to insure the longest life, but due consideration should be given to the particular kind that will best hold the spike; and for this reason the white oak possesses advantages that should merit its consideration."

* * * * * * *

"The requirements of a rail for electric traction are strength, joint connections, durability. In some localities there are municipal requirements specifying what the head of the rail shall be.

"For strength we rely chiefly on the weight of the rail and the thickness and depth of the web.

"For joint connections that rail which affords the best method of keeping both ends of the rail in perfect alignment is the best, and as the girder rail possesses peculiar advantages in this respect its almost universal adoption is due to that fact.

"For durability we depend on the height of the head of the rail at the gauge-line over the lower flange, and the quality of the metal."

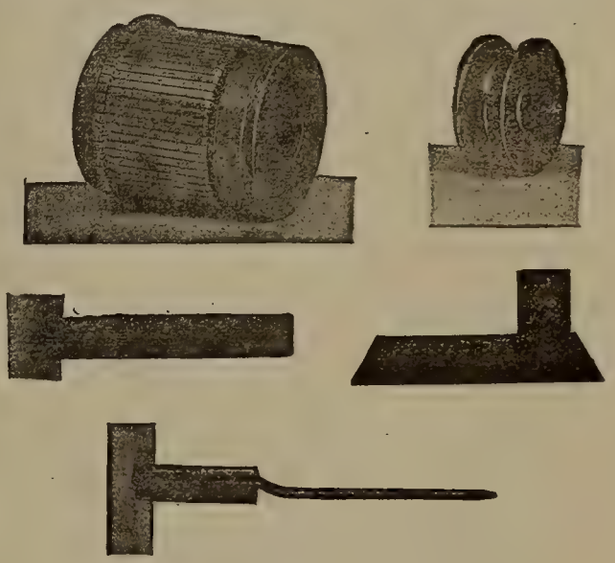
THE EUREKA TEMPERED COPPER COMPANY.

When the representative of the ELECTRICAL AGE called at the works of the Eureka Tempered Copper Company, North East, Pa., they were just finishing a line of tempered copper tubes with flanges 8½ inches inside, 10½ inches outside, and 3 feet 6 inches long, and one of the special commutators made by this company was being put together in the special assembling-room, tempered copper and mica insulation being used throughout.

The works of the Eureka Tempered Copper Company occupy two acres of ground, and so great is the volume of its business that the works are kept going night and day. The machine-shop and finishing-room are very large and commodious. The dimensions of the moulding-room, which was formerly 50 x 140 feet, have been considerably increased, and the melting-room has been enlarged from 24 x 36 feet, with 8 pots, to 60 x 72 feet, with 24 pots. A new smoke-stack has been built 100 feet high and lined with special brick, as are also the melting-pots.

There are 28 men employed in the moulding-room, each man doing his own particular work with the aid of helpers. Only pure Lake Superior copper is used, and at the present time the company has 75,000 pounds of unpacked copper on hand. One man goes through the moulding-room emptying the flasks, and another takes the castings to men in the gate-rooms, where the gates and ridges are cut off by a Miller's Falls Company's power hack-saw.

In the rolled sheet and rod copper room a large quantity of metal in these forms is constanly kept on hand for the manufacture of brushes. A Riehle Bros."



EUREKA TEMPERED COPPER GOODS.

testing-machine is used for testing the tensile strength of the copper. The company always has on hand a supply of tempered brushes for all systems.

Natural gas is used for lighting the works, and the company furnishes power for operating the lights in the town of North East, which are those of the Weston system of arc lighting.

At the present time the company is busily engaged in making 60 tons of commutator sections, etc., for the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa.

The Eureka Tempered Copper Company is sole manufacturer of pure tempered copper journal bearings, electric commutators, commutator segments, brushes, rolled goods, and copper castings of all kinds.

Alfred Short is general manager of the company, and the directors are: Chas. H. Strong, L. Merket, John C. Brady, Almer Thomas and Alfred Short.

INCORPORATIONS.

Browne Telephone and Telegraph Company, of Chicago, Ill., capital, $5,000,000.

Delaware Avenue Electric Land Company, of Buffalo, N. Y., capital, $115,000.

Suburban Electric Light and Power Company, of St. Louis, Mo., capital, $10,000.

Hyndman Electric Light, Heat and Power Company, capital, $150,000.

North Shore Heat, Light and Power Company, of Chicago, Ill.

Atchison Electric Motor and Street Railway Company, Atchison, Kan., capital, $500,000.

Cripple Creek (Col.) Telephone, Electric Light and Power Company, capital, $100,000.

Standard Glass Insulator Company, Portland, Me., capital, $1,000,000.

ELECTRIC RAILWAYS.

At the meeting of the American Institute of Electrical Engineers, held at 12 West 31st street, New York, October 25 last, a joint discussion was held on the papers read at the general meeting of the Institute, Chicago, June 8 last, on "Series Electric Traction," "A New System of Electric Propulsion," and "Electric Railway Motor Tests."

Dr. Cary T. Hutchinson opened the discussion. Referring to the last-named paper, he said:

"He [Professor Shepardson] speaks of the comparative value of the rheostat and 'commutated field' methods of regulating. There have been two other papers published recently, one by Mr. Thorburn Reid, the other by Mr. Wellman, touching on that subject. Mr. Reid says the motor with the commutated field is much more efficient; Mr. Wellman says it is not. I rather wished to be convinced that Mr. Reid's argument was right; but I confess I could not understand it, and I could not make much more of Mr. Wellman's.

"This matter has been argued back and forth for more than three years, but in this time no one, apparently, has thought of appealing to experiment to settle it. It seems to me that the matter can be definitely decided very simply, and to this end, that we may hear no more of the subject, I have prepared the following table showing the the case of

"COMMUTATED FIELDS *vs.* RHEOSTATS.

C.	Position.	S.	$\phi 1$	$\phi 2$	$\phi 3$	$\phi 1 - \phi 3$
20	VII.	9.1	84%	..%	84%	0%
20	IV.	6.3	69	63	60	9
20	I.	4.4	50	44	42	8
15	VII.	10.6	83	..	83	0
15	IV.	7.3	73	64	61	12
15	I.	5.4	59	48	45	14
10	VII.	13.3	78	..	78	0
10	IV.	8.8	75	63	60	15
10	I.	7.0	66	50	48	18

"Here ϕ_1 is the efficiency of a No. 6 Sprague motor for the various current values and corresponding speeds taken from my tests referred to above; values are given for the three switch positions: ϕ_2 is the electrical efficiency with rheostat for the same current and speed. This is calculated by reducing the E. M. F. of the motor in proportion to the reduction of speed. The efficiency $_2$ is then the ratio of the reduced E. M. F. to 500. This of course takes no account of hysteresis, eddy current and friction losses. Putting these all at five per cent., *e.*, taking 95 per cent. as the efficiency of conversion from electrical into mechanical energy, we get the column for $_3$; that is, $\phi_3 = .95\ \phi_2$.

"It will be seen that in every case the commutated field method gives an efficiency higher even than the electrical efficiency with rheostat, and much higher than the best probable value of the actual efficiency.

"This comparison is made with the same motor and involves no element of doubt. There can be no question that with these motors the commutated field is the more efficient, and it is very clear to me that it must always be so."

After fully discussing the paper of Mr. H. Ward Leonard on a new system of electric propulsion, Dr. Hutchinson concludes that its disadvantages are:

Increased cost of total equipment per car.

The adding of two additional machines, with the consequent increased cost of repairs, depreciation and maintenance.

The greatly increased weight of the car, with the consequent increased power required.

The very small saving over commutated field regulation, due to the low efficiency of large machines lightly loaded;

And, greatest of all, sacrifices of simplicity.

The advantages are:

Excellent speed regulation.

Ability to return energy to the line.

Ability to use electric braking.

DR. EMERY—I wish to ask one question before the subject changes. I understand that series parallel, or series multiple traction is pretty well covered by patents. If my information is correct I do not see how the various applications spoken of by the last speaker can be made by engineers generally and will be pleased to hear the statements of others more fully informed on the subject.

MR. SPRAGUE—If I can depart from the chair for one moment I will make one reference to this subject. The series system was tried at Richmond five years ago. Twenty cars were fitted with multiple series switches used with the commutated fields. They worked perfectly so far as increased torsional effort, the slowing down of the machine, and all that, was concerned. The method was not patented. Where it failed was when on heavy grades the attempt was made to run the machines in series, and to start on a slippery track. In that case, if there was slipping on one portion of the track on account of ice or sleet or for any other reason, one motor would begin to race and the other motor would slow down. The claims made for series multiple regulation have afforded me a good deal of amusement. As to the effectiveness there is no question, but the series multiple system, when running at full service, will make little difference in the coal burned. So we simply threw away our series multiple switches and ran our machines invariably in multiple. The action of two machines in series is easily understood. Of course, the total counter-electromotive force built up is the sum of the counter-electromotive forces of the two motors, and if one runs fast the other must necessarily run slow, so that sometimes we had one running one or two hundred revolutions a minute and the other standing dead still.

Referring to Mr. Nelson W. Perry's paper on Series Electric Traction, President Sprague said:

"The series system of electric propulsion is absolutely dead. Every now and then an attempt is made to revive it. It has been tried on one or two roads in England. It has been tried on one or two roads in this country; but if I may make reference to Mr. Short's own work, his experience has been a suggestive one. He started five or six years ago on the series system in Denver and elsewhere, and about four years ago in West Virginia. It is dead. And then he went on to the double-wire multiple-arc system overhead, as did the Thomson-Houston Company in Cincinnati to accommodate the local requirements of the telephone interests, and that plan is practically dead, and we have come, on the five hundred railroads in operation in the United States and elsewhere, to one single method of operation—a multiple arc system of distribution with a single wire overhead—and that is where we will stand. I have no hesitation in putting myself down as a prophet in some of these matters. There have been great advances made in the last three or four years in electric railways. My own connection with them for the past two years has not been active. I am now going into a different class of work. But while there have been improvements in price and improvements in mechanical applications, more perfect machinery, greater interchangeability of parts, there has been little if any increase in the actual economy. Four years ago forty cars were running on the Richmond road with engines of 375 horse-power, in other words, nine horse-power per car at the central station. Every car on that line was doing all that it could

do. We have in fact retrograded in some respects, and the number of accidents which are to-day cited, sometimes justly and sometimes unjustly, in opposition to the trolley system, is due in a large part to turning backward, and to the additional complication of apparatus. The plan which seemed to me to be the proper one was to give the man who ran the car as little as possible to think of. All that he should be required to do is to move a lever—as small as convenient—one way to go ahead and to pass through all the gradations of starting, increasing the speed, going at full speed, and by reversing that movement by a single stroke of the hand to pass through the retrogression of those changes, to reverse his machine and to run in the opposite direction. That plan has been abandoned. Two levers must now be used, and many a life has been the forfeit. The demands of street-car service have continually increased. We can no more creep up a five per cent. grade at three miles an hour to-day than we can put a horse on the car to pull it up. The schedule time of roads will not permit of that operation. At first it was 15 horse-power to a car; to-day it is 20, 30 and sometimes a 40 horse-power equipment. Why? Not because of the requirements at starting, but simply because when running at the full speed at which the machine will run when loaded, with the cars, with the trucks, with the passengers carried, the motors are required to do that amount of work when working under the highest possible efficiency for which they are built. We cannot go back."

Regarding Mr. Leonard's paper, Mr. Sprague said:

"Independent of any possible merits of the plan, there are, I am sorry to say, many inaccuracies; some have been pointed out by Dr. Hutchinson, and there are others which Mr. Leonard himself may notice in looking over his notes. There is much assumed in the matter of economy, but when we consider the time limit involved in starting, I unhesitatingly assert that the amount of coal burned in the central station will be fully as great, if not greater, by this plan, than with the system of direct supply, because of the amount of energy needed for the continuous rotation of the power converter.

"He has made one reference to elevator work. It is an unfortunate allusion. An elevator is in some respects the hardest sort of railroad service. I have a record made over a period of about eleven months on an elevator driven by a motor which is a compound machine, governed purely by a rheostat. This motor runs for ten hours a day. It is a very fair example of good elevator service so far as the element of time is concerned. It stops at five floors of a building, carries both freight and passengers, and is practically in continuous service. Its operation is much more continuous than very large numbers of hotel elevators and many office-building elevators. That record shows that for ten hours duty a day there is used at the terminals of the motor the equivalent of about 100 ampères at 240 volts for one hour. These are from meter records, and meters were never known to lie in favor of the customer. We run about 250 feet a minute, stopping at every 10, 20 or 30 feet, and oftentimes running slow. There is not used in the rheostat itself over ten per cent. of that energy; that is, 10 ampères at 240 volts for one hour. An elevator of that lifting capacity, if driven on a three-motor scheme, would have to be supplied with a motor and dynamo of at least equal capacity driven by a motor of about 30 horse-power. Two of these machines would normally, of course, have to run all the while. Of the size specified, they could not be run from a 240-volt circuit for less than about 15 ampères. Consequently we have the equivalent of 150 ampères at 240 volts for one hour. In other words, for the system of regulation alone to take the place of the rheostat, there would be used 150×240 watts against a total present use of only two-thirds of that, and against a use of one-fifteenth part of it for the rheostat. So I say this is probably a clear illustration of how the time element enters to continually cut off the efficiency of the system where you have anything that runs continually."

Mr. H. Ward Leonard: "I think that never since I first thought of this system of regulation have I felt quite so much encouraged as this evening, for after having had my figures, for several months at any rate, and having examined them, that Dr. Hutchinson should find that I only claimed 97 per cent., and when he is willing to grant that it may possibly be 20 per cent. and upwards, it shows me that I have something to work for, and with the possibility of success. The fact, joking aside, in regard to the question of efficiencies, is that quite accurate tests have been made of the system by a concern so well equipped for making tests as Wm. Sellers & Co., of Philadelphia, and that the efficiencies shown by the tables in this paper have been quite well borne out. I may say, while I am on that subject, that the losses in the fields and the friction, and the Foucault current and hysteresis losses which I have assumed, are derived principally from the tests of the Franklin Institute, and are also checked by the data of the test averages of the Edison dynamos, and I think they will bear the closest scrutiny. As regards the figures I have given in the tests, Dr. Hutchinson has pointed out one or two apparent errors, but I think it is due to a misunderstanding of one or two points by him. One point which he spoke of was the impossibility of having a central station equipped with only six horse-power per car, when in one of the most favorable cases he figures out eleven and a half horse-power as required by a car. Without stopping to check that figure, I would say that I did not intend that six horse-power in the central station would be enough if every car were in operation simultaneously at its full power, but that six horse-power per car would be an average figure, some of them being at rest or going slowly, and some coming down grade, under which conditions they would assist the central station.

* * * * * *

"As regards the depreciation of machinery, which I find I have made a memorandum of, there is, apparently, three times as much depreciation in three machines as in one; but when two of those machines are placed out of the influences which are the principal cause of depreciation, and when the third one is in a condition such as to have a minimum of sparking and a minimum of heating of its field, and when the motor generator portions are also under the best conditions as regards sparking, etc., such will not be the case. The fact is that in practice the operation of the system shows that the machinery requires almost no attention. And I know of instances in which electric elevators, which as Mr. Sprague has pointed out represent the worst kind of street-car service, have been in operation for three or four months at a time without the slightest attention of any kind whatever. They have self-oiling bearings, and being entirely sparkless, they have had no attention whatever for months at a time.

"The importance of a single lever rather than a multiplicity of things to handle on a street car has been touched upon both by Mr. Sprague and Mr. Mailloux in a rather forcible manner, and I call attention to the fact that in this system there would be but one lever which would accomplish all the changes of speed in either direction, and also apply the brakes, as the production of energy and the restoring of energy to the line is the braking action for the car, and under any normal use of the system no mechanical brakes of any kind would be used, and the instance cited by Mr. Sprague of something on the track which makes reversal necessary can be dealt with by this system with the greatest of ease and the utmost rapidity. * * * * One of the best points in connection with the system, in my opinion, is the ability to restore energy to the line, in coming down

grade or stopping, and what follows directly from that, the stopping of the car by an electric brake, which is not only an electric brake in the sense of being operated by electricity but a brake which is an efficient means of stopping the car. It is the only brake I know of which will enable one to stop a car from its full speed down to a dead rest, and at all times during that period the application of the brake causes a positive saving on the system by the production of energy to assist in operating other devices."

HEADQUARTERS OF THE BROOKLYN CITY R. R. CO.

If fine buildings are evidence of prosperity then the Brooklyn City Railroad Company may properly be included among the successful concerns. Its new executive home, at the corner of Montague and Clinton streets, Brooklyn, is one of the handsomest edifices in the city, and we give herewith a view of the building made from a photograph.

Above the main floor the walls are built of old gold brick, while below iron is used. The interior finish of the building is very elaborate and artistic. The building is fireproof throughout, being constructed on the Guastavino system. The first or main floor is entirely occupied by the offices of the railroad company, and part of the second and top floors are also utilized for various purposes by the company.



BROOKLYN CITY R. R. CO.'S BUILDING.

Otis elevators run to the top of the building and electric light is supplied from the Edison street mains. The building is wired on the three-wire system and the work was done by the Tucker Electrical Construction Co., of New York, about 25,000 feet of wire being used for the purpose. Interior conduit tubing is used throughout, and where the tubes were run through cement they were first surrounded by plaster of paris. The wire used is the best Grimshaw white-core, with outside fireproof braid. There is only one wire in each tube. There are 400 outlets in the building, and 600 lights—three Edison lights to a room.

Separate riders were run to supply the lights in the public parts of the buildings, such as the halls, etc.

The electroliers and fixtures were furnished by the W. C. Vosburgh Mfg. Co., of Brooklyn, and are of artistic design.

The Tucker Company also wired the building for the telephone service for the New York and New Jersey Telephone Co. A large tube runs from the cellar to the top of the building, in which the wires are run, and at each floor branches are run to each office. A complete hall-bell system is also installed, the wiring being done by the Tucker Company.

The beauties of the building are brought out in strong relief by the agreeable surroundings, and probably few street-railroad companies in this country can boast of such elegant headquarters. Mr. A. W. Ross, of Brooklyn, was the architect of the building, which cost about $150,000.

THE WEST END STREET RAILWAY COMPANY.

The following excerpts from the annual report of the West End Street Railway Company, of Boston, for the year ending September 30, affords an excellent opportunity of comparing animal with electric traction, as that company operates both systems on a very large scale. Financially the report is eminently satisfactory, the results, however, being largely in favor of electric traction, which is to be ultimately adopted throughout the entire system.

The net earnings were $1,839,422, which, after the deductions of fixed charges of $509,701, left an available balance for dividends of $1,329,720. The dividend charge of $1,323,362 reduced the amount carried to surplus account to $6,358. Of these amounts 53.39 per cent. came from electric and 46.61 per cent. from horse cars. The miles run during the year were 17,498,660, made up as follows: Horse, 8,988,377; electric, 8,510,293. Whole number passengers carried, 126,210,781.

By Jan. 1, 200 cars will be added, bringing the electric mileage up to 16,000,000 miles a year. It is expected that power-houses will be completed by Jan. 1, giving dynamos sufficient to supply all demands for power. Up to the present time, said President Whitney, the company has really had little advantage from the large engines, owing to the fact that until Oct. 1 but one of them had been delivered. Of the 25 large dynamos to be delivered, eight have so far been received.

The growth of the business from Cambridge, Charlestown, Somerville and Everett, which places are supplied by power from the Cambridge station, may make it necessary and advisable within two or three years to add another engine or some dynamos to that station. Provision has been made for this in the original plans, and the cost will be comparatively small. With this possible exception the power provided would appear to be ample for many years to come. Large sums have been spent upon the tracks during the year, preparing them for the extension of the electric system. By Jan. 1 all the tracks in regular use in the city proper will have been rebuilt. With the larger proportion of the road electric the remainder may be rebuilt gradually as the growing community may from time to time require.

The year 1893 should see the substantial closing of all the construction or reconstruction work. From January, 1894, all future expenses connected with existing lines should be borne by the surplus earnings as a credit to depreciation account. The earnings of the electric system over that of horse-power for the last year show an average difference in favor of electric of 10 cents a mile, the average earnings of electric per mile being 15¾ cents, horse about 5½ cents. The expense by the new motors is only 1 cent a mile, while by the old ones it required 3 cents a mile, hence the great saving to be made in the future by the purchase of the new dynamos.

In conclusion President Whitney said he felt that with

the saving in expenses by new dynamos of the electric increase of earnings over horse-power, together with the remarkable results of last year, from which to forecast, the future should show an increase of $1,000 a day in earnings.

The following directors were elected: Henry M. Whitney, G. T. W. Braman, Prentiss Cummings, Eustace C. Fitz, Walter Hunnewell, Samuel Little, Theophilus Parsons, Nathaniel Thayer, Isaac T. Burr, Joseph S. Fay, Jr., Henry D. Hyde, E. D. Jordan, William Powell Mason, Dexter N. Richards, Walter S. Swan.

PROTESTS FROM THE ELECTRICAL CO.

Protests are being made in the electrical trade against the decision of the board of directors of the World's Fair to close the exhibition at 7 P.M. each day. Many electrical exhibitors had made plans to pay particular attention to the night exhibits, when the best electrical effects can be produced, and, it is said, that it was generally understood that the gates would be kept open until 10 or 11 o'clock each night. Pressure will be brought upon the board with a view to having this rule changed.

STORAGE BATTERIES.

The secondary battery absorbs and stores energy electrically transferred to it.

The passage of a current of electricity through the dilute sulphuric acid between the plates of a secondary cell decomposes that liquid into its constituent elements, oxygen and hydrogen. In this manner the positive plate or plates become oxidized and the negative plates hydrogenized, the capacity of the oxygenation being equivalent to the storage capacity of the secondary battery. When pure lead is employed for the electrodes the process of oxidizing is very slow before an appreciable return can be obtained, and the cells have to be frequently reversed in charging to make the positive plates spongy by hydrogenizing them, so that the degree of oxygenation may be greater at the next reversal and the capacity of the cell increased.

This process is called "forming" and when completed the accumulator so made is more satisfactory than when an oxide is used in the form of a paste. Red lead, or litharge, are the usual oxides of lead that are employed. It is pressed in the form of paste into a grid, or frame, several of which are arranged alternately and coupled in parallel within a water-tight box to form a cell. The storage capacity depends upon the area of the lead surface immersed, and the internal resistance upon the distance that separates the plates. The internal resistance is reduced by placing the plates closely together, using strips of glass, or other insulating material, to separate them.

The process of forming is considerably curtailed when there is an oxidized and spongy surface to start with.

Re-charging a *completely* discharged accumulator produces no other visible effect than to slightly disturb the liquid; but when the storage capacity is nearly attained, bubbles are freely given off, caused by the evolution of hydrogen gas. A discharged accumulator should be immediately re-charged, as the sulphate of lead formed by the action of the sulphuric acid upon the non-active surface of a discharged cell is injurious.

Owing to the discharge of a conductor in Columbus, Ohio, who had refused to receive a mutilated dime from a passenger, all of the conductors and motormen employed by the Columbus Street Railway Company went on a strike on November 8.

NOTES OF GENERAL INTEREST.

The contract for the erection of the new electric-light works at Marlboro, Mass., has been awarded to J. I. Aldrich.

Every effort is being made by the Standard Construction Mining Company, of Bodie, Cal., to have its electric-power plant in working order by December 1.

Messrs. M. G. Elmore and C. B. Greene, of San Francisco, have been granted a franchise by the Marin county board of supervisors to erect an electric-light plant at Saucelito, Cal.

Arrangements are being completed by the American Electric Company, of Philadelphia, for the erection of an electric-light plant, water-works, ice factory, etc., at Morrillton, Ark.

The trustees of Rutgers College, New Brunswick, N. J., have conferred the honorary degree of E.E. upon Clarence L. Edgar, class of '82, general manager of the Edison Electric Illuminating Company, of Boston.

Messrs. C. F. Annett and W. G. Van Horne have applied to the city council of Salt Lake City for a franchise to operate an electric plant within the city limits for the purpose of supplying telephone service, electric light and power.

It is reported that rapid progress is being made in the construction work on the St. Louis and Chicago electric railway. It is stated that over one-half of the right of way has been secured, and that hundreds of men are employed on the line.

At a recent meeting of the electrical committee of city councils, at Philadelphia, an appropriation was made for the extension of the city's underground conduit system through a number of streets. Several applications for increases of salary of various employés of the electrical bureau were approved.

Mr. A. W. Decker, who was until lately connected with the San Antonio Company, has accepted a position with the Redlands Electric Light and Power Company, of Redlands, Cal., as supervising engineer. The company expects to have everything in readiness to supply light and power by July 1 next.

About December 15 next the new iron lightship will be placed in position off Cornfield Point, Long Island Sound. This vessel will have the distinction of being the first lightship whose lights will be operated by electricity. The ship will have a duplicate dynamo plant so as not to be wholly dependent upon one.

A semi-annual dividend of 25 cents per share on series D has been declared by the Thomson-Houston Electric Company, of Lynn, Mass. The company has purchased a lot of property in Peabody and will erect thereon dwelling-houses for their employés at West Lynn. Property has also been secured at Pleasant Hills for a similar purpose.

While Hiram McIlvaine, of 55 N. Second street, Camden, N. J., was repairing an electric-light wire at Eighth and Cooper streets, Philadelphia, he received a shock from the current and was instantly killed, his body falling to the ground. As his hands were found to be badly burned, the belief is that he had lost his balance on the pole and grasped the live wire to recover himself.

San Francisco and Monterey capitalists have organized a company under the title of the Pacific Grove Electric Light and Power Company for the purpose of constructing a plant for the illumination of Pacific Grove with electric lights, and also to furnish power for the propulsion of an electric railway between Monterey and Pacific Grove. Work on the erection of the plant will be commenced without delay.

A clause in the contract between the Edison Electric Light Company, of North Plainfield, N. J., and the borough for the lighting of the street provides for a double rebate for every unlighted lamp. During the past few weeks there have been a large number of unlighted lamps and the borough officials will enforce the penalty, deducting the amount from the company's bill as an incentive to secure good service.

At a recent meeting of the board of electrical control, held in the mayor's office, New York, permission was granted the Edison Illuminating Company to build ten short sections of subways in certain streets. The board refused to consider an application from the same company for a subway in Fifth avenue from Fifty-eighth to Sixtieth street. Electric lighting companies have been notified by the board to take down their poles in a number of streets.

Many complaints have been made by the residents of Baltimore of the failure of a large number of the electric lamps used for illuminating the streets to give light, a number of places being left in total darkness. Another complaint was that although the contract called for the lighting of the lamps when it was dark it is quite some time after darkness sets in before they are lit. Mayor Latrobe and Major Symington will hold a conference with the Brush Company to determine what plan to adopt to effect a remedy.

The operation of an electrical carriage in the streets of Chicago has suggested the idea that electric livery stables may be looked upon as one of the things yet to come. This is not the first instance of a carriage being propelled by electricity. In London, England, a similar experiment is going on with an omnibus ; and while in neither case has the scheme been proven a commercial success, the possibilities are highly encouraging. We have the electric light, electric railway, electric heater and cooking apparatus, and why not the electric carriage ?

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

Mr. R. S. Dobbie delivered an experimental lecture on " The Electric Arc " before the New York Electrical Society on Thursday evening last, November 10.

Mr. Dobbie began his remarks by referring to the discovering of the electric arc in 1810 by Sir Humphry Davy, and described the manner in which Davy showed the phenomena. He also explained the origin of the name " electric arc " and the misapprehensions arising therefrom.

Regarding the " crater " formed in the carbon, Mr. Dobbie said it varies in size and shape, the size being determined by the current and the shape by the E. M. F., other things being equal. The quality of the carbon itself had some influence in the formation of the crater. Broadly speaking, however, the greater the current the larger the crater, but if the E. M. F. is varied we find that while with small difference of potential we have a deep crater, with a larger value it becomes shallow, and if carried beyond a certain point, no crater is formed on the end of the carbon, the latter assuming a rounded appearance.

The substances used and methods of making carbons were touched upon briefly, and then regarding the " arc " Mr. Dobbie said: " That the arc is composed of vapor is, I think, very satisfactorily proved by the insignificant light we obtain from it, it being a well-known fact in physics that incandescent vapors do not radiate light in proportion to their temperature as solids." He then showed how easy it was to extinguish an arc by a puff of wind, and also showed the effects of a magnet upon the arc.

Mr. Dobbie next took up the subject of alternating-current arc lamps, in which the carbons are consumed equally. Owing to the rapid alternations the light was in reality a series of flashes, but so quickly do they follow each other that the human eye cannot notice them. There is as much light thrown up as down in the alternating lamp, in which respect it differs from the direct-current lamp, which throws most of its light down.

In concluding his lecture Mr. Dobbie referred briefly to the subject of regulators and lamp mountings, and projected on the screen pictures of many of the styles of lamps made.

The lecture was well illustrated by lantern-slides, the projection of the arc and the maintenance of the arc under water calling forth extraordinary applause.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

Prof. Wm. Main, of the Union Electric Co., New York, will on Friday, November 18, deliver a lecture before the department of electricity of the Brooklyn Institute of Arts and Sciences, on the subject of " The Application of Storage Batteries as Motive-Power on Electric Railways." The lecture, which will be given at 502 Fulton street, at 8 P.M., will be fully illustrated by apparatus and lantern photographs.

CHICAGO NOTES.

The Nuttall Railway Supply Co., 801–802 Monadnock Building, Chicago, is now permanently and comfortably settled in its new quarters. This company was recently organized in Illinois by the following-named gentlemen, whose official positions are also given : W. C. Groetzinger, president; P. H. Carey, vice-president and secretary; E. H. Harrison, treasurer; R. D. Nuttall and C. J. Mayer. The company will manufacture the best quality of street-railway supplies, and will aim to maintain the standard of excellence which characterizes the goods of the R. D. Nuttall Co. This company is said to be the only one in Chicago and the West carrying a stock of railway motor repair parts, for all systems.

Mr. P. H. Carey took an order at the Cleveland convention for the R. D. Nuttall Co. for 200 cast-steel T.-H. single-reduction gears from Mr. Pearson, of the West End Street Railway Company, Boston. The Nuttall Company's goods are so well known throughout the country for their excellence that their mere name disposes of them. The Chicago house will no doubt find plenty to do in its new field.

MONTREAL NOTE.

Mr. H. A. Everett, the managing director of the Montreal Street Railway Company, which is converting its system into an electric one, has announced that the company will build one hundred sleds to be used in removing snow from the track, the idea being as soon as snow falls to employ one thousand men to shovel it into the sleds. In addition three powerful sweepers and a scraper will be used. Mr. Everett believes that in this way he will be able to keep the tracks sufficiently free of ice and snow to operate the line continuously. As no difficulty has been experienced in operating the cars in Ottawa during the winter season, where the snowfall is equal to that of Montreal, the latter city should also be able to do so without any great trouble.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, November 12, 1892.

JOHN C. FRANCIS, manufacturer of electrical goods, is located at Room 75, 52 Broadway, where he will be pleased to receive callers and furnish estimates on anything in his particular line.

IT is reported that the Electrical Union of New York has incorporated the Co-operative Electrical Construction Company, with a capital of $100,000, and will compete against the combined organization of employers.

THE MATHER ELECTRIC COMPANY, through its New York office, 97 Nassau street, sold during the week ending Nov. 5 one 150-light and one 350-light dynamo to Messrs. Hahne & Co., Newark, N. J., and one 10 H. P. motor to C. H. Jones & Co., 114 Fulton street, New York. The company has closed the contract to furnish the dynamos, motors, switchboard, etc., for the new Herald Building.

THE electric-light plant of the cruiser "Cincinnati," which was launched at the Brooklyn Navy Yard last Thursday, will consist of two dynamos and two engines so arranged that either dynamo can be connected with any or all of the incandescent or arc-light circuits. They are to make 400 revolutions per minute to deliver an electromotive force of 80 volts and have a capacity of 200 ampères. The vessel will also be equipped with three Mangin search-lights.

H. M. LOUD, of H. M. Loud & Sons' Lumber Co., Oscoda, Mich., is in town. Mr. S. M. Leonard, the New York representative of the company, has his headquarters at room 308, 18 Cortlandt street. The Norway pine octagonal poles, plain cedar poles and cross-arms for telegraph, telephone, electric-light and street-railway purposes, also railroad ties, etc., manufactured by the above company are in general use throughout the country, and enjoy an immense popularity for their excellent quality. The company claims to make the best modern pole on the market.

MR. HERMANN AICH, 43 Murray street, manufacturer and importer of enamelled hoods for arc lamps and shades for incandescent lamps, reports that the demand for these goods in the United States is rapidly increasing. Large sales are being made to central stations, manufacturers of arc and incandescent lamps and contractors of both systems all over the country. These goods are very serviceable and worth a trial. They are made of the best sheet steel and enamelled. The enamel is practically indestructible. It never wears off, is a perfect reflector and resists the action of all kinds of weather.

AT a recent meeting of the New York city gas commission it was decided to place electric arc lamps in Ogden, Sedgwick and Lind avenues, and Wolf street. The number of lights in the down-town streets will also be increased. The Commission granted the Mount Morris Electric Light Company the privilege of lighting Park place, Greenwich and other streets in the lower section of the city on the condition that the current be supplied from underground wires. In the opinion of Public Works Commissioner Gilroy, New York is the poorest lighted city in the country, and that wherever possible gas should be supplanted by electric lights. The gas commission is evidently of the same mind, and adopted a resolution to have all streets supplied with subways lighted with electricity hereafter, when it can be done at regular rates. As it is, provision has been already made for the illumination of a very large number of streets with electric lights, and applications from a number of districts were referred to the commissioner of public works, to act upon at his discretion. The board will advertise for proposals at once, for both electric and gas lighting, the bids to be opened by the commissioner of public works on December 8. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	59 00
American Telegraph and Cable	14,000,000	100 00	87 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	116 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Chicago Gas	25,000,000	100 00	98 00
Commercial Cable Co	7,716,000	100 00	17 00
Cons. Gas Co., N. Y.	35,430,000	100 00	122 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	109 00
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	45 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	119 75
General Electric Co., 5s	4,000,000		*105
General Electric pref.	4,223,700	100 00	118 25
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	26 50
Laclede Gas pref.	2,500,000	100 00	73 25
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			140 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co	10,394,600	100 00	60 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	96 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co	30,000	10 00	9 50
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,300	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
Western Union	100,000,000	100 00	99 00
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	38 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

I wish to draw particular attention to the fact that all the New York dailies whose financial articles and regular quotations are of any value, took their text and made their argument and forecast on the day after election on the Industrials. This class of securities have for the past six months engaged the attention of the Exchange more and more. Lately several new combinations have been successfully floated, some being applied for several times over and the stock taking a place immediately among the dealings. Electrics held the lead part of the time and are still above par—both bonds and stock. It has been mooted, and now must be proved, that in the event of a change of administration a change would come over the scene, giving one the choice between becoming a bear or a bankrupt; that any considerable combination of capital or interests would be construed to mean a Trust, and that all Trusts, except those incorporated as such to act as trustees without interest in the amalgamation, would be declared illegal and forced to liquidate. But it is the unexpected which generally happens on the Stock Exchange, and nearly every stock went up after opening from a fraction to two points off and closed at an advance. Railways were dull as dishwater, brokers seeming to rest, expecting London to start the pace, but it was not started. Next, orders were expected from the West and failed to materialize; the result was the old story of "steady and firm." One writer puts it this way, which is about the size of it: "It is four months before Mr. Cleveland can be inaugurated. It will be many months after that before any decided legislation can be accomplished. Sugar and cordage are about the only Industrial stocks that are likely to be directly affected by tariff legislation, and they will have ample time to adjust themselves to the new situation." With everything of an electric nature the outlook is most promising. The business is so abundant that not even strikes can make any material trouble. When the linemen—and direct electricity requires lines and linemen in every instance—struck against the construction corporations in New York the last week in October, it is alleged the unions could not muster up men enough to do the work laid out for them. How can this state of things, which exists all over the country, help but increase the income of every company prepared to perform its duty? Yet every week there are opportunities for the investment of more capital, and it can earn more money in this line than in any other.

Electricity has not yet reached its first resting-place; improvements, new devices, new inventions and their application are of daily occurrence. It is only a decade since Edison, Brush, Westinghouse, Sheehy, Thomson, Bell, Swan, Short, Coffin and a few others began to mount the ladder of fame and fortune; they gained strength like the whirlwind and drew into their vortex scores of men who developed the requisite ability, and to-day they all enjoy well-earned honor and wealth. The field is comparatively as vast as was the country when the thirteen colonies declared their intention of independence and started to occupy the land from their then confines to the Pacific. There are many capable men in New York to-day so well educated in practical electricity and its adaptation, that, given the desire, they will work out the completed machinery in reasonable time and for reasonable compensation, thus enabling the theorist to not only ascertain quickly if his dream is feasible, but if so to have it demonstrated under his own supervision. I hear of these constantly and their success; it is the story over again of one mind leading another. The first long-distance telephone trial I remember was in the hands of a woman from the South. She came to New York and in a very short time had her method applied one quiet Sunday under most auspicious circumstances; she knew nothing of the practical methods required, but those she enthused had the talent and proved the extent of her applications some 500 miles—at that time an improvement but not good enough to adopt. There is another point which must add value to firmly established corporations. They can without extraneous expenses quietly introduce the new discoveries as they come along, unless hampered with a contract binding them to a particular system. Each of these by reducing expenses increases the dividends; for instance, I hear this week of a new arc lamp which is interchangeable from arc to incandescent circuits, and vice versa, which also burns anywhere from eight to eighty hours without attention (a good one for the Brooklyn Bridge lamp-trimmers this winter). It costs less to manufacture than any arc lamp I know of. Then there are new electric signals and annunciators on tap just now, all cheap before introduction, but sure to help money to earn money for shareholders in the immediate future.

TRADE NOTES.

The Standard Electric Company, 2246–2248 N. Ninth street, Philadelphia, has issued a circular calling attention to the automatic time cut-out manufactured by it. The object of this device is to automatically cut out lights at a specified time and thus dispensing with the necessity of personal attendance. The device can be applied to either incandescent or arc-light systems.

The Electric Engineering and Supply Company, of Syracuse, N. Y., in a very attractive circular makes known the fact that its electrical goods are being used exclusively in wiring the World's Fair buildings at Chicago, and claims this to be a very satisfactory indication of the superiority of its goods. The company has just issued a new catalogue.

The Pond Engineering Company, of 707–709 Market street, St. Louis, Mo., has sent us cards of its various specialties, which include steam-boilers for all purposes; Houston, Stanwood & Gamble standard slide-valve steam-engines; Hopper live steam and exhaust steam feed-water purifiers; Blake improved steam-pumps for every possible service; pump-valves of all descriptions; the Sheffield grate-bar, which is claimed to have no equal for efficiency and durability, etc., etc. The company issues a number of illustrated pamphlets descriptive of its various lines of goods.

CHARLOTTE, N. C., Sept. 3, 1890.

THE AKRON BELTING CO.,
AKRON, O.

Gentlemen: The leather belting furnished by you for this mill and the Gate City Oil Co., of Atlanta, Ga., was equal in all respects to the requirements of the specifications, and we consider the specifications very difficult to fill.

It is the best belting outfit ever put in a Southern mill. We take pleasure in giving you a letter testifying to above. Yours truly,

CHARLOTTE OIL AND FERTILIZER CO.,
FRED OLIVER, Pres. and Treas.

NEW YORK, N. Y., July 14, 1892.

MESSRS. FORREST SILVER BRONZE PACKING CO.,
115 LIBERTY ST., NEW YORK CITY.

Gentlemen: I am pleased to state that the silver bronze packing which we have been using on our piston-rod ($7\frac{3}{4}$" diameter, 12 ft. stroke) for the past three years has given good satisfaction. The rod vibrates in the course of its stroke about $\frac{1}{4}$ of an inch, and the superiority of your packing over all others on this rod has

been due in my opinion to the ability of your Silver Bronze Packing to accommodate itself to the vibration referred to above, together with its fine anti-friction qualities, evinced by the splendid condition of the rod. The packings applied since to auxiliary engines are all tight and doing good work. Yours very truly,

(Signed) S. C. MIDLAM, Chief. Engr.,
Steamer "Albany," Albany Day Line.

The Electrical Age's Illustrated Patent Record.

Issued November 8, 1892.

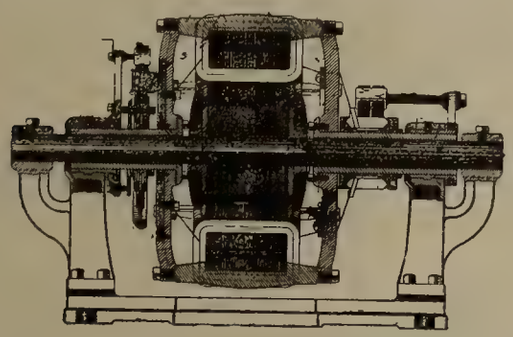
485,615. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 15, 1886. Renewed April 12, 1892.

485,616. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 15, 1886. Renewed April 12, 1892.

485,617. Incandescent-Lamp Filament. Thomas A. Edison, Llewellyn Park, N. J. Filed July 17, 1888. Renewed April 12, 1892.

485,618. Apparatus for and Process of Refining Copper by Electricity. Franklin Farrel, Ansonia, Conn. Filed April 26, 1892.

485,619. Rheostatic Controller for Electric Motors. Jonathan P. B. Fiske, Lynn, Mass., assignor to the



485,669.—CONTINUOUS-CIRCUIT TRANSFORMER.

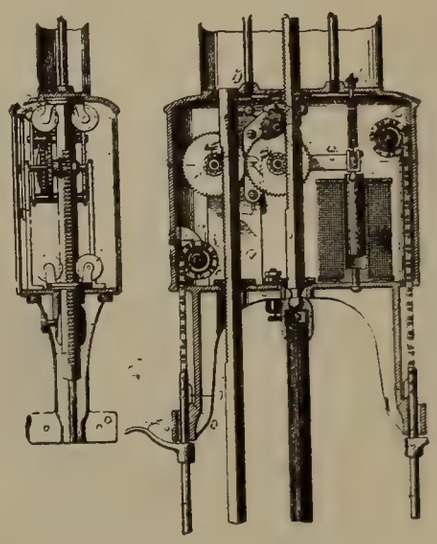
Thomson-Houston Electric Company, of Connecticut Filed Feb. 5, 1892.

485,620. Electric-Motor Controller. Jonathan P. B. Fiske, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 5, 1892.

485,643. Switchboard for Electric-Light Circuits. John J. Moore and Catharine M. Henry, administratrix of Dorwin A. Henry, deceased, New York, N. Y., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed April 9, 1890.

485,645. Electric Clock. James D. McAnlis and Harvey E. Fleming, Beaver Falls, Pa. Filed June 7, 1892.

485,647. System of Lighting Railway Cars and Platforms. Danton H. Nichols, Boston, and Charles L. Cotton and Charles A. Cotton, Dedham, Mass. Filed Sept. 7, 1891.



485,895.—ELECTRIC-ARC LAMP.

485,658. Electric Transmission of Power. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Sept. 18, 1891.

485,659. Electric Transmission of Power. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-

THE "CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

Houston Electric Company, of Connecticut. Filed Sept. 18, 1891.

485,668. Electric-Railway Switch. Charles A. Stone and Edwin S. Webster, Boston, Mass. Filed Oct. 30, 1890.

485,669. Continuous-Current Transformer. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 28, 1891.

485,682. Incandescent Electric Lamp. Augustus C. Carey, Lake Pleasant, Mass. Filed Jan. 15, 1892. Patented in England.

485,728. Electric Railway-Signal. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed Feb. 29, 1892.

485,739. Thermostat and Alarm. Gustav Fischer, Chemnitz, assignor to Arno Vieweg, Siegmar, Germany. Filed July 20, 1892.

485,744. Electric-Arc Lamp. Georg Kirkegaard, Brooklyn, N. Y. Filed May 13, 1892.

485,754. Electric Belt. Emory N. Tefft, Iola, Kansas, assignor of one-half to Robert Cook and Charles H. Fryer, same place. Filed July 30, 1892.

485,767. Electric Perforating Pen. Aaron D. Lewis, Canton, Mo. Filed June 30, 1892.

485,826. Voltmeter. Eugene R. Carichoff, Richmond, Ky. Filed May 12, 1890.

485,841. Method of Magnetically Separating Ores. Thomas A. Edison, Llewellyn Park, N. J. Filed July [illegible], 1892.

485,842. Method of Magnetic-Ore Separation. Thomas A. Edison, Llewellyn Park, N. J. Filed July 20, 1892.

485,876. Telephone. James W. McDonough, New York, N. Y. Filed July 21, 1884.

485,895. Electric-Arc Lamp. James R. Steers, New York, N. Y. Filed May 28, 1892.

485,919. Manufacture of Mandrels for Electrolytic Deposit of Tubes. Francis E. Elmore, Leeds, assignor to Elmore's American and Canadian Patent Copper Depositing Company, Limited, London, England. Filed Aug. 12, 1891. Patented in England, in France, in Sweden, in Switzerland, in Norway, in Luxemburg, in Italy, in Cape of Good Hope, in Victoria, in Tasmania, in New South Wales, in South Australia, in Queensland, in New Zealand, in Spain, in Brazil, in Western Australia, in Canada, in India and in Austria-Hungary.

485,950. Automatic Electric Scale. Paul J. Kuhbacher, Ashland, Ky. Filed March 24, 1892.

486,029. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Dec. 22, 1891.

486,031. Auxiliary Motor for Cars. William Crook, Sr., Winnipeg, Canada. Filed Jan. 8, 1892.

486,047. Railway Signal Apparatus and System. Jacob W. Lattig, Easton, Pa. Filed Aug. 18, 1892.

486,051. Telegraph-Sounder. James Maret, Mount Vernon, Ky., and William L. De Graff, Homer, Mich. Filed Aug. 4, 1891.



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ELECTRICAL AGE

VOL. X. NEW YORK, NOVEMBER 26, 1892. No. 48.

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A SUGGESTION TO THE TELEGRAPH COMPANIES.

We wonder if the astute directors of the Western Union Telegraph Company have ever considered the feasibility of renting wires to business men on the five-minute plan, after the method of the long-distance telephone. It seems as if this might be made a paying branch of the business after its existence became known among business men. It would be an easy matter for, say, a New York merchant to make an appointment with one in Chicago to be at the telegraph office at a certain time on a certain day, and hold a five, ten or fifteen minutes business conversation over a wire rented for that period. The only difference would be that the communications between the two parties would be telegraphed through the medium of a third party, *i.e.*, the operator, instead of communicated directly by telephone. The telegraph company could afford to set apart one room or more for such purposes, in each of which could be placed a telegraph instrument connectable with the main wires of the company, and with a corps of skilled operators in constant attendance business men would, no doubt, be glad to avail themselves of the opportunity to communicate in this manner with business connections in distant cities. We offer this suggestion for what it is worth, free of cost.

ELECTRICAL PROGRESS IN AUSTRIA.

A press despatch from Vienna, Austria, states that an electric railway line will probably be built along the banks of the Danube between that city and Buda-Pesth, a distance of about 130 miles. The most noteworthy feature of the project is the speed of the cars, each of which, we understand, will be independent of all others as far as driving-power is concerned. It is calculated that the locomotor will attain a speed of 123 miles an hour. At the present time details are unobtainable, but this project, together with the one in our own country—the Chicago-St. Louis electric railway—will undoubtedly strengthen the belief among many in the electrical science that the practical high-speed electric road is a possibility.

UNDERGROUND RAILWAY FOR NEW YORK.

The second great step in the direction of attaining an improved system of rapid transit in New York city has been taken. The board of rapid-transit commissioners for the city of New York last week made public the terms of sale and specifications for the construction of the rapid-transit railroad in New York city located by the board. The franchise will be auctioned off in the City Hall rotunda at 2 P.M., December 29, next. The specifications provide that no method of propulsion be used that will produce gases from combustion and mentions electricity as one of the available agents. Whatever form of power be used it will be necessary to be able to maintain a speed of at least 40 miles an hour, and the motor must be sufficiently powerful to readily start a train of 8 cars weighing not less than 30,000 pounds, not including the passengers. Electricity is evidently favored by the commissioners, and there is no question that the electrical problems involved in this vast undertaking can be successfully solved by electrical engineers. What a grand triumph it will be for electricity to fulfil the exacting requirements of this project. The successful accomplishment of this undertaking, taken in its entirety, will be one of the most interesting events in modern times, and when one considers the great magnitude of the work it would hardly seem possible that it could be finished within our time; yet, according to the terms, the work must be completed in five years. We publish in another part of this issue the terms and specifications quite fully, and also produce an outline map of New York city, showing the route of the proposed lines, and the locations of the stations thereon.

THE ELECTRIC LAUNCH "ELECTRA."

The accompanying illustration shows the electric launch "Electra," the successful competitor in the trial tests made at Chicago during the past summer on the lagoons at the World's Fair grounds. The object of these tests, as has already been stated in these columns, was to determine which class of craft was best suited to fulfil the requirements of passenger traffic on the waterways of the fair grounds. Steam, naphtha and electric launches were placed in competition, with the result of success for the electric boat "Electra."

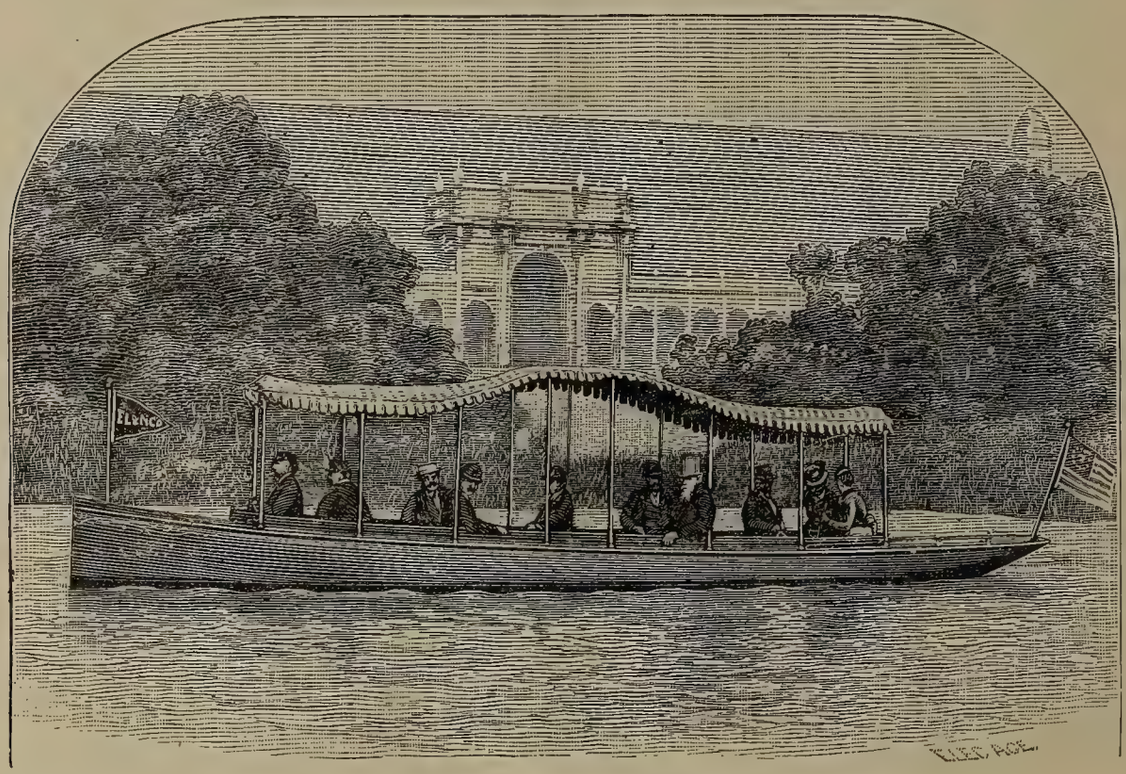
The General Electric Launch Co., 44 Broad street, New York, has just been organized for the purpose of building and equipping electrically propelled launches of any style and finish desired, and of any size, from 20 feet to 100 feet in length. This company is the sole licensee for marine purposes of The Consolidated Electric Storage Company. The motors and other electrical devices necessary for launch uses are especially designed by the General Electric Company.

The "Electra" and her sister boats which will be used during the fair are owned by the parent company, the Electric Launch and Navigation Company, of New York, while the General Electric Launch Co. handles all of the business outside of that contract.

During the competitive tests in Chicago the "Electra" made a continuous run of 10 hours, carrying a load of 25 people. At a moderate rate of speed the batteries will drive the boat 60 miles on one charge, and while her speed on the lagoons will be limited to 6 miles an hour she can be spurted at a rate of from 9 to 11 miles an hour.

In the ELECTRICAL AGE of June 11 last a full description of the "Electra" was given. Her principal dimensions are: length over all 34 feet and beam 6 feet. She carries seventy-eight storage cells, each of 125 ampère-hours capacity, developing a total energy of 2,250 watt-hours. The motor used for driving the propeller was designed by Mr. Anthony Reckenzaun, of London. The batteries and motor are placed beneath the seats and flooring, so that the utmost carrying capacity of the boat can be availed of.

The General Electric Launch Company, we understand, will bring electric launches up to the highest state of development and efficiency, and will turn out superior workmanship in every line concerned in the building of this class of craft.



ELECTRIC LAUNCH "ELECTRA" IN WORLD'S FAIR LAGOON.

AT THE AMERICAN INSTITUTE FAIR.

The 61st exhibition of the American Institute is now being held in New York, and the electrical exhibits are more numerous and extensive than ever.

The object of the American Institute is to encourage American industry and manufactures, and award medals and diplomas for improvements and inventions. Its history is one of encouragement to the American inventor and of benefit to American enterprise. The Morse telegraph became better known through its exhibition under the auspices of the American Institute, and it is said that the telephone was first exhibited at the American Institute Fair. The president of this worthy institution is Mr. J. Trumbull Smith, and Mr. Charles Chamberlain is the press agent.

THE DAIMLER MOTOR CO., of Steinway, Long Island City, N. Y., has a launch equipped with its well-known motor.

ROBT. H. INGERSOLL & BROS., 65 Cortlandt st., exhibit their numerous specialties and novelties, including their toy electric motor. One can spend 10 minutes interestingly at their stand.

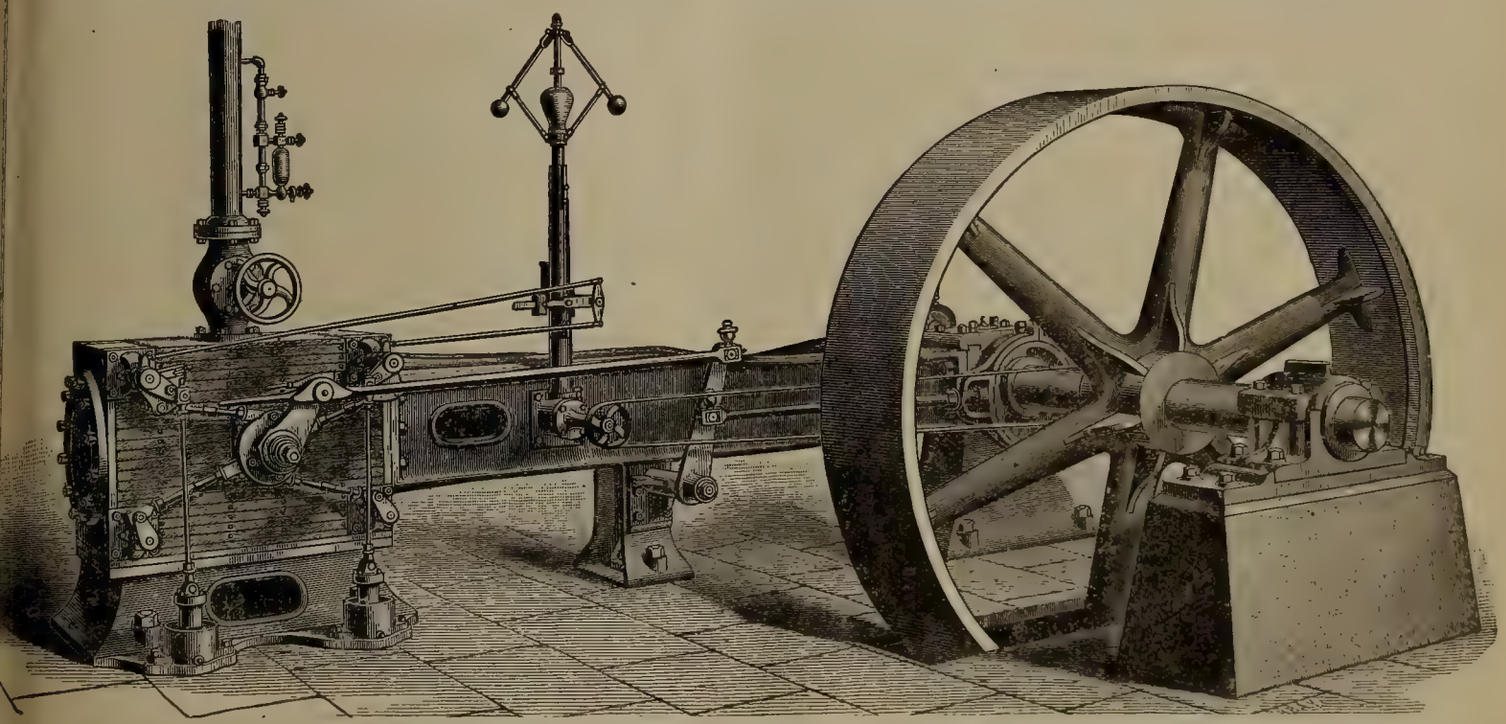
THE UNION TELEPHONE AND ELECTRIC MFG. CO., 64–66 Broadway, has on exhibition its acoustic telephone, full description of which can be seen in the ELECTRICAL AGE of Sept. 24, 1892. The company has two exhibits, one on either side of the hall. These telephones are sold outright at a small cost. They are being used by a number of prominent New York concerns and are spoken of very highly.

COLWELL LEAD COMPANY, 63 Centre street, New York, has on exhibition one of its famous Crystal Wave Toilets. The same can be seen at its up-town store, 681 Sixth avenue, New York.

G. E. WRIGHT, 9 and 11 Alling street, Newark, N. J., has on exhibition some finely built small engines and boilers. The engines, some of which are ½ H. P. of Corliss type, are indeed worthy of notice. They are manufactured by the L. Wright Machine Works. Same address as G. E. Wright.

THE ELECTRICAL PIANO AND MOTOR CO., 679 Broad street, Newark, N. J., has an exhibit of several Feldkamp motors in operation. One is run as a dynamo. This furnishes current for a motor which runs three ceiling fans, and another motor runs a 20-inch Barnes drill. This drill is made by the Garvin Machine Co., Laight and Canal streets, New York City, as is also a 14 x 6 Hendey lathe which is included in this exhibit.

FAYERWEATHER & LADEW, New York, show a huge belt made by them for the Brooklyn City R. R. Co. It is 116 feet long and 72 inches wide, and weighs 2,112 lbs. Two smaller belts are also shown.



WHITEHILL-CORLISS ENGINE AT AMERICAN INSTITUTE FAIR.

JAMES H. MASON, 366 Myrtle ave., Brooklyn, has on exhibition his famous batteries in combination with small motors, bells, miniature incandescent lamps, alarm-clocks, electric horns, reading-lamp, outfits, etc. There are 36 No. 11 cells used for lighting the booth, which occupies a prominent position in the hall. The electrolier has 6 lamps, and there are light standards on the counters, all fed from the same battery. The same current runs a 1 H. P. Crocker-Wheeler electric motor, which in turn drives a Wing disc-fan in a very lively fashion. A sewing-machine operated by electric power from the same battery is also exhibited. The exhibit is a very attractive one and is making quite a hit. Mr. Mason has taken a good many orders at the fair for his batteries.

MICHAEL O'GORMAN, 59 Elm street, New York, exhibits the Peerless gas regulator. Mr. O'Gorman says by the use of this regulator gas bills are reduced from 20 to 50 per cent. The regulator is guaranteed for 10 years.

IRA J. GRIFFIN, of Sing Sing, N. Y., has on exhibition his patent fluid-pressure regulator. It works admirably and is worth investigating. He also has on exhibition some lock nuts designed especially for locomotives and high-speed machinery.

THOS. HALL, 853 Broadway, New York, exhibits his improved "Ideal" twist-drill grinder. He says it is the only machine that will sharpen small twist-drills from ⅜ inch to No. 70.

THE DETROIT HEATING AND LIGHTING CO., of Detroit, Mich., has one of its well-known Bolton hot-water heaters on exhibition.

J. W. CHAPPELL, 25 E. 20th street, New York, manufacturer of silk lamp-shades, has a variety of handsome shades on exhibition. Mr. Chappell makes a specialty of electric shades.

THE WATERBURY RUBBER CO., 49 Warren street, New York, has a large quantity of galvanized spring-steel-armored hose on exhibition. It claims that this hose will stand practically unlimited pressure.

THE WRIGHT UNIVERSAL ELECTRIC CO., of 26 Whitehall street, New York, has a most unique exhibit including electric coach-lamps run by primary battery, the globes being imported from Europe and guaranteed not to break. The Edison-Swan Co., London, is the manufacturer. The company's stable lantern, quite a new and novel invention, gives a four-candle-power light through the agency of a primary battery, the lantern and all weighing but three pounds; it can be run from five to seven hours without recharging at a cost not exceeding three cents. It also has a primary battery for phonograph inspectors' use, which will run two hours at a cost of one cent and all together weighs but three pounds. The company's electro-medical and surgical instruments are indeed very fine. Among others it has a tongue depressor, laryngoscope, and laryngoscope with adjustable handle. At a recent convention at Buffalo of the National Carriage-Builders' Association, one of the directors of the company, Dr. Robert Taylor, was received enthusiastically when showing a test of these new coach-lamps.

THE H. B. SMITH CO., 121 Liberty street, New York, has on exhibition some of its recent improvements in the line of wood-working machines. Among others may be mentioned the No. 2 mortiser outside-bearing 36-inch

band-saw, three-spindle boring-machine, 16-inch jointer or hand planer, No. 1 Universal Saw Bench, double-spindle variety moulder, 26-inch cabinet planer, self-feed saw, and 9-inch straight-moulder. Many beautiful designs in wood-cutting are shown the visitors.

MR. TIMOTHY KIELEY, of 11 West 13th street, New York city, among other specialties exhibits a multitubular oil-separator.

MESSRS. WM. BARAGWANATH & SON, Chicago, Ill., have installed one of their hot-water heaters in conjunction with the boilers which supply the steam for the engines in the building.

SEVERAL Edison phonographs are shown in the company's booth, and music of any kind can be had on tap for a nickel. The phonographs do not get a chance to get rusty ; they are in constant use.

THE EDISON ILLUMINATING CO., of New York, has two 500-light Edison machines in operation for the purpose of supplying current for the incandescent lamps in the hall. There is also a complete switchboard.

A BEAUTIFUL Third avenue cable car attracts a great deal of attention. The car is painted in vermilion on the outside, and the inside is finished in an elegant manner in mahogany. The ventilators around the car roof are works of art, being made of fragments of vari-colored glass in imitation of mosaic-work, and the seats are upholstered in cardinal plush. The car was made by the Laclede Car Co., St. Louis, Mo., and is an elegant specimen of car architecture and work. It is equipped with the Baltimore Car Wheel Company's wheels and flexible gear, with dust and oil-tight boxes, designed by W. S. G. Baker, of Baltimore. The platform gates were made by the Pitt Iron Works, of 82 Reade street, New York, and altogether a handsomer car has never been designed. Patent brakes are used.

THE RIDER ENGINE CO., of New York, shows 7 improved Rider Compression engines of various sizes in practical operation.

THE EASTON ELECTRIC CO., of Brooklyn, has a notable exhibit. It consists of 4 Easton dynamos, with adjustable bases, one C. & P. dynamo, and an automatic switchboard. The 4 Easton dynamos supply the current for the arc lights in and about the hall. The C. & P. dynamo generates a current which is transmitted to a motor dynamo on the glass-etching stand located a short distance away, down the main aisle. The 4-inch belts used in the Easton Company's exhibit are of the make of the New York Leather Belting Co., of 84 and 86 Gold street, New York city.

A NOVEL application of electric current is shown by Dr. A. H. Phelps, of Glens Falls, N. Y. He etches glassware by means of a platinum electrode heated to a white heat by electric current. He calls the process electro-thermogravure, and the facility with which glass is etched by it is remarkable. The incandescent electrode is simply traced over the glass after the fashion of writing with a pen, and a fine thread of glass is taken from the surface by the heat, leaving the course of the electrode clearly traced out. Any design can be executed with great facility. The current used by Dr. Phelps was generated by a dynamo motor built for him by the Easton Electric Co., of Brooklyn. The motor obtained its current from the C. & P. dynamo in the Easton Company's exhibit, and the dynamo part of the machine generated the current used for the etching process. It was regulated by means of a rheostat.

A. C. MANNING & CO., of Otto Gas Engine fame, 18 Vesey street, New York, have a 7 H. P. gas engine on exhibition, and judging from the smooth way in which it runs, this latest engine must be quite a success. It is equipped with the new Bunsen burner and all automatic poppet valves. Its construction is simplicity itself.

NEW YORK LEATHER BELTING CO., 84 and 86 Gold street, New York, has a corner that contains over 8,000 feet of belting weighing 3,000 pounds. It is worth one's while to take a look at it.

THE ELECTRIC CUTLERY CO., of 113 Chambers street, has a beautiful showcase containing various styles of its handsome cutlery. Its factory is located at 4th and Dickerson streets, Newark, N. J.

THE NASON MFG. CO., of 71 Beekman street, New York, has on exhibition an Equator Steam-Boiler for house-heating, Gulf Stream hot-water boiler for house-heating, Ammonia fittings for freezing machines, etc. ; also specialties, including Steam Trap, O. O. E. Valve, Glue Heater, Radiator and Pipe Vise.

THE MODEL HEATING CO., of 144 N. 2d street, Philadelphia, Pa., has on exhibition and is manufacturer of the Novelty hot-water and steam circulator for heating and ventilating.

THE machinery for the whole building is run by a 200 H. P. 22 x 48 Cylinder Whitehill Corliss Engine. This engine is running at 75 revolutions per minute. The Whitehill Engine and Picket Ice Machine Co., of Newburg, New York, is the manufacturer. Its New York address is 21 Cortlandt street.

THE WEST SIDE ARCHITECTURAL IRON WORKS, of 550–560 and 553–557 W. 33d street, New York, have on exhibition a window which they claim is absolutely fireproof ; it is quite interesting to architects, and has been very favorably commented upon.

THE CLINTON WIRE CLOTH CO., of 76 Beekman street, New York, exhibits some of its perforated metals. They are attracting a great deal of attention.

BARNES' FRICTION-CLUTCHES AND CUT-OFF COUPLINGS.

The value of friction-clutches and cut-off couplings for connecting and disconnecting countershafting with engines, water-wheels, dynamos, electric motors, etc., is too well known and recognized to require any proof at our hands. The advantages of such apparatus are well known to every engineer and mechanic, but it is in the nature of things that every manufacturer of such devices

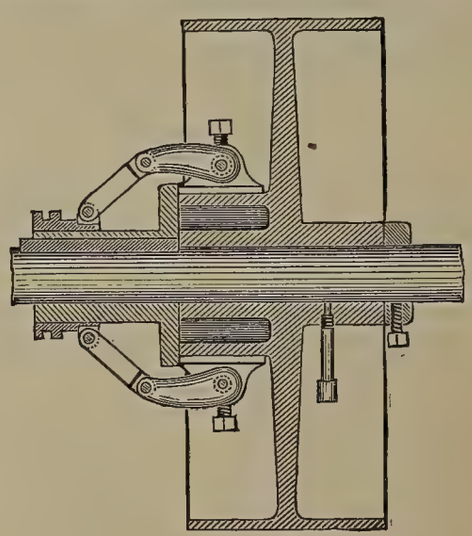


FIG. 1.

should claim for his own goods points of superiority over like goods of other make.

The J. H. & D. Lake Co., of Hornellsville, N. Y., manufacturer of the Barnes' patent screw-lever friction-clutch pulley and the Barnes' patent screw-lever friction-clutch cut-off coupling, both of which are illustrated herewith, claims that these devices are superior in point

of simplicity and strength. The clutch pulley is claimed to be the best made; it has positive grip and absolute release; it is adapted to light or heavy work and operates quickly, starting and stopping machinery easily without shock or jar. The same advantages are claimed for the cut-off coupling.

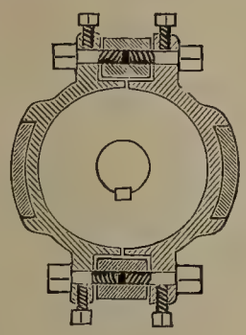


FIG. 2.

Fig. 1 shows a sectional side view of the Barnes' friction-clutch pulley in the position it assumes when released, and shows the driving-hub keyed to the shaft.

Fig. 2 is a sectional end view showing the friction-hub encircled by the friction-ring, the former being cast in one solid piece with the pulley. The projecting lugs on the opposite sides of the driving-hub of the ring drop into the lug cavities of the friction-ring, and when the clutch is on these lugs take all the driving-power.

Fig. 3 represents the operating lever attached to the slipper-sleeve in operating position, while Fig. 4 shows the same in released position.

Figs. 5 and 6 show respectively a sectional side view and perspective view of the Barnes' single-lever or multi-band friction-clutch pulley, which is claimed to be very efficient for light or countershaft work. The friction-ring of this clutch is merely a spiral band which closes by traction pressure at the ends. In operation, to obtain the power the slipper-spool on the shaft is forced under the cam-lever, the wedge-fulcrum end of which comes between the cylinder and a wedge-shaped projection of one end of the friction-ring, the other end of the ring resting against an adjusting set-screw, which gauges the pressure of the friction-ring.

The J. H. & D. Lake Co., which controls the Barnes' patents on these devices, was organized under the laws of New York State last June, and it is reported that its business has increased and continues increasing very rapidly.

The daily capacity of the company's foundry is 20 tons, and the factory is lighted by electricity on the incandescent system.

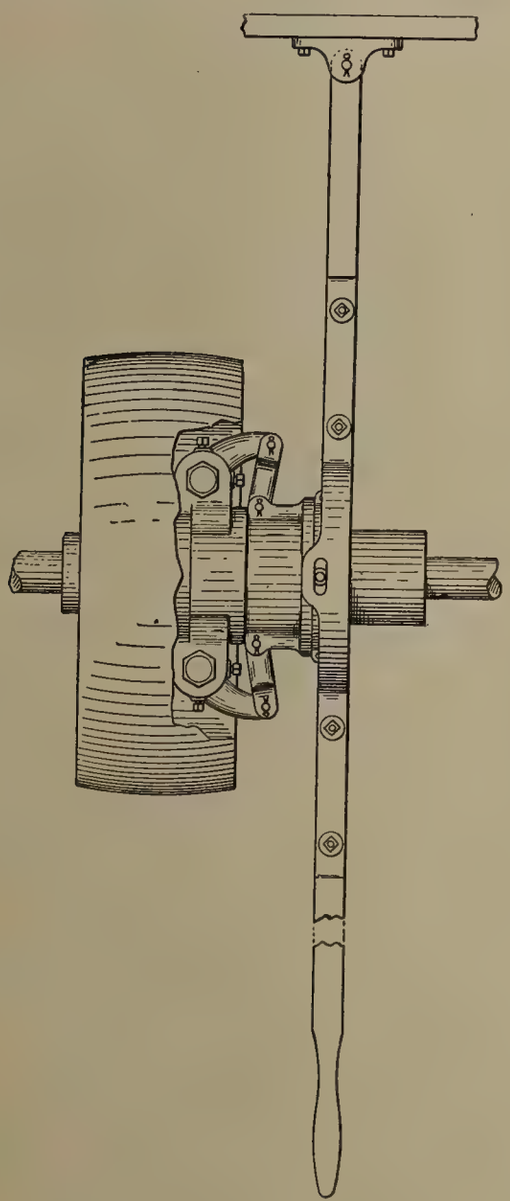


FIG. 3.

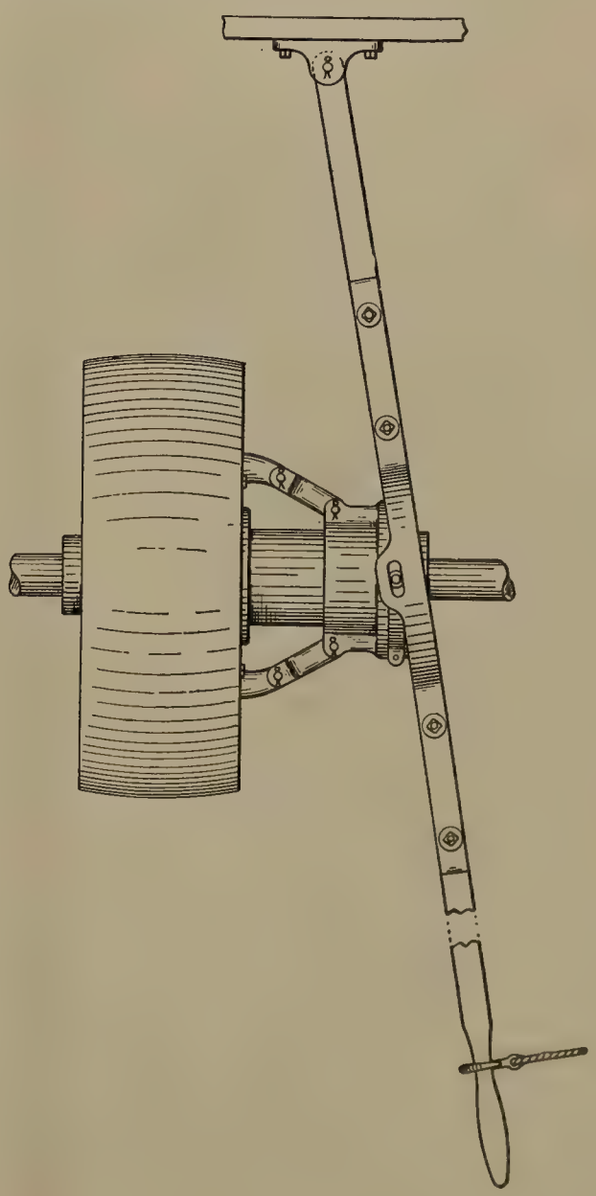


FIG. 4.

THE residual magnetism of dynamo field-magnet cores may be dissipated by mechanical knocks, or reversed by actual contact with other magnets.

"WARD" SEARCH-LIGHTS.

A very few years ago the electric search-light was an apparatus of scientific interest only, and we all remember how old salts expressed their opinion against the light on the ground that it would be too bright, and would blind by its dazzling brilliancy. Fortunately, however, development along electrical lines has in no way been dependent upon the opinions of old sailors, who are proverbially opposed to new-fangled notions or innovations of any kind. Wiser ones foresaw from the beginning that there was a great and important field for the use of electric search-lights, and many electrical engineers have given the subject much attention in late

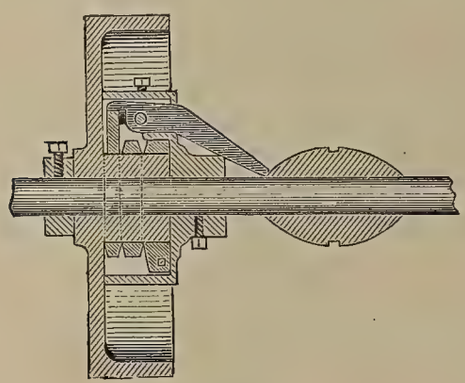


FIG. 5.

years. Among the foremost concerns to take up the search-light and develop it to a state of high efficiency was the Electric Construction and Supply Co., of New York.

Many of this company's search-lights are now in use and are giving the very best of satisfaction. The one illustrated herewith is known as the "Ward" small search-light, and was devised to meet the demand existing for a light of its character. It is represented as being on the top of a pilot-house, the controlling mechanism being located in the interior. The light itself works automatically, and it is placed on top of the cylinder so that only the carbons with their supporting rods pass into the cylinder. A concave ground-glass lens

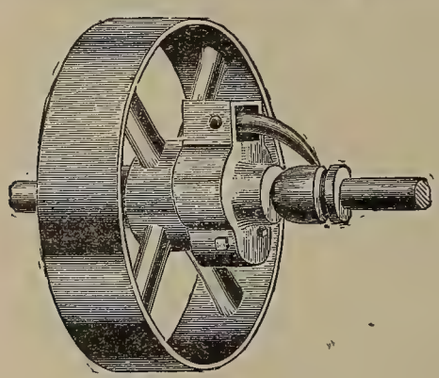
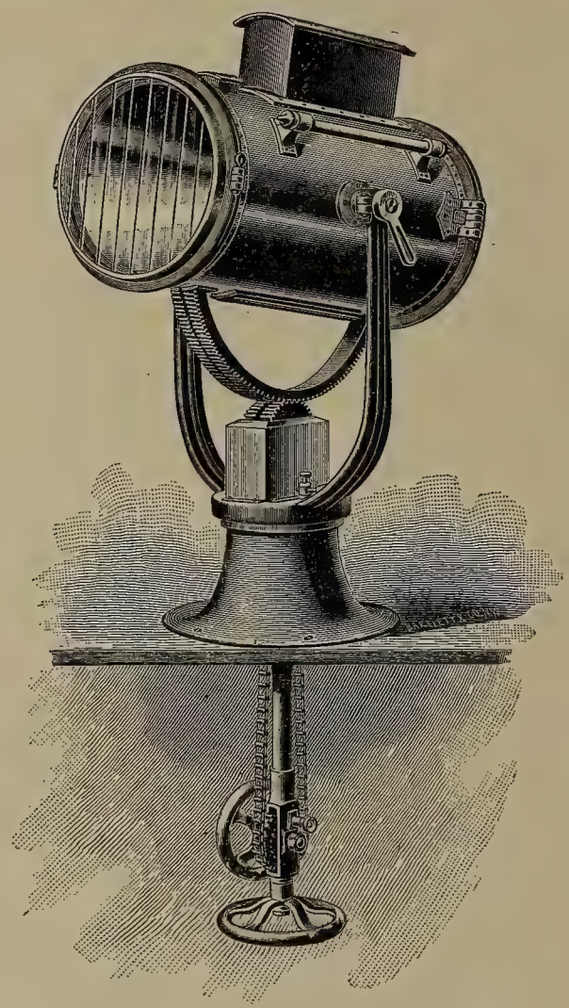


FIG. 6.

is used as the condenser. It has an 18-inch focus, and is silvered on the convex side, which arrangement gives the greatest amount of light possible from a given current. The lens, it is claimed, never tarnishes, and therefore never needs cleaning, and it always yields the same amount of light.

The lamp and all its parts are made of finished brass, making it a very attractive as well as serviceable lamp, the main object being, however, to avoid any disturbance of the compass, as there would be in case the lamp were made of iron or other magnetic metal. The connections are such that the revolutions of the lamp in either direction do not in the least involve the wires—the latter being independent of the action of the lamp. Therefore it is possible to revolve the lamp indefinitely one way or the other without impairing the connections or supply of current.

This lamp possesses the essential qualities of concentration of light and penetration, and it is so simple in construction that it is easy to manipulate and hard to



"WARD" SMALL SEARCH-LIGHT.

get out of order. For small craft, such as pleasure yachts, where there is an electric-light plant on board, a light of this sort is very valuable, as it enables the pilot to pick his way along narrow channels and distinguish other vessels or objects near by or far away.

The company makes other classes of "Ward" search-lights, including the large light and the one especially made for ocean steamers. All require low-tension current for their operation.

ELECTRIC LAMP FOR MINERS.

Mine-owners and miners will be pleased to learn that Col. Engledue, an Englishman, has produced a battery by which an electric lamp can be successfully employed in mines. Many attempts have hitherto been made to adopt the electric light for this purpose, storage batteries and in some instances primary batteries being used. They were all practical failures. The cost of maintenance was excessive, the lights did not burn long enough and the weight was too great. All of these objections are said to have been done away with in the Engledue battery. This battery consists of a wooden case 6½ x 5 x 3 inches, divided by a partition into two cells, lined with lead, to which four carbon plates are connected, thus establish-

ing an electrical circuit between the carbon and lead. The battery is hermetically sealed at the top by an india-rubber washer, over which an ebonite cover is tightly screwed into the wooden base. Through the ebonite cover two plugs of the same material are screwed, each holding a cylindrical zinc element, everything being fastened by rubber washers so that there shall be no leakage when the battery is reversed. Contacts are made with an incandescent lamp in the usual manner. In operation Colonel Engledue's electrolytic fluid is used, the battery being charged to about within an inch of the top. After working about four hours, when a portion of the zinc and also the strength of the battery is somewhat exhausted, the battery is reversed. This exposes a large surface of zinc which has hitherto been free from the action of the solution and a further period of six hours illumination is secured. By the employment of a simple and effective handle the lamp is kept swinging properly after its centre of gravity has been altered by reversal. It is said that by actual test these lamps have given a satisfactory light for a period of from 10 to 12 hours. Such being the case, and as it is claimed that the cost of maintenance is practically the same as that of the ordinary oil lamp, these lamps should be in great demand. There is no comparison between an electric and any other kind of light; the electric light is supreme, and all others must eventually give way to it. The apparatus weighs about five pounds.

ELECTRIC WELDING.

A peculiar physiological effect of the light produced in electric welding machines is thus recorded in London *Iron*: "A section of the men employed at the Kolomna Ironworks, situated near Moscow, has lately had some unpleasant experiences with electric welding, which, with the aid of 500 accumulators, is there practised according to the Benardos process. While engaged on the trying work the artificers' eyes were protected by tinted glasses, but the skin being exposed, the following symptoms were manifested: burning sensation on the skin and in the eyes; in from three to four hours discharges from the nose and the eyes; three to four hours later a dry cough; four or five hours later swelling of the skin and development of other symptoms; eight to ten hours from the commencement of the disorder continuous irritation of the eyes, lasting from four to six hours; and finally, coloring of the skin. Then the various effects ceased, and the skin began to peel. On the third day the cuticle had completely decorticated, and by the sixth all the painful symptoms disappeared. But for weeks afterwards the skin remained colored. These effects, it would seem, are exactly the same as those which are induced under scorching by the sun. The best protection which can be afforded the workmen against the evils mentioned, Mons. Maklakoff, the manager of the works, believes, consists in a covering of yellow waxed cloth or red and green veils."

ENJOINED FROM MAKING LAMPS.

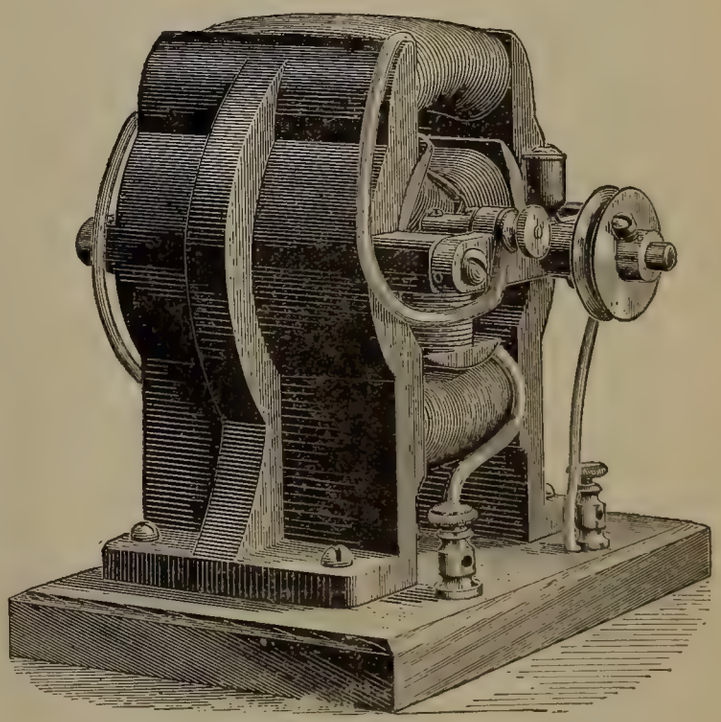
On November 18 the Edison Electric Lighting Co. and the Edison General Electric Company commenced suit in equity before Judge Lacombe, in the United States district court to restrain the Sawyer-Man Electric Company from manufacturing incandescent lamps. The plaintiffs were represented by Clarence Seward, G. P. Lowery and R. M. Dyer, and the defendant by Edmund Wetmore, Elihu Root and Leonard E. Curtis. The plaintiffs asked for a preliminary injunction against the manufacture of incandescent lamps by the defendant, their patent on the incandescent lamp having been upheld by the circuit court of appeals.

Mr. Curtis, for the defendant, argued against the granting of any injunction on the ground that the complainants are violating the anti-trust law. He read an adffiavit from George Westinghouse, Jr., in which that gentleman declared that the General Electric Company is trying to get a monopoly of the electric lighting business, and had told the World's Fair directors that the Westinghouse Company could not supply lamps, with the object of preventing the award of the contract for lighting the buildings to the Westinghouse Company.

The injunction asked for was granted on the 19th, to continue in force until December 6, when the case will come up before the court of appeals.

DEMOTT ELECTRIC MOTOR.

The thousands of women who are wearing their very lives away by incessant toil at the sewing-machine will find in that mysterious force called electricity a friend that should be welcomed with open arms. While the sewing-machine is unquestionably one of the greatest labor-saving devices in the world to-day, the physical effort required to operate it continuously soon has a disastrous effect upon the entire system. It was to lighten the labor of the operator, and in this way to save her from a premature grave, that careful attention was given to the adaptation of the electric motor for the running of sewing-machines at a cost which would bring it within the reach of all. While the original outlay may seem to be large it is really not so, in view of the fact that the machine can be operated at an expense of less than three cents an hour. The motor illustrated herewith is admirably adapted for the purpose, and is said to have given every satisfaction under severe tests. No one recognizes the evil effects of operating machines by the present method more so than do physicians, and they are heartily in favor of the electric motor. It can be attached to any machine, and is under the complete control of the operator, the speed being regulated by pressure of the toes or heels on the treadle of the machine. A cord is attached from the treadle to the motor regulator and is claimed to be perfect in every respect. James H. Mason, 366 Myrtle avenue, Brooklyn, is sole agent for the motor and outfit. A sewing-machine operated by the Demott electric motor may be seen at the present time at Mr. Mason's exhibit at the American Institute Fair, New York.



DEMOTT ELECTRIC MOTOR.

OIL VERSUS AIR AS AN INSULATING MEDIUM.*

BY JAMES BOWSTEAD WILLIAMS, M.D.

All who have attempted to enlarge in the smallest degree the bounds of our knowledge recognize the importance of the faithful collection of facts which, though seeming separately insignificant, may yet when brought together resolve themselves into distinct and important scientific truth. By combining the results of investigations carried on from different standpoints we obtain a view of the subject more complete than any single mind, however masterly, could give us. Hence every item of information has its importance, as it may prove to some other investigator the exact clue needed to solve some long-pondered problem. Acting upon this principle, the writer now offers an account of some experiments made by himself to determine the comparative insulation resistance of oils and air; and it has appeared to him that the results obtained from these experiments are specially important from the fact that *all* of the apparatus used was absolutely insulated, and that the only leakage that could take place was through or across the various substances experimented upon.

The relative powers of oils and air to resist disruptive discharges and also to insulate alternating currents will not be considered at this time, as the writer proposes to reserve those subjects for a future paper.

The instruments used in the experiments from which the results about to be set forth in this paper were obtained were an electrometer, a discharge-key, a 6-inch spark-coil and a Grenet cell to operate it, and apparatus for holding the oils and other substances while they were being tested.

The electrometer was a special form of quadrant electrometer, designed and made by the writer in San Francisco, in 1886, for the purpose of testing insulating material generally, and particularly for determining the comparative I. R. of very short pieces of insulated electric conductors. Its quadrants and needle system are similar to those of Lord Kelvin's electrometer, but the mounting of the quadrants and the needle suspension are different. No glass is used for insulating the various parts, this insulation being effected entirely by means of the best quality of hard rubber, which is well paraffined. The suspension is of the bifilar type, is about six inches in length and is provided with adjustments. The replenisher and gauge are contained in a separate vessel, and when they are electrically connected with the electrometer proper the combination can be used in the same manner and for the same purposes as the "White pattern" quadrant electrometer. The insulation of this instrument is so perfect that its quadrants, when charged to potentials of about 6,000 volts, will retain their charge for several hours without any perceptible leakage.

Before the electrometer is used for comparative testing it is so adjusted that the quadrants, when fully charged, will be charged to any desired potential of from one to six thousand volts.

The discharge-key resembles those in common use, the only difference being in the trigger, which is so constructed as to insulate as highly as any of the pillars of the key.

This instrument was used when time measurements were taken.

With this apparatus, using the same potential as that used in these experiments, the "dielectric after-working" of Boltzman can be demonstrated, if a few inches of a highly insulated wire are tested. The variation of the capacity of a condenser having a small bare wire for its inner coating can also be shown.

*Abstracts from a paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 8, 1892.

The apparatus in which the oils were first tested consisted of a glass cup to contain the oils and two circular brass discs, parallel to each other, which were immersed in the oil and between which layers of oil could be formed.

These discs were each 2⅛ inches in diameter, one of the discs, the lower, being fixed and the other, the upper, movable. The movable disc was soldered to the end of an adjustable screw passing perpendicularly through the centre of the hard-rubber cover of the cup, which was 3 inches in diameter. The fixed disc was supported at the middle of a U shaped device formed of hard-rubber tubes, both of the arms of which were cemented to the cover of the cup. One of these arms passed through the cover and extended about six inches above it, and contained the wire which was soldered to the fixed disc. The discs were absolutely insulated from each other and from the earth, and were separated one-thirty-sixth of an inch by each revolution of the adjustable screw. The apparatus in which the second tests of the oils were made will be described later.

The method of testing the oils was briefly as follows: The needle of the electrometer, the induction-plate and one pair of quadrants were electrically joined to the frame of the instrument and to earth, and the second pair of quadrants joined to the upper disc.

The lower disc was connected with the binding-screw of the upper contact of the discharge-key, the lever of the key being depressed and held against the lower contact of the key by the trigger. The lever of the key was joined to earth. Oil was then poured into the cup sufficient to cover the upper disc when this disc was separated from the lower disc by one-half inch, this being about the effective range of the screw.

The quadrants, and of course the upper disc were then charged by sparks from the coil to a potential of about 2,300 volts, the illuminating apparatus and scale having previously been adjusted so that when the quadrants were fully charged the image of the cross-wire would settle at the upper end of the scale at 300, say.

As the quadrants and discs were absolutely insulated at the potential used there could be no leakage of the charge as long as the lower disk remained insulated from the earth; but as soon as this disc was connected with the earth, either through the medium of the discharge-key or by having its electrode touched with a wire fastened to the gas-pipe, leakage would take place through the layer of oil, whatever its thickness might be between the discs; and the rate at which this leakage took place was indicated by the rate at which the image of the cross-wire passed down the scale, *i.e.*, by the rate at which the electrometer was discharged.

The oils tested were rosin, paraffin, linseed, cotton-seed and castor. The rosin oil was what is known as London oil. The paraffin oil had a specific gravity of 24° B. All of the samples were procured from wholesale dealers, and were declared to be of the best quality.

The first set of experiments include tests of paraffin and rosin oils, air, and a specimen of well-known insulated wire. This last test was made to show what took place when the dielectric of insulated wires was tested by means of charges of high potential, and also to make a rough comparison between specific resistance of this dielectric and that of the oils about to be tested.

The temperature during the tests was 82° F., and the humidity, as indicated by a Lambrecht's polymeter, 80.

* * * * * * *

From a careful consideration of the foregoing tests the results thereof appear to the writer to prove, when continuous high-tension currents *alone* are concerned:

1. That air, even when it has a humidity of 80 per cent., is infinitely superior to oil for insulating conductors carrying such currents.

2. That pure paraffin is far superior to oil, both for nsulating conductors and for preventing the escape of the current across the surface of glass.

3. That air having a humidity of 80 per cent. is superior to paraffin as an insulating medium.

4. That oil will not prevent leakage of the current across the surfaces of glass.

5. That whenever oil covers the surface of hard rubber, even when the latter is paraffined, it destroys the high-surface insulation of the paraffined hard rubber; that is, the low-surface insulation of the oil has been substituted for the higher surface insulation of the hard rubber when used bare and clean, or when covered with paraffin.

A few words relative to the use of the oils in practice may not be amiss here. To use oil for insulating conductors there must be an enclosing vessel of iron or its equivalent for the oil and conductors. If long tubes are employed for this purpose, two things are indispensable —plugs in the ends of the tubes, and means for keeping the wire or cable concentric with the tube and the individual wires of a cable separated from each other. For the latter purpose fibrous material is probably the most convenient means. Jute, when pure and dry, is an excellent fibre, both for the oils when used alone and when thickened with rosins, etc., for by reason of the peculiar nature of the fibre a larger amount of insulating material can be placed within a given space than if a closely-lying vegetable fibre is used; and there will also be fewer points of contact of fibre between the wires and the inside of the tubes. Experiments made by the writer show that there is but little difference in the specific resistance of different kinds of vegetable fibre when the fibre is clean and absolutely dry. The resistance of such fibre is high as long as it remains in this condition. But it is almost impossible to keep it so. It may be a matter of surprise to many to learn that cotton which has been dried, and which therefore possesses good insulating properties, loses these properties in less than ten minutes if exposed to a damp atmosphere.

Whatever means are used for the purpose last above stated they should have a high specific resistance and allow the use of as much oil as possible.

The plugs must be formed of insulating material which is not injuriously affected by the oils. The best hard rubber, or some special vulcanized rubber or gutta-percha compound, appears to be the best for this purpose. Paraffined wood is very apt to be of little use in a short time, for no matter what kind of soft, porous material is paraffined by allowing it to absorb the melted wax, the wax rarely hardens in a solid form, but usually contains numerous small spaces, and these spaces absorb moisture by capillary attraction. It is for this very reason that a dielectric which is formed of fibre saturated with paraffin soon loses its high insulation when exposed to the air. The microscope will demonstrate the presence of these minute air-spaces.

All oil should be carefully heated, sufficient to expel all moisture and air, before it is used. If paraffin oil is used it is better to subject the oil to a comparatively low temperature and exhaust the air by means of a vacuum than to heat the oil to a high temperature. After the moisture has been removed the oil must be kept excluded from the air or it will again absorb moisture.

If oil is used as a covering for insulators made of inferior glass or porcelain, to be of value it must contain no moisture or dirt; and if used in damp and dusty localities, means must be provided for the self-renewal of the oil, so that fresh surfaces of oil may constantly be exposed. But if insulators had surfaces formed of glass which contained a large proportion of pure silica better insulation would be effected if these surfaces were not covered with oil. The writer once found a moulded glass vessel having about the same dimensions and area as the "pony" insulators, which had a surface insulation vastly superior to that of the "pony" insulators. If insulators were made wholly or in part of *such* material a covering of oil would be worse than useless, for experiments have shown that when glass or other material does prevent surface leakage, covering it with oil at once ruins the high-surface insulation.

Experiments made upon the expansion of paraffin and rosin oils shows that when paraffin oil is heated to 280° F., a column of it 3½ inches long and three-fourths of an inch in diameter expands one-half of an inch; and that if a column of rosin oil of the same dimensions is heated to the same temperature, it expands three-eighths of an inch. These facts should be taken into consideration when using these oils in pipes, for if the pipes are full and the oil gets heated, it will expand, and probably either expel the plugs or exude at the ends. If it exudes, dust and moisture will collect upon the film of oil and cause surface leakage. This leakage at the ends of pipes containing telephone or telegraph wires might not be detrimental to the working of the lines, but if the pipes contained wires carrying high-tension currents serious trouble might arise.

The efficiency of oil to fill holes in dielectrics depends greatly upon circumstances. If the holes or gaps should be formed in the dielectrics of wires conveying weak currents, the oil, if not too sluggish, would have plenty of time to move into and fill such spaces; but if in the dielectrics of wires conveying strong currents, the oil must move very quickly or a disastrous burn-out is the result. And not only this, but the oil becoming hot expands, and the pipes, if of lead, are apt to be strained or broken by the increased pressure from within outwards. If the burn-out occurs near the ends of the pipes the plugs may be expelled. If the filling of spaces were the *only* thing required of the oils the lighter ones would accomplish this purpose better than the denser ones. But the heavier oils—*e.g.*, heavy and light paraffin oils—are much better for insulating purposes than the lighter.

In conclusion, the writer would state that he feels warranted in believing, unless the contrary can be demonstrated, that dry air, if employed to form a portion of the dielectrics of insulated conductors and if the conditions upon which its highest efficiency depends are fulfilled, is an insulating material superior to oil and even paraffin. In making this statement, he takes it for granted that his method for testing—a method which he does not remember ever to have seen published before his use thereof over five years ago—yields results the accuracy of which can be relied upon. This belief has been established after several years of experimental work upon insulating materials and the manufacture of different kinds of insulated conductors. Certainly air is cheaper than any other insulating material, and it is not destroyed or injured by intense currents. Burn-outs do not affect it, and if it can be kept dry, which is the great difficulty attending its use, the conductors which it insulates will have a high insulation resistance, and a low electrostatic capacity — two things which are of the greatest importance in electrical engineering.

MARRIED.

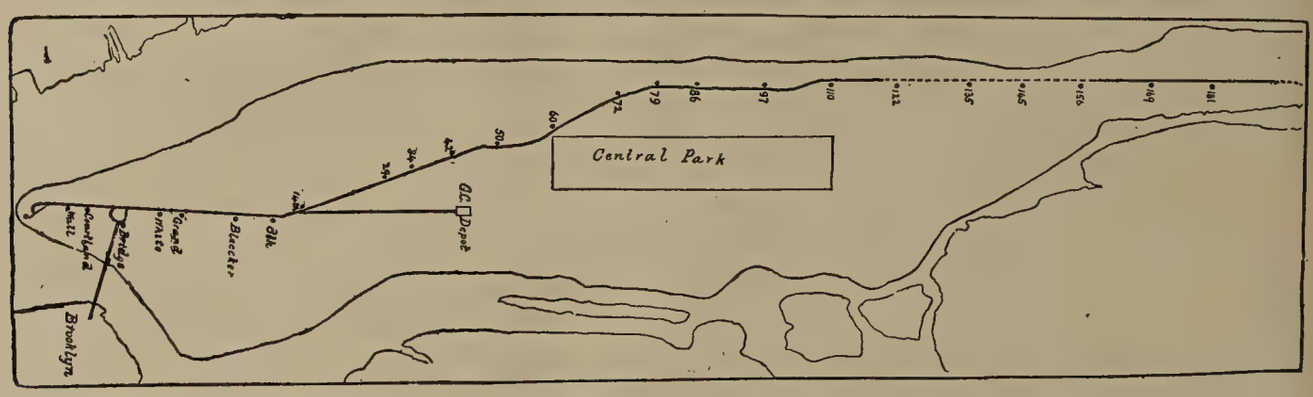
Mr. Paul D. Cravath, well known in electrical circles, was on November 15 last married to Miss Agnes Huntington, the singer, in New York. Mr. Cravath is a member of the firm of Cravath & Houston, attorneys for the Westinghouse Electric and Manufacturing Company. He is thirty-three years old, a native of Ohio and a graduate of the Columbia Law School. His numerous friends extend hearty congratulations.

RAPID TRANSIT IN NEW YORK CITY.

TERMS OF SALE AND SPECIFICATIONS FOR THE CONSTRUCTION OF A RAPID-TRANSIT RAILWAY IN THE CITY OF NEW YORK.

The following are the principal terms of sale under which will be sold the right, privilege and franchise to construct, maintain and operate for a period of nine hundred and ninety-nine years the railway under Broadway and other streets in the city of New York as laid out and determined by the board of rapid-transit railroad commissioners for the city of New York :

1. The right, privilege and franchise to construct, maintain and operate for the term of nine hundred and ninety-nine years from the date of sale, the railway under Broadway and under and over other streets and lands in the city of New York as laid out and determined by the board of rapid-transit railroad commissioners, will be offered for sale by said board at public auction by Eugene L. Bushe, one of said board, on Thursday, the twenty-ninth day of December, 1892, at 12 o'clock noon, in the rotunda of the City Hall in the said city of New York.



MAP OF NEW YORK CITY SHOWING ROUTE OF PROPOSED UNDERGROUND RAILWAY AND LOCATION OF STATIONS.

The following is a description of the route of said proposed railway : The centre line commencing at a point under the westerly side of Whitehall street, distant along the same 62.5 feet north from the northerly line of South street produced; thence by diverging lines under Whitehall street and Battery Park and State street respectively, forming a loop line, the tracks converging to parallelism at a point under Broadway between Bowling Green and Morris street; thence under Broadway and Union Square to 59th street; thence under the Boulevard to One Hundred and Twenty-first street; thence by viaduct to One Hundred and Thirty-fourth street; thence under the Boulevard to the south line of One Hundred and Fifty-sixth street; thence by viaduct to the north line of One Hundred and Fifty-ninth street; thence under the Boulevard to One Hundred and Sixty-ninth street; thence under Eleventh avenue to a point 1,460 feet north of the centre line of One Hundred and Ninetieth street; thence by viaduct on the same straight line produced to a point 442 feet north from the intersection of said straight line with the centre line of the Kingsbridge Road; thence to the right on a curve with a radius of 1,910 feet and in tunnel a distance of 860.6 feet; thence by tangent 138 feet; thence by curve to the left with a radius of 1,910 feet, a distance of 350 feet in tunnel and a distance of 510.6 feet by viaduct to a point on a line coincident with the central line of Audubon avenue produced and distant 425 feet north from the centre line of Two Hundred and Seventeenth street; thence by viaduct and on a tangent coincident with the centre line of Audubon avenue produced, across the Government ship canal, and thence by the same tangent and in depressed structure 670 feet; thence on the same tangent and by viaduct to and across Spuyten Duyvil creek; and thence on the same tangent by viaduct, depressed structure and tunnel as the contour of the lands may require, to a point 100 feet north of the central line of Delafield lane; thence to the left on a curve with a radius of 1,910 feet to a point 30 feet south from the centre line of Delafield's old lane; thence by a tangent to a point 112.4 feet south from the south line of Rock street; thence to the right by a curve with a radius of 500 feet for a distance of 220.8 feet to a point in the centre line of Forest street, 112.4 feet north of the south line of Rock street; thence by tangent coincident with the centre line of Forest street to the city limits.

Also, a loop from Broadway, under Mail street, City Hall Park, Park Row, and Chambers street and again connecting with the Broadway line.

Also, a branch route the centre line diverging from the Broadway line at or near Fourteenth street, running under Union Square to Fourth avenue; thence under Fourth and Park avenues to a point 112.15 feet north from the north line of Fortieth street; thence to the left on a curve with a radius of 250 feet for a distance of 154.55 feet; thence by tangent a distance of 292.18 feet to a point 40.1 feet north from the south line of Forty-second street, and 215.7 feet west from the centre line of Fourth avenue; thence to the right on a curve with a radius of 250 feet, a distance of 124.23 feet; thence by tangent 46.39 feet; thence to the left on a curve with a radius of 250 feet a distance of 182.37 feet to a point 4.4 feet north from the north line of Forty-third street, and 159.5 feet east from the centre line of Madison avenue.

2. The person or persons to whom said right, privilege and franchise shall be sold will be required to pay to the auctioneer for the account and benefit of the city of New York, at the time and place of sale, and for which the receipt of said board will be given, ten per centum of the amount bid for said right, privilege and franchise and will be required to attend at the office of the comptroller of said city, No. 280 Broadway, and to deposit with said comptroller, in cash or securities to be approved by this board, the sum of one million dollars, as a guarantee of full compliance with the terms of sale by the purchaser and by the corporation to be formed for the purpose of building and operating said railway, as herein provided, within five days after written notice has been served upon him or them by mail, at the address of said purchaser or purchasers given at the time of sale, that his or their bid has been accepted by the board of rapid-transit railroad commissioners; and in case of failure or neglect so to do, he or they will be considered as having abandoned their said bid, and thereupon said right, privilege and franchise shall be again sold by said board.

The balance of the amount of said bid, viz., ninety per centum, shall be paid to said comptroller within thirty

days after written notice, that the bid of such purchaser or purchasers has been accepted, shall have been served by mail upon the said parchaser or purchasers at his or their address, given at the time of sale.

3. The person or persons whose bid shall be accepted by the board of rapid-transit railroad commissioners shall within thirty days after the acceptance of said bid, pay to the comptroller of the city of New York, the sum of $89,247\frac{15}{100}$ dollars, with interest from the twelfth day of November, 1892, being the amount of expenses incurred by the said board of rapid-transit railroad commissioners and paid by the city of New York from the organization of said board to the 12th day of November, 1892, together with the sum of

dollars, the expenses incurred by said board after said 12th day of November, 1892, for which said city is liable, with interest to the date of payment, which said amount will be announced at the time of sale. Said person or persons shall also, within thirty days after the acceptance of said bid, pay to the commissioners of rapid transit, as a reasonable compensation for the duties performed by them, the amount to be determined by the general term of the Supreme Court of the first judicial department, which said amount will be announced at the time of sale.

4. The person or persons to whom such right, privilege and franchise shall be sold, shall, within two months after service upon him or them by mail, of a written notification at the address given at the time of sale, that said sale has been approved by the board of rapid-transit railroad commissioners, organize a corporation to exercise the said rights, privileges and franchises and to construct, maintain and operate said rapid-transit railway, with the powers and subject to the duties and liabilities granted or imposed by chapter 4 of the laws of 1891, and the acts amendatory thereof, and in conformity with these terms of sale.

5. Said corporation shall have a capital stock of fifty million dollars and shall be authorized to issue five hundred thousand shares of the par value of one hundred dollars each, on which five per cent. shall be paid in cash by the subscribers on subscribing for such shares.

6. The maximum amount of the bonded indebtedness which said corporation shall be authorized to incur, and which may be secured by a mortgage upon its property and franchises, shall be fifty million dollars.

The maximum rate of fare which said corporation may charge and collect for the carriage of a person over the whole or any portion of said railway, shall be five cents, and the maximum rate of freight shall be twenty cents per ton per mile, in not less than car-load lots.

For less than car-load lots the maximum shall not exceed five cents per hundred pounds, but the corporation shall not be required to transport any package for less than twenty-five cents.

7. The work of constructing said railway or railways shall at all times be under the supervision of the board of rapid-transit railroad commissioners, and shall be subject to the approval of an engineer or engineers to be appointed from time to time by the board to superintend the construction of said railway.

8. The salary or salaries of such engineer or engineers as may from time to time be fixed by the said board of rapid-transit railroad commissioners, shall be paid by said corporation, and said engineer or engineers shall hold their office at the pleasure of said board.

9. Said corporation shall, before commencing work upon the proposed railway, execute and deliver to the mayor of the city of New York a bond or obligation for two million dollars, with sufficient sureties, by which said corporation and said sureties shall be bound to pay or cause to be paid to the city of New York, and to any and all persons or corporations owning lands along the line of said railway, any and all direct damages or injury that the property of said city, or persons or corporations, shall sustain by reason of the construction of said railway; and that said corporation shall restore the streets and avenues to as safe and as good a condition as the same were in before the commencement of work thereon. Said bond shall be in such form as said board of rapid-transit railroad commissioners shall determine, and the sufficiency of the sureties upon said bond shall be approved by said board, and the mayor of the city of New York shall hold said bond in trust for the benefit of the parties interested therein.

* * * * * * *

11. The bids and all rights which may have been acquired thereunder, shall become null and void and of no effect at the option of said board of rapid-transit railroad commissioners should there be a failure to organize a corporation to exercise such rights, privileges and franchises as required by these terms of sale, and by chapter 4 of the laws of 1891, and the acts amendatory thereof, or for any violation of any of the requirements of these terms of sale which should be complied with before such corporation is organized; and thereupon any deposit and payment which may have been made pursuant to these terms of sale, shall be paid into the treasury of the city of New York, upon a certificate being made and filed by said board with the comptroller of the city of New York that said bid and all rights which may have been acquired thereunder have become null and void and of no effect; and said rights, privileges and franchises shall be again sold by said board, subject to all the provisions of said chapter 4 of the laws of 1891 regulating such cases.

12. The said corporation shall begin the construction of said railway within four months after said bid shall have been accepted by said board, and said railway shall be finished and in running operation over the entire route within five years from the commencement of the construction thereof.

13. Said corporation shall complete and finish the several portions of said proposed railway within the times herein respectively limited from the time above provided for the commencement of the construction of said railway as follows: The portion between City Hall and Fourteenth street within two years; the portion south of the City Hall, and the portions between Fourteenth and Fifty-ninth streets and between Fourteenth and Forty-third streets on the east side branch within three years; the portion between Fifty-ninth street and Harlem river within four years, and the remaining portion within five years.

14. The board of rapid-transit railroad commissioners, however, reserves to itself the right and power to extend the times for the commencement and completion of the construction of said railway and of the several portions thereof, if in its discretion the said board shall deem such extension, or extensions to be for the best interests of the city of New York.

15. In case the corporation formed for the purpose of constructing said railway, shall fail to begin or finish the construction of said railway and of the several portions thereof within the times for those purposes respectively limited, all rights, privileges and franchises of such corporation to maintain and operate said railway shall be forfeited, and upon such forfeiture being adjudged by the court in a suit brought for that purpose in the name of the people or by said board of rapid-transit railroad commissioners, then said board shall have power to advertise and re-sell said rights, privileges and franchises and so much of said road as shall have been constructed by such corporation, and the proceeds of such re-sale shall be applied first to the payment of the expenses of the re-sale, then to the discharge of any liens which may have been created upon such property and the baiance shall be paid over to the said corporation.

16. The bidding will be kept open after the rights, privileges and franchises have been struck down, and in case the purchaser fails to comply with any of the above

conditions of sale, said rights, privileges and franchises will again be put up for sale under the direction of said board of rapid-transit railroad commissioners under the same terms of sale, and said purchaser will be held liable for any deficiency there may be between the sums for which said rights, privileges and franchises shall be struck down upon the sale and that for which they may be purchased on the re-sale and also for any expenses occurring on said re-sale.

17. The board of rapid-transit railroad commissioners reserves to itself the right to reject all bids and re-advertise the said rights, privileges and franchises for sale under the same or different terms of sale as often as it may deem necessary in the interest of the city of New York; and said board will only accept that bid which, under all circumstances, in its opinion is the most advantageous to the public and the city of New York. If such bid be rejected the amount paid will be returned.

18. The corporation to be organized to construct and operate such rapid-transit railway and to enjoy and exercise the rights, privileges and franchises herein mentioned shall be created and organized in the manner following:

Articles of association shall be duly signed and acknowledged by not less than twenty-five persons, and such articles shall set forth the name of the proposed corporation and the duration thereof. Said articles must also state that they are made and filed under and in pursuance of chap. 4 of the laws of 1891, for the purpose of taking and exercising the rights, privileges and franchises so purchased as aforesaid, according to the terms of sale; and must in all respects comply with said act. Such terms of sale and all plans and specifications must be made a part of said articles, and annexed thereto and filed therewith.

The said articles must also contain such other provisions as the said board may deem requisite and necessary not inconsistent with the terms of sale or with the act above mentioned. The said articles must be approved by said board by the concurrent vote of four members thereof, and its approval must be endorsed thereon and attested by the seal of the board and the signature of its presiding officer, and must then be filed in the office of the secretary of state, and a duly certified copy or a duplicate thereof must be filed in the office of the clerk of the city and county of New York.

19. Immediately after the articles of association shall have been so made, approved and filed, the board of rapid-transit railroad commissioners shall cause books of subscription to the capital stock of said corporation to be opened, and shall give public notice of the opening of such books and of the time and place at which subscriptions will be received; and when the full amount of such capital stock shall have been subscribed by not less than fifty persons, and five per cent. of the amount subscribed shall have been paid in in cash to such bank or trust company as the board may select, the said board shall call a meeting of the subscribers for the purpose of organizing said corporation, serving upon or mailing to each subscriber a notice of such meeting at least ten days before the time appointed for holding the same; and the person or persons whose bid shall have been accepted by the said board of rapid-transit railroad commissioners, shall, if they elect to become subscribers to the capital stock of such corporation, be entitled to a preference for themselves and their associates in subscribing for and in the allotment of the shares of the capital stock of such corporation.

A MYSTERIOUS DEATH.

Charles Bartold, an employé of the electric-light company at Stockton, Cal., was killed in a peculiar manner on the night of November 12. He attempted to fix a lamp which needed attention and, as the despatch says, "without taking the usual precaution to stand on a non-conductor, he attached a crank while standing on the earth and instantly fell." He died in a few moments, but local electricians claim that he was not killed by shock because there was not a mark on his body.

TELEPHONE ON BOARD.

The police tug *Stokley*, of Philadelphia, is probably the only boat afloat equipped with the telephone. In her cabin is placed a regular telephone outfit, and when she lies at her dock, the instrument is connected with the city telephone system by means of a switchboard on the dock. In this way instant communication between the boat and any point in the city can be had. The advantage of this would be inestimable in case of emergency.

NOTES OF GENERAL INTEREST.

ANDREW KELLY has secured a verdict for $2,000 damages against the Essex County Electric Company, of Newark, N. J. Kelly sustained a fracture of a leg and an arm by the breaking and falling to the ground of a pole at the top of which he had been working.

THE foundation-stone of the new electric-light station, which is to be erected at Portsmouth, N. H., on the site of the music hall which was destroyed by fire about a year or so ago, was laid on November 11. The system to be used in this station is the invention of Prof. Garnett, and the entire plant when completed will cost $300,000 Two miles of sea-wall and four miles of the principal thoroughfares will be lighted by means of 124 arc lamps of 2,000 C. P. each. The plant it is expected will be in operation by next August.

A HORSE owned by a milk-dealer at Pittsfield, Mass., touched his nose to an electric-light pole and was killed instantly. A telegraph wire had crossed the electric-light wire and in this way the pole became charged. On the same date at New Bedford, Mass., a letter-carrier's horse stepped upon the broken end of an electric-light wire and was killed.

FOREIGN NOTES OF INTEREST.

The press on which the Vienna *Fremdenblatt* is printed is run by electric power, the current being taken from the mains of the International Electric Company.

The Brussels Tramway Company and a suburban concern of similar character have asked permission to introduce the overhead electric trolley system on their lines, and the applications have been favorably reported upon.

ELECTRIC RAILWAY ALONG THE DANUBE.

News comes from Vienna to the effect that an electric railway is projected to be built along the banks of the Danube from Vienna to Buda-Pesth. An electric locomotor, the invention of Herr Kostler, will be used. This machine, it is said, will move at a speed of 123 miles an hour. Each car is designed to carry forty persons, and will be provided with a motor. From the meagre facts obtainable at the present time, it is evident that each car will be an independent unit—that is to say, will contain its own propelling mechanism—and will not be dependent upon any outside source of motion.

ELECTRICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the monthly meeting of Council held November 15, the following associate members were elected:

Craig R. Arnold, electrician and treasurer, Arnold

Electric Mfg. Co., Chester, Pa.; Ludwig K. Bohm, Ph.D., consulting electrical and chemical expert, 81 Nassau street, New York city; Edward Durant, electrician, with F. Pearce, 115 E. 26th st., New York city; Horace B. Gale, consulting electrical and mechanical engineer, 40 California street, San Francisco, Cal.; Fred S. Hunting, electrical engineer, Fort Wayne Electric Co., Fort Wayne, Ind.; James F. McElroy, mechanical supt., The Consolidated Car Heating Co., 131 Lake avenue, Albany, N. Y.; Th. Stahl, Creusot Works, Creusot, France.

The following associate members were transferred to full membership, their applications having been approved by the Board of Examiners:

Frank Bourne, electrical engineer, Field Engineering Co., 143 Liberty street, New York city; Benj. F. Thomas, professor of physics, Ohio State University, Columbus, Ohio; Alexander J. Wurts, electrical expert, Westinghouse Electric and Mfg. Co., Pittsburg, Pa.; George R. Metcalfe, electrical engineer, editor *Electricity*, New York city; Lewis B. Stillwell, electrical engineer, Westinghouse Electric and Mfg. Co., Pittsburg, Pa.

At a meeting of the institute in the evening, Dr. J. B. Williams made a series of tests of the insulating qualities of different oils, referred to in his paper read at the Chicago meeting of the institute. The insulation of samples of various wires was also tested, and the use of his apparatus fully explained.

Abstracts from this paper will be found on another page.

NEW LONDON ELECTRIC CLUB.

At a meeting of the New London Electric Club, held at 194 Bank street, New London, on November 10, an interesting paper was read on the "Electric railway, and the adaptation of electricity to elevated and underground railways."

POSSIBLE CONTRACTS.

For the information of electrical engineers and contractors and steam-plant contractors, we give below a list of new buildings projected in which electric and steam installations may be required:

A new building is to be erected for the Chicago Academy of Sciences, Chicago.

An imposing structure is being erected by the First National Bank, of Durham, N. C.

A new building will be erected by the Englewood Field Club, of Englewood, N. J., containing all the modern improvements.

A magnificent new building is being erected by the Chicago Historical Society, Chicago, at Dearborn avenue and Ontario street. It will cost $150,000.

The building at 14 Maiden lane, New York, will be torn down and a new ten-story steel and granite structure erected, to be occupied as a diamond exchange.

A fine club-house will be erected in Harlem, N. Y., at an expenditure of $500,000, to be known as the Mount Morris Club house. W. S. Seymour is president.

The College of the City of New York will move uptown. Plans for a new building are being prepared by Architect W. B. Tuthill. The building will cost about $750,000.

A club-house to cost $60,000 will be erected at South Lakewood, N. J., by a syndicate of New York men, with Louis M. Simson and J. H. Louis at the head of the enterprise.

The armory board of New York has decided to proceed at once with the building of a new armory for the Sixty-ninth regiment. An armory will also be built for the use of Troop A.

New quarters will be erected for the New York College of Pharmacy at 68th street and the Boulevard, New York, to cost $250,000. Little & O'Connor, 28 West 23d street, are the architects.

Honesdale, Pa., will soon have a novel hotel. The sides will be covered with coal taken from the mines in the district. The hotel will be known as the "Anthracite," and will have 250 rooms.

The plans for the construction of the union depot at St. Louis, Mo., have been approved by the city board of public improvements, and when finished it will have cost, including the ground, $5,000,000.

It is said that a hotel of the highest class may be erected on Michigan boulevard, Chicago, between Twelfth street, and Park place and adjoining the new Illinois Central depot. Messrs. Ira Holmes and C. W. Rigdon are the interested parties.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, November 19, 1892.

THE storm of last Tuesday night caused some trouble with street electric lights. A pole at the corner of Duane street and Broadway took fire through a short circuit, evidently within its interior.

W. J. NEWTON, manager of the Clamp Socket Manufacturing Co., 136 Liberty st., says he is ready to receive orders. These people have lately fitted up an office and the same is in the hands of an able manager.

THE enamelled reflectors for incandescent lamps, handled by Mr. Hermann Aich, 43 Murray street, city, are just what the trade is looking for. They are indestructible and are easily cleaned, and they relieve life of some of its burden.

A CROSSED wire in the Hudson River cable station of the Western Union Telegraph Company at the Pennsylvania depot, Jersey City, started a fire during the night of November 16, and all but two of the 185 wires were destroyed. The damage was repaired early the following morning.

AMONG the companies warned to pay up arrears for taxes are the Brush Electric Illuminating Company for $6,560.61; the Consolidated Telegraph and Electric Subway Company, $65,766.33; Central Park, North and East River Railway Company, $4,982.85; Southern Boulevard Railroad Company, $2,216.25, and United States Illuminating Company, $2,789.39.

A FIRE occurred in the dry-goods establishment of Henry Batterman, Brooklyn, E. D., on November 15, caused by the crossing of an electric-light wire with another one leading into the building. The damage was slight. A similar accident occurred at the extreme end of the elevated railroad platform at Flushing avenue station, but the flames were soon extinguished.

T. J. MURPHY, manufacturer of slate switchboards, etc., recently received an order from the Brooklyn Sugar Refining Co., Kent ave. and Smith st., Brooklyn, for a 70-foot switchboard. Mr. Murphy agreed to have the same finished in 2 weeks. Three days after he had ordered it from the quarry the board was on its way to New York. The Brooklyn people had it 6 days ahead of the promised time, and are very much pleased with it.

SINCE May 1 the New York office of the Wainwright Mfg. Co., of Boston, Mass., has sold over 100 heaters aggregating close to 25,000 H. P. These sales do not include Chicago, San Francisco or Boston houses which have been (aside from what are reported by the New York house) very large. There have been large sales of expansion joints, also surface condensers. Among the

recent sales of the latter was one for a large surface condenser for the Manhattan Elevated R. R. Co., New York, to be used at its coal-hoisting station, now being erected on the Harlem river. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	59 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	207 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	113 50
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	138 00
Brooklyn Municipal Light	500,000	10 00	15 75
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Chicago Gas	25,000,000	100 00	96 75
Commercial Cable Co	7,716,000	100 00	175 00
Cons. Gas Co., N. Y.	35,430,000	100 00	122 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	109 00
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	47 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	113 50
General Electric Co., 5s	4,000,000		*103
General Electric pref.	4,223,700	100 00	118 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	25 00
Laclede Gas pref.	2,500,000	100 00	72 25
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			136 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co	10,394,600	100 00	59 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	96 00
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co	39,767,200	100 00	13 00
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co., Va.	30,000	10 00	9 50
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
U. S. Rubber Co.	26,947,000	100,00	43 25
Western Union	100,000,000	100 00	98 50
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	37 75
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

To those who have garnered young fortunes for any considerable time from industrial investments, especially those indulged in abroad, the present conditions of the New York market should be as plain to follow as an elevated-railway track. Since such things were made possible by the acts of the British Parliament in 1862, they have been abundantly propagated by the London promoter, and have proven at least as profitable as patents; in fact, a very much larger portion of the incorporations have succeeded than the patents. When a few years ago the limited liability condition was placed on our statute-books it was tested by a few corporations, but did not seem to find any more favor than the various co-operative schemes; still the seed was planted, and it remained for the era of electric development to nurture it into active life, and for the past ten years the industrials have grown rapidly, until now it is quite the proper racket to float them in the markets of New York and a few Eastern cities instead of sending them at much extra expense to Europe. Nearly every company which has gone to the public for capital this year has been gratified by full applications for all the shares offered. The dividends are being earned and paid with such continuous regularity that European investors are turning their attention this way, and it is not at all unlikely that a considerable portion of these securities will find a quiet, permanent resting-place there.

Among the list none are superior to the electrics. Western Union, chief of them all, with its $100,000,000 of capital dealt in daily, practically at par, and increasing at that, is a magnificent financial monument showing the possibilities of the past and the probabilities of the future. From this down to the latest patent granted—for a learner's telegraphic key and sounder, more simple and effective than the next cheapest, which costs more than as much again to manufacture, and one-half of which is offered for the trifling sum of $500—the whole field is snapping with the growth of industrial successes in that line. Electric-light and railway corporations multiply so rapidly that a weekly census, such as the electrical press can gather, falls far behind. The supply corporations are situated in every city of consequence, and vie with each other in introducing improvements, regardless of the few parent companies whose business is so extensive that they do not know their own assets or belongings. The business even calls for a language of its own. Webster is for once left behind. The encyclopædias offer little assistance to the student; a new work has been found absolutely necessary. Of course the demand is supplied, being published simultaneously in London and New York and christened "The Standard Electrical Dictionary;" its six hundred and odd pages filled with pictures, descriptions, directions and definitions of terms, machines, measurements, construction, assembly, equipment and completion of every known thing in the electrical science down to the fall of 1892. It is a necessity to the workman, expert or investor, and will in its way pay dividends equal to the best bonds or shares in the market. The *Sun* has recently published a guide to New York, and advises all who wish knowledge of the city to "consult the guide instead of a policeman." The same advice holds in this case: if you want to know all about electricity, don't ask, but look in "Sloane's Dictionary"—it's there.

I fancy a pot of money is being lost by not securing Westinghouse preferred seven per cents. It is

impossible to tell as yet how the incandescent lamp business will affect the company or to what extent, if any, the new lamp will help them out, but in any case par is a cheap price for it. If I had a few hundred of those sevens in my strong box I should turn the key on them until they doubled in price. They are a good Christmas present, the next best to a year's subscription to the ELECTRICAL AGE, a guarantee identification card, or if old and cold, filled with rheumatism and cramps, and forced to be out this winter climbing poles, stringing wires or otherwise exposed, a set of Ivory & Wlson's magnetic soles. The bonds of the General Electric and Edison Illuminating are reaching up among the figures occupied by the Governments. Can it be that investors consider them equally good? Speculators do not purchase securities at such prices, they prefer rails which are at the beck and call of the Exchange to industrials, the intrinsic value of which can be decided on from a supply-and-demand standpoint. The General Electric Co.'s common stock books will be closed from Nov. 29 to Dec. 7 for the purpose of facilitating the allotment of the $6,000,000 five per cent. bonds as per circular of Nov. 15.

PERSONAL.

S. F. Austin, superintendent of the French Atlantic Cable Company, 34 Broad street, New York, left on November 16 for a four months' pleasure trip to the Pacific coast. All his friends join in wishing him a most enjoyable time.

Mr. A. Leofred, mining engineer, Quebec, Can., is kept as busy as he can be all the year around making assays or preparing reports on American and Canadian mines.

CONSULTING ENGINEER.

Mr. Wm. M. Sturges, of 22 Main street, Utica, N. Y., offers his services as consulting electrical and mechanical engineer. He has had 15 years' experience in the practical management, construction and equipment of electric railways, power-houses, tracks and shops for the same, and has been connected with some of the best managed and paying roads in the country. All necessary advice and instruction for the equipment of a first-class electric railway Mr. Sturges is capable of giving.

AN IMPORTANT LICENSE.

Queen & Co., of Philadelphia, have granted a license to George Cutter, of Chicago, to sell a new line of ammeters and voltmeters, which will be known as the "Cutler non-inductive instruments." These goods come under the Cardew patent, which is the property of the former concern, and covers instruments that make use of a heated wire.

TRADE NOTE.

AKRON, OHIO, Dec. 31, 1891.

AKRON BELTING CO., City.

Gentlemen: Referring to your inquiry as to how we like your belting, would say that at different times we have had most of the best makes, always buying the best we could find. We have always used your "Akron" grade almost exclusively for the past three years or more, and we are decidedly of the opinion that there is no better belting made. We have never had any other that would equal it from one end of the roll to the other in uniform quality.

Yours respectfully,

LEWIS MILLER, *Supt.*

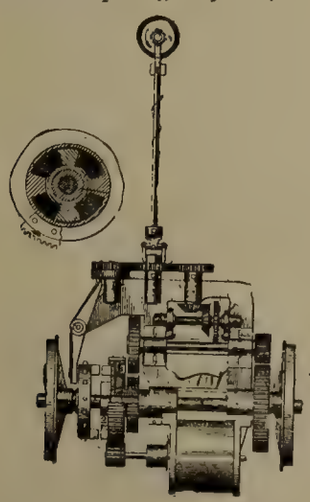
The Electrical Age's Illustrated Patent Record.

Issued November 15, 1892.

486,068. Electric Locomotive. William E. Allington, East Saginaw, Mich. Filed June 9, 1891.

486,078. Armature for Dynamo-Electric Machines and Electric Motors. Charles S. Bradley, New York, N.Y. Filed Nov. 17, 1890.

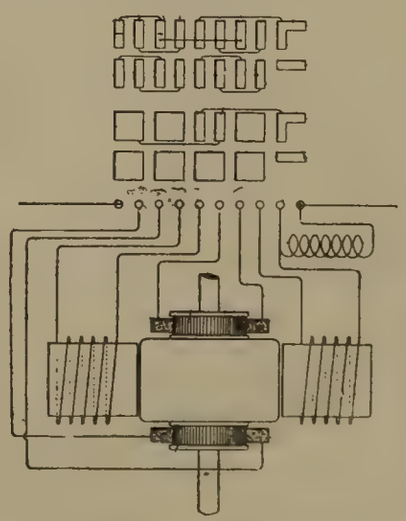
486,094. Secondary Battery. Rudolf Eickemeyer, Yonkers, N. Y. Filed April 4, 1890.



485,068.—ELECTRIC LOCOMOTIVE.

486,123. Electric Meter. John Perry, London, England. Filed June 8, 1892. Patented in England, in France and in Belgium.

486,149. Test-Circuit for Burglar-Alarm Systems. Edmund R. Wilder, Kansas City, Mo., assignor to the Wilder Duplex Electric Burglar Alarm and Messenger Company, of West Virginia. Filed Aug. 22, 1891.



468,213.—GOVERNING ELECTRIC MOTORS.

486,176. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Jan. 12, 1892.

486,206. Police Signal System. John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portland, Me. Filed Oct. 14, 1887.

PATENTS.—Continued.

486,213. Governing Electric Motors. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Dec. 19, 1891.

486,214. Governing Electric Motors. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Jan. 2, 1892.

486,215. Double Snap-Switch. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Feb. 10, 1892.

486,234. Armature for Dynamo-Electric Machines. Albert L. Parcelle, Boston, Mass. Filed Nov. 7, 1891.

486,241. Electric Switch. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 16, 1891.

486,243. Electrical Annunciator. Franklin S. Carter, Burlington, N. J., and George P. Stumpf, Philadelphia, Pa. Filed Aug. 13, 1891.

486,244. Microphone. Charles Clamond, Paris, France. Filed March 21, 1892.

486,282. Messenger-Call System for Buildings. Frank H. Fuller, Springfield, and Charles B. Perkins, Holyoke, Mass.; said Fuller assignor, by mesne assignments, to Elroy F. Cross, West Springfield, Mass. Filed April 5, 1892.

486,315. Electric-Railway Conduit. Augustine W. Wright, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, of Illinois. Filed May 12, 1892.

486,324. Sign for Electric Lamps. Edwin W. Clay, Louisville, Ky. Filed June 21, 1892.

486,332. Telegraph System. Adolphus Gipperich, Richmond, Va. Filed July 30, 1892.

486,333. Trolley for Electric Railways. Augustus H. R. Guiley, South Easton, Pa., assignor to himself and Wilson B. Solliday, same place. Filed Dec. 31, 1891.

486,334. Regulable Electric Lamp. George W. Hall and Joseph J. De Marr, Georgetown, Col. Filed Dec. 1, 1891.

486,338. Electric Alarm. Henry A. Hull, New Brunswick, N. J. Filed April 20, 1892.

486,354. Electro-Magnetic Bell. James J. Ross, Detroit, Mich., assignor of one-half to George R. Holden, same place. Filed Dec. 29, 1891.

486,377. Electric-Arc Lamp. Daniel Higham, Boston, Mass., assignor by mesne assignments, to the Higham Electric Company, Portland, Me. Filed July 9, 1892.

486,417. Regulator for Dynamo-Electric Machines. Alexander Dow, Elgin, Ill. Filed March 20, 1891.

JOHN A. CROSS,
Consulting
Electrical and Mechanical Engineer and Expert,
136 LIBERTY STREET, NEW YORK.
Electrical Exchange Building.
Lighting or Power Plants and Special Machinery Designed and Constructed.



SAL AMMONIAC
(ELECTRIC BRAND)
For Electrical Purposes
Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by
A. KLIPSTEIN, 122 Pearl St., New York.

THE CLARK COMPANY, NEW YORK, 192 BROADWAY,
CLARK is the only Company in the United States that makes a specialty of manufacturing under own patents, Electric Arc Lighting Apparatus for every purpose, including the finest arc lamp in every respect, suitable for any class of interior lighting, with plain or ornamental fixtures, and can be used on incandescent circuits, on any voltage from 65 upwards, in series or single, or on arc circuits of standard current.

PLATINUM
FOR ALL PURPOSES.
Scrap and Native Platinum Purchased.
BAKER & CO.,
408-414 New Jersey Railroad Ave., Newark, N J.

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ELECTRICAL AGE

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THE NATIONAL ELECTRIC-LIGHT ASSOCIATION.

We are informed by Secretary Porter that the 16th convention of this association will be held in the Bell Telephone Building, St. Louis, Mo., February 28, March 1 and 2, 1893.

THE GROUND RETURN PROBLEM.

We print elsewhere in this issue the discussion which followed the reading of the report of the committee on "A Model Electric Street Railway Roadbed and Underground Wiring" at the Cleveland convention of the American Street Railway Association last October. It is interesting as showing that the problem of securing an efficient ground return has not yet been satisfactorily solved. Some novel and interesting suggestions were made by practical street-railroad men, who, while not electrical engineers, have some original ideas which are well worth considering. One, for instance, proposed that the old rails be buried under the surface of the ground, and so connected as to be used as the ground return. The theoretical objection to this plan was pointed out to be the difficulty in making a good joint between the ends of the rails; the committee, however, thought that it was worth trying. One way to solve the problem of making good joints would be to weld the ends of the rails together, which could be done electrically. Some enterprising concern should try the plan; it certainly is worth trying.

ELECTRIC LIGHT IN SINGAPORE.

Electricity is pre-eminently a civilizing agent. Almost every day we hear of its adoption in some form or another in sections of the world that were a few years ago regarded as impregnable to the influence of improvement. The latest report is to the effect that the Sultan of Singapore will probably adopt the electric light when the city gas contract expires on January 1 next. Our friend, the Sultan, shows his appreciation of the good things born of civilization and progress in expressing a desire to visit the World's Fair in Chicago next year.

ELECTRICAL EXHIBITS AT THE WORLD'S FAIR.

About three hundred concerns and individuals directly connected with the electrical industry in every branch have applied for exhibition space in the electrical department at the World's Fair. It may seem to some persons that 300 applications do not tell a very flattering story of enthusiasm, but when it is remembered that a great many of these 300 applicants will represent the interests of many other concerns besides their own, it can be readily seen that the actual exhibits will far outnumber the applications for space. There is no danger of any lagging on the part of the electrical trades.

OPENING THE WORLD'S FAIR EVENINGS.

The strong and positive opposition expressed in the electrical trades against the closing of the World's Fair at 7 o'clock each evening is having a softening effect upon the authorities. Col. R. C. Clowry, chairman of the World's Fair committee on electricity, called the attention of Mr. H. N. Higinbotham, chairman of the council of administration, to the state of feeling in the matter, and the latter gentleman promptly replied to the effect that it was the intention of the Fair authorities to open the gates at 8 o'clock and keep them open till 11 o'clock on three to six evenings a week, according to circumstances. To electric-lighting interests this practically means that they may have three opportunities or they may have six each week to exhibit their goods as they should be exhibited. As we have already pointed out it would be a task impossible of accomplishment to produce electric-light effects in broad daylight. Without natural darkness they are robbed of their charm, and no concern handling goods of this character would think of trying to display them to the best advantage in the daytime. The electric-lighting interests are very large, and cannot be ignored in this matter. The Fair should be open every night in the week without reserve. The correspondence above referred to will be found in full elsewhere in this issue. Mr. Higinbotham's reply is too indefinite to be satisfactory.

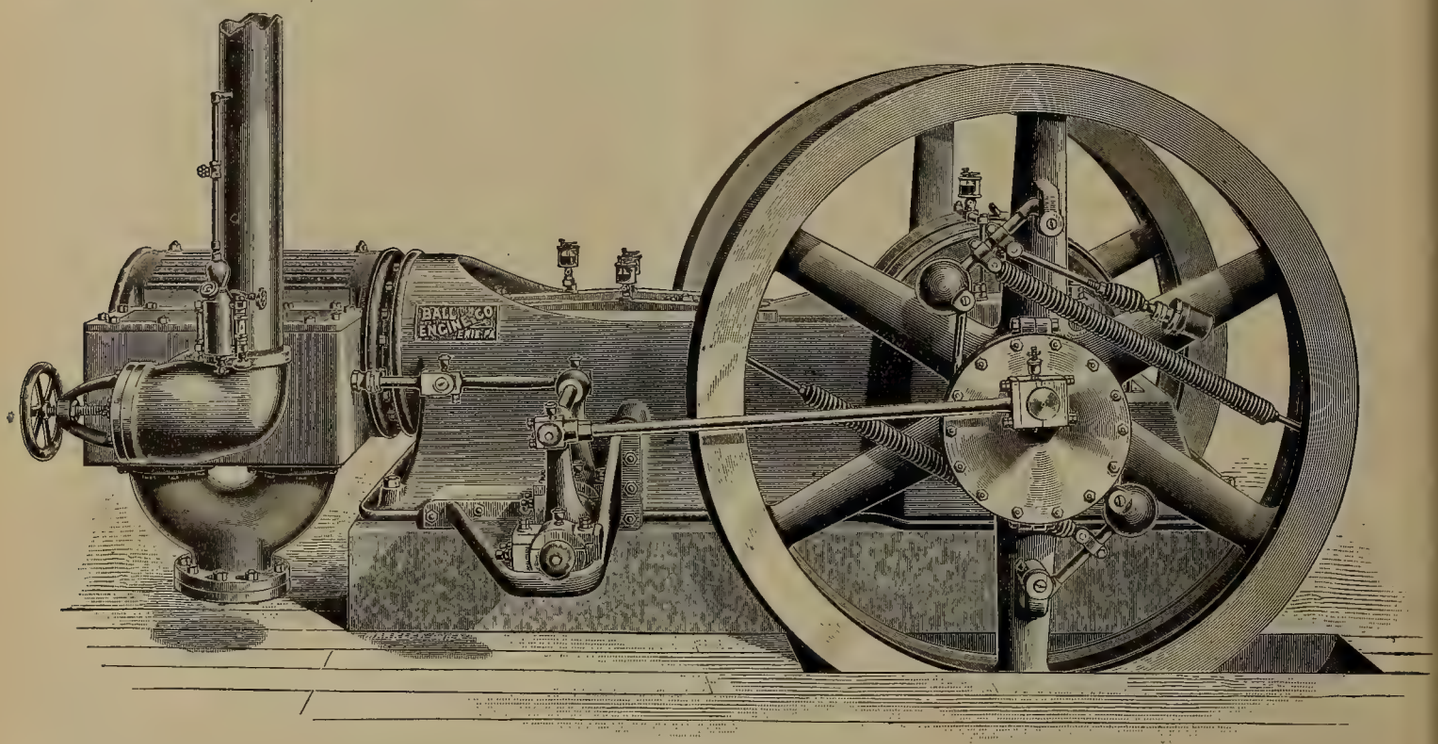
NEW HEAVY-DUTY ELECTRIC RAILWAY ENGINE.

In selecting an engine for electric-railway service the character of its duties should be carefully considered. It will be found that the work is very exacting and severe, and the engine should be adapted for heavy duty, varying load and long, continuous runs. It should, therefore, have great weight and strength, with sufficient metal so distributed as to receive the various strains and thrusts of moving parts without deflection or vibration.

The engine shown in the illustration was designed by the Ball Engine Co., Erie, Pa., especially for electric railways and electric welding, and possesses the above requirements to an admirable degree, as may be seen by the view and the description following.

The frame of the engine is massive and heavy and internally ribbed so as to give the greatest attainable stiffness. The crank-shaft is forged out of a solid steel ingot of the best quality, and is of large diameter and great strength. The connecting rod and straps are forged out of steel ingots and are of a new design, combining strength with efficiency. The main bearings are unusually large, and are so arranged that both the vertical and side wear of the liners may be taken up. The main bearing liners are genuine babbitt, carefully scraped and fitted, and as they are made removable they can be quickly and easily taken out and replaced with new ones if necessary. The crank-pin boxes are lined with genuine babbitt. The cross-head boxes are made of pure copper and tin. The cross-head is a steel casting with very large bearing surfaces, and is babbitted on the four faces with genuine babbitt. The cross-head pin is tool steel, and the piston-rod a fine quality of crucible steel. The oiling devices are of the most improved form, and all fittings are complete and of the best description. The regulation by means of the improved governor is such that the engine has shown in practice perfect regulation under conditions where the variation in load on the generator from zero to the full capacity has occurred in less than five seconds of time.

Without going into any further details, it will suffice to say that thorough workmanship and materials of the highest excellence go into the construction of the engine, and every detail receives the most careful attention. The manufacturer, the Ball Engine Co., Erie, Pa., confidently offers it as the best engine on the market and, for its horse-power and type, the strongest and heaviest built. Believing that the electric street-railway interests require a strictly first-class engine in every respect, it has designed the engine to that end, and it claims has succeeded.



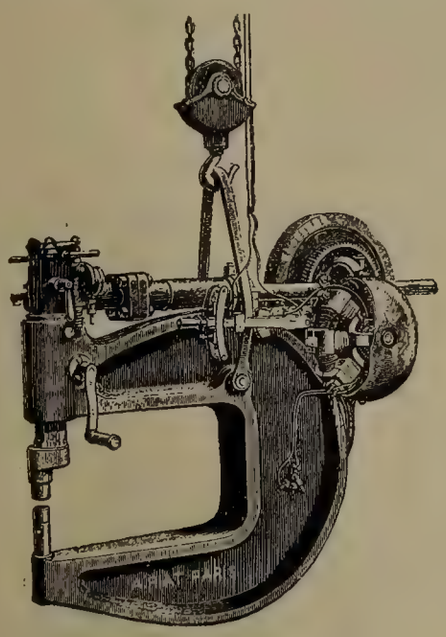
NEW ELECTRIC RAILWAY ENGINE.

ELECTRIC RIVETING-MACHINE.

At the Crystal Palace Exhibition in London one of the latest applications of electric power is shown in the electric riveting-machine made by Delaloe and Piat, of Paris, an illustration of which will be found herewith.

"In this machine," says the London *Engineer*, "the piston is moved forward in a horizontal direction by the action of the electric motor working through speed-reducing gear, and compresses oil on the upper surface of the ram up to 300 kilogrammes per square centimeter—two tons per square inch. The ram, which acts vertically, has an area of 16 square inches, and therefore the pressure on the rivet-punch amounts to 32 tons. To effect this, the motor takes 25 ampères at 110 volts, or about $3\frac{3}{4}$ electrical horse-power, for a period of two or three seconds at each rivet. The motor is a multipolar machine, having eight poles on each side of the armature and two carbon brushes placed 45 degrees apart. The switch for starting the machine is seen in the engraving, and is arranged so that the lever in the furthest position cuts off the current after the piston has developed sufficient momentum In this position also a brake can be applied to the fly-wheel to suit the requirements of the work. In bringing the lever back to the intermediate position a spring carries it clear of the starting contact and places it in the position ready for reversing. On reversing the motor the piston is carried back ready for the next rivet. The rivet-punch is raised in the present machine by a hand-crank, but it is intended to perform this by the action of the motor on reversing. The inventors intend to further improve the capability of the machine by heating the rivets *in situ* by an electric current. The illustration

shows the machine slung ready for riveting horizontal webs or angle-irons of girders, the rivet-punch being especially fixed with a set out from the centre in order to take flush work. The machine can also be slung in



ELECTRIC RIVETING-MACHINE.

the other position for upright work. In France and Germany these riveters have been used successfully and economically, and patents have also been granted in England. Some are now in use on three large bridges, each about 2,000 feet span. The generating dynamos are fixed on the bank, and the current taken along the whole length of the bridge by bare conductors. To

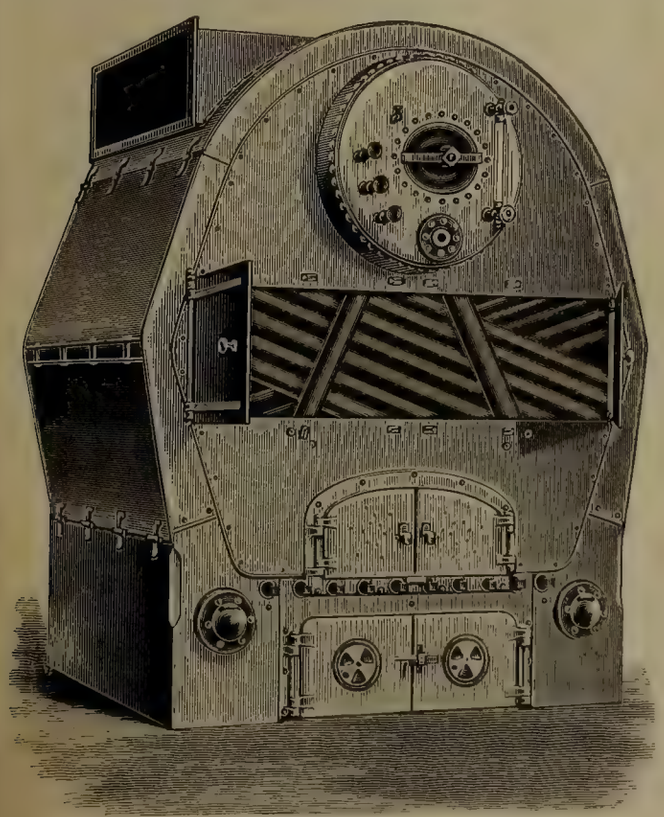


FIG. 1.—WATER-TUBE BOILER.

these can be attached the insulated leads, connected to the riveter in any position required. The system as far as canalization is concerned has a decided advantage over the conveyance of water under pressure in flexible pipes, with the inevitable crowding and difficult working in and out among the lattice-work of the girders."

NEW WATER-TUBE BOILER.

In designing this sectional water-tube boiler the following features were the objects sought: safety, durability, accessibility, high evaporative efficiency and economy as to space. All of these the builder claims to have attained to an eminent degree, and guarantees entire satisfaction with the performance of these new boilers.

In the construction of these boilers material of superior quality is used, and absolute safety and entire freedom from leakage is guaranteed. The grate area and heating surface are of liberal proportions and the entire interior of the boiler is readily accessible from the outside for examination, cleaning or repairing. The fur-

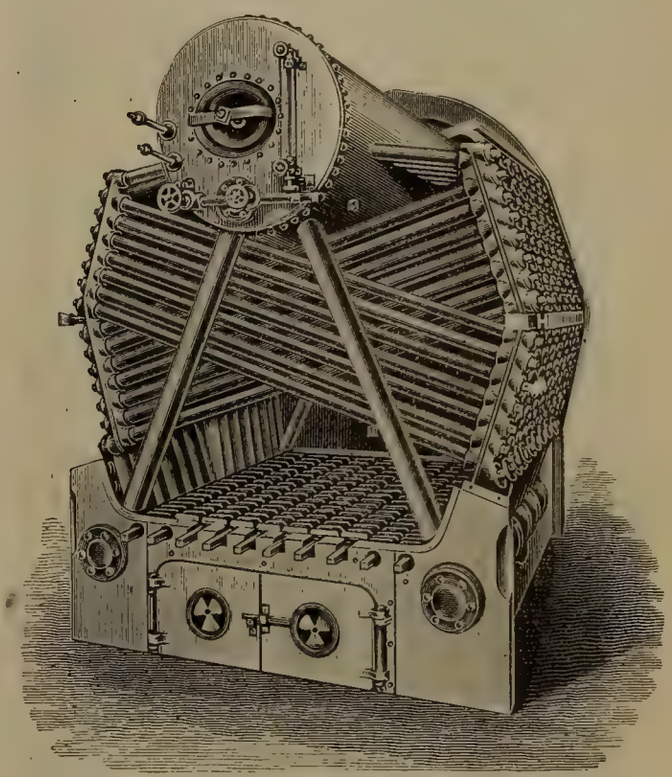


FIG. 2.

nace extends under the entire boiler and is so constructed that any kind of fuel may be used.

Fig. 1 gives a general front view of the boiler with the two front doors open showing the interior.

Fig. 2 shows the arrangement of the tubes. They are placed in transversely inclined series, with several tubes in each section. As will be seen, every tube is wholly in the furnace, directly over the fire, and every square inch of surface is in active employment. The heating surfaces and water-ways are so arranged that the movement of the water in the boiler is constant and rapid. On account of the shortness of the tubes the expansion is reduced to a small fraction, and the proportion and combination of the various parts of the boiler is such that expansion and contraction occurs without strain or disturbance of any of the parts.

Provision is made for the inspection of the interior of each tube, cleaning and re-expansion of the same, and, when necessary, a new tube can be substituted with little trouble or delay.

The mud-drum is accessible from the outside at each end through a removable cap.

After the sections, drums, etc., are ready for pressure, and after being tested, they are encased in heavy sheet-iron, lined with a non-conducting material composed of asbestos and magnesia, and the casing is well bolted to a wrought-iron angle or channel-bar frame

Fig. 3 shows a boiler completely encased, as it appears when in use.

At the front and rear, and on both sides opposite upper and lower headers, hinged doors are provided for the purpose of interior examination of the boiler.

The grates supplied with each boiler are designed to suit the fuel to be used, and the usual complement of valves, gauges, etc., is also furnished.

These boilers are rated for generating power on the basis of the centennial standard, *i.e.*, the evaporation of 30 lbs. of water at 70 lbs. pressure, from temperature of 100°—one horse-power, this duty to be accomplished with a consumption of anthracite coal of good quality at the rate of 12 lbs. per hour per square foot of grate, with good natural draft.

The actual steaming efficiency and the ultimate capacity, however, is largely in excess of this rating.

Safety is one of the advantages claimed for this boiler. Each section of tubes and headers is tested under a hydrostatic pressure of 500 lbs. before being assembled, and each steam drum has a tensile strength of not less

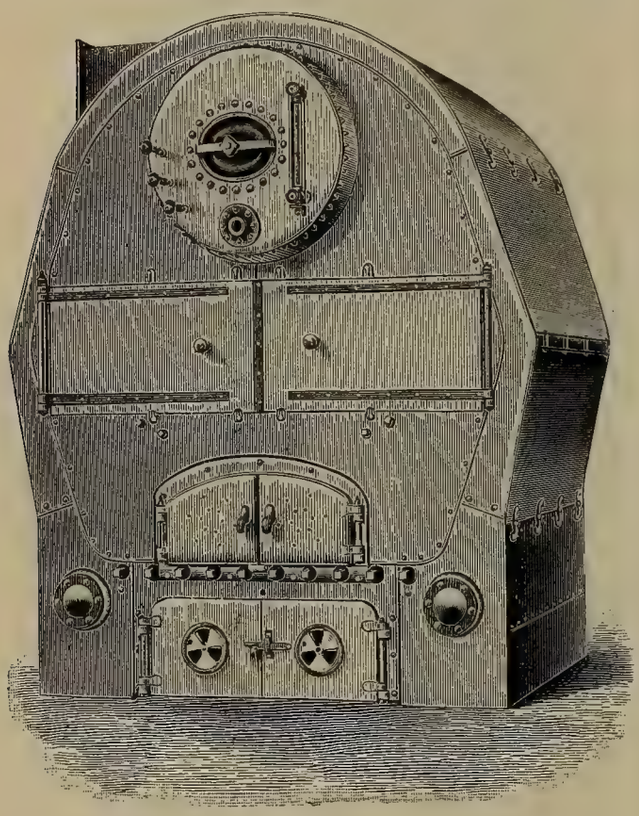


FIG. 3.

than 60,000 lbs. per square inch of sectional area. Each plate employed is of proper thickness to carry a working pressure of 250 lbs. per square inch. Positive circulation is another important advantage claimed for this boiler. The water passing through the tubes is exposed to the action of the fire in a steady and continuous flow, and the generated steam is quickly conducted to the drum.

The compactness of this boiler is another feature. A boiler of 200 H. P. can be passed through a 4′ x 4′ doorway, window, or sidewalk opening, and a 100 H. P. boiler occupies a floor space of 7½ feet square, and is less than 10 feet high.

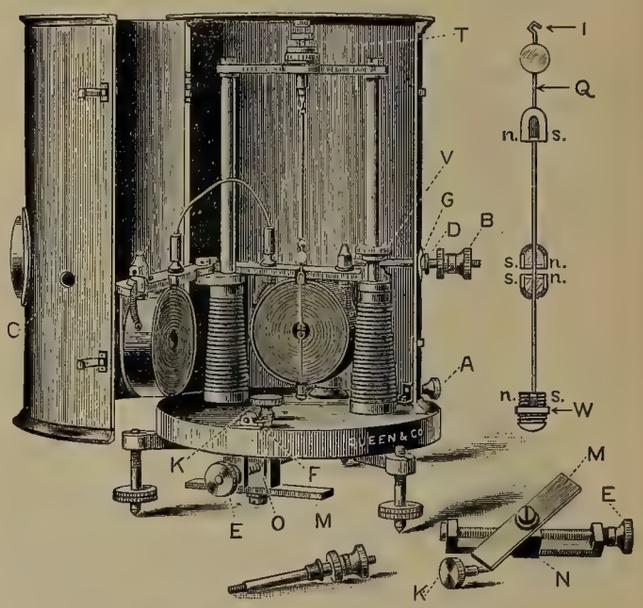
The New York Safety Steam Power Co., 30 Cortlandt street, New York city, is the builder of this boiler, which is of the Worthington patent.

NEW BALLISTIC GALVANOMETER.

For the measurement of currents of extremely short duration, such as those given by condensers, the ballistic galvanometer is the only available instrument.

For several months James W. Queen & Co., of Philadelphia, have had in practical use in their laboratory a galvanometer of this class, which represents the result of elaborate experiments, and is claimed by the firm to be the most perfect ballistic galvanometer on the market. An illustration of the instrument is shown herewith.

The two coil frames are supported by polished corrugated hard-rubber pillars $2\frac{7}{16}$ inches high, and the coils are graded, having five changes of wire. They are so arranged that they can be joined in series, multiple, differentially or singly by means of the flexible cord connector, shown at R in the illustration. The coil



NEW BALLISTIC GALVANOMETER.

frames are made strictly to gauge and interchangeable, and are removable with great ease for the substitution of others of different resistance.

As will be seen, the suspension system is easily accessible for inspection. The suspension consists of a very fine quartz fibre, which has proved superior to cocoon silk for this purpose; it is perfectly elastic and shows no "set."

A regular light suspension is also provided and can be substituted for the ballistic system very readily. A control magnet, M, is provided for use with the light suspension.

As usually supplied the coils of this instrument have a total resistance of 500 ohms, but interchangeable coils of greater capacity can be supplied to order, thus giving the instrument a capacity for measurement of a great range.

The instrument embodies one of the most important improvements to galvanometers which has been made for many years, viz.: the method of varying sensibility within the widest limits, without "drift." This is accomplished by altering the magnetic moment of one or more of the magnets of the system, by strengthening or weakening their fields by means of a device attached to and moving with the system itself. The system shown at the right of the figure consists of four bell magnets the upper and lower making one set and the central pair another. The lower magnet has cut upon it a screw thread, upon which moves the soft iron ring, W. The outer magnets being a trifle longer than the others, control the system. If, now, the weight is raised the lower magnet will have its lines partially short-circuited and the system will become astatic. This astaticizing process may be carried as far as is desired, and hence the instrument made correspondingly sensitive. As no exterior magnetic field is used the instrument has absolutely no "drift" except the exceedingly small one due to the shifting of the earth's meridian itself. Periods of vibration of over a minute are easily obtained with an absolutely inappreciable "drift."

THE ERIE ELECTRIC MOTOR CO.

Street-car companies are very important factors in the development of cities, towns and villages, and without doubt the Erie Electric Motor Company has done its share in developing the industries, etc., of Erie, Pa. This company has a capital stock of $700,000, and $350,000 bonds. The annual meeting is held on the first Tuesday in January.

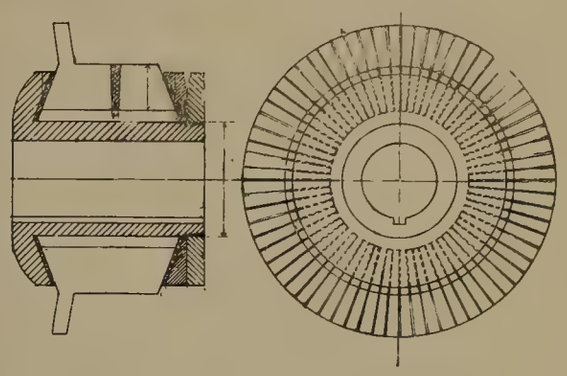
This company operates 24 miles of road. Passengers are transferred to all parts of the city for one fare.

The rolling stock consists of 71 motor cars and 10 trailers; 14 closed and 26 open cars of the J. G. Brill Company make; 15 closed and 15 open, made by the Pullman Co., and 11 by the Feigel Car Company. Six new closed cars are now on the way from the Brill Co. All the cars are mounted on Brill trucks.

A new power-house, 100 x 130 feet, has recently been erected. The King Bridge Company, of Cleveland, Ohio, put up the steel trusses that support the slate roof. Six Edison 60 K. W. generators and three 150 H. P. Ball engines, with two 150 H. P. tubular boilers, were the equipment in the old power plant, which has been increased by two 175 K. W. Edison generators and one 500 H. P. improved tandem-compound heavy-duty Ball engine (made by the Ball Engine Company, of Erie), and three 200 H. P. tubular boilers made by the Erie City Iron Works, two 500 H. P. condensing engines (Davidson's) with 500 H. P. Baragwanath feed-water heater.

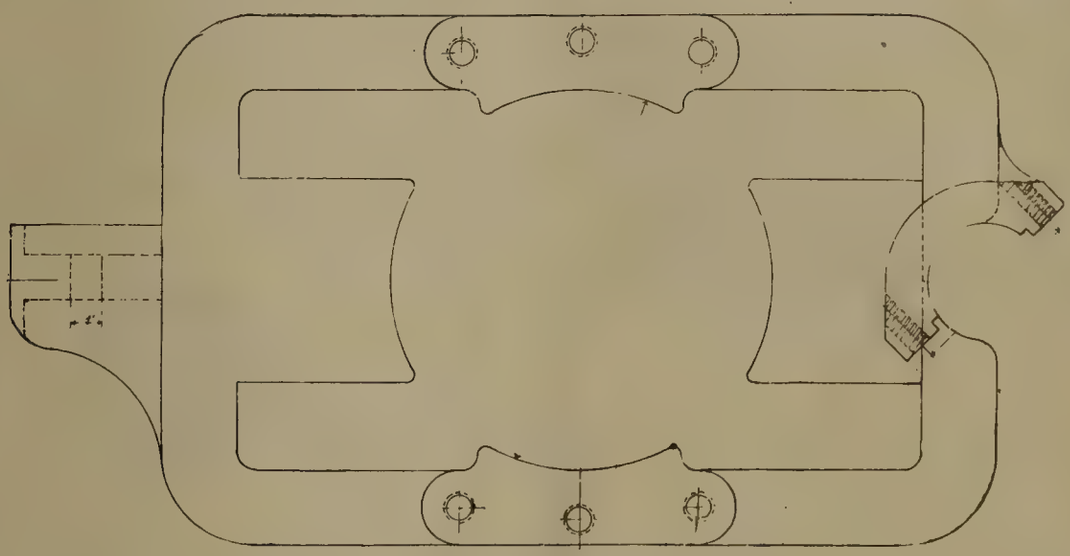
Mr. J. F. Pfetch, general manager of the Erie Electric Motor Company, speaks very highly of the Ball engine.

Mr. Pfetch designed the power-house, and also designed and built the new single-reduction motors used by the company, which have been running now a little over six months without showing the least sign of trouble.

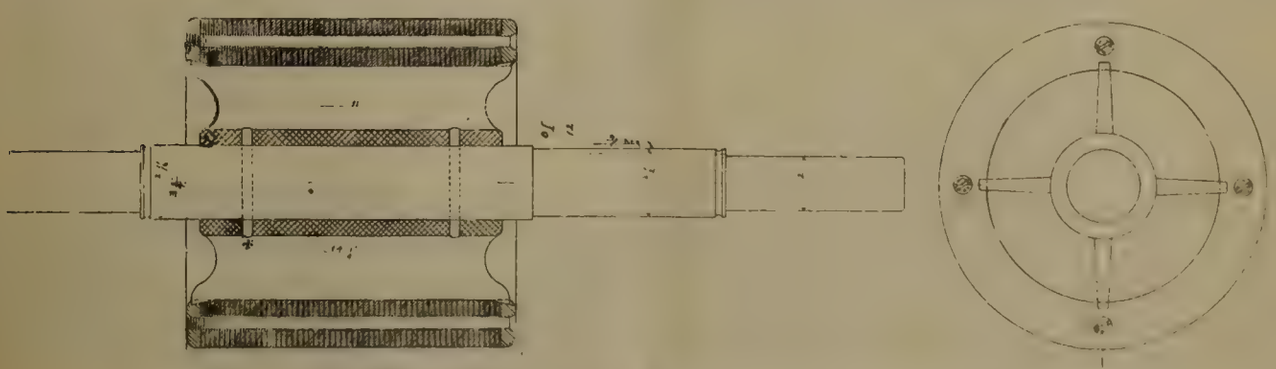


SECTIONAL VIEWS OF COMMUTATOR OF ERIE ELECTRIC MOTOR.

The principal features of this new motor are: as few pieces as possible, which means cheap maintenance; easy to take care of, and consumption of the least amount of current per H. P. produced. The main body or motor-frame, pole-pieces, etc., are cast in one piece, with one removable yoke. The armature is of the gramme ring type, series-wound and cross-connected so that only two brushes are used. The fields are connected in series and multiple, and a little resistance or choker is used to start the motors.



SECTION OF FRAME OF ERIE ELECTRIC MOTOR.



SECTIONAL VIEWS OF ARMATURE OF ERIE ELECTRIC MOTOR.

ELECTRIC MOTOR AND PUMP COMBINATION.

The accompanying illustration shows an 8″x 12″ Dean duplex pump driven by a 20 H. P. "C. & C." motor installed in the Hamilton Club, Brooklyn, N. Y., by the Whittier Machine Company, for filling roof-tanks which operate two hydraulic passenger elevators. The cranks of the pump are set at 90°, and it has a capacity of 300 gallons per minute. The motor is coupled to the pump, and by means of a pair of right and left hand worm-wheels and screws running in oil, the end thrust on the motor-shaft is avoided.

The starting and stopping of the pump is regulated by a large fire-proof rheostat of the well-known railroad type, the arm of which is connected to a piston that works in a small cylinder. An aero-controlling valve, made by the Whittier Machine Company, Boston, connects the cylinder to the supply-pipe in such a manner that when the pressure in the tank drops the piston rises, and permits the weight to pull on the arm of the rheostat, in this way cutting out the resistance and starting the motor and



PUMP OPERATED BY AN ELECTRIC MOTOR.

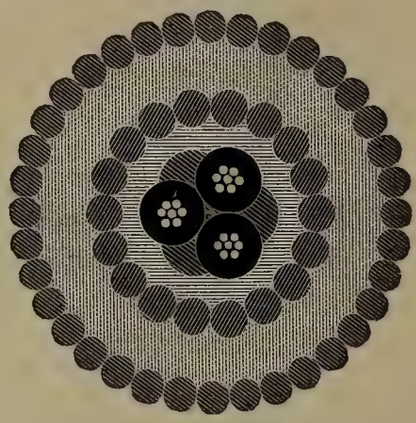
pump. When the pressure in the tank resumes its normal condition the piston is forced down and pulls off the rheostat arm and stops the motor.

The Whittier Machine Company has patented this device, which is rapidlv coming into use in connection with elevator plants where an automatic regulator that will work with certainty on a variation of five pounds in pressure is needed

The "C. & C." motor which is used to operate the pump is manufactured by the C. & C. Electric Motor Company, of New York. These motors are in general use all over the county for power purposes and are giving every satisfaction.

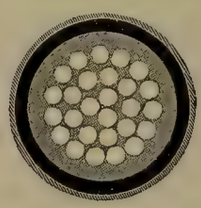
THE BISHOP GUTTA-PERCHA COMPANY.

In 1847, there was established in the city of New York a company which to-day enjoys a reputation and popularity for turning out a superior grade of work that it may well be proud of. We refer to the Bishop Gutta-Percha Company, of 420–426 E. 25th street, manufacturer of highly insulated wires, flexible cords, aerial subaqueous and subterranean cables, insulated with gutta-percha, india-rubber, balata and their compounds. The Bishop Company has reduced the manufacture of this line of goods to a science, and has every facility in its immense establishment for producing a thoroughly reliable article. As to the satisfaction given by the products of this establishment, it is only necessary to say that they are in general use all over the country under all sorts of condition and climate, without as yet any complaint having been made of their reliability. The company is at present finishing for the U. S. Government 7,000 feet of 3-conductor and 3 miles of single-conductor submarine cable to be used in transmitting the current for the lighting of the buoys off Sandy



3-CONDUCTOR SUBMARINE CABLE.

Hook. Another order this company has under way is for three miles of underground electric-light cable with 000 conductors. It is first insulated with rubber 4-32 of an inch, then taped, after which it is covered with lead 5-64 of an inch thick, then braided with heavy cotton, and finally thoroughly saturated with waterproof compound at a high temperature. This cable is being made for The West End Electric Company, of Philadelphia, which is already using the Bishop Company's cables, and in a letter to Secretary Reed the manager, Mr. A. J. Martin, of the West End Co., speaks very highly of it,

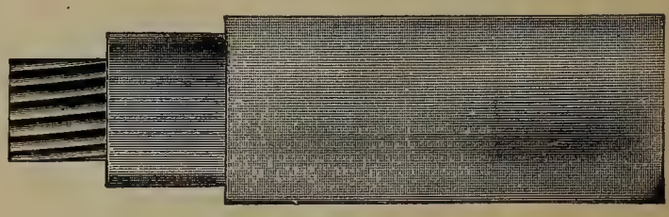


CROSS-SECTION UNDERGROUND ELECTRIC-LIGHT CABLE.

stating that he has never had a fault with the cables nor in a joint. The Bishop Company is also making 200 feet of 60-conductor cable for the Roosevelt Organ Company, of New York, for use in its electric organ system.

VALUABLE HANDBOOK.

The Washburn & Moen Manufacturing Company, of Worcester, Mass., manufacturer of iron, steel and copper wire for all purposes, has just issued the tenth edition of its very valuable pocket handbook of "Iron and Copper Wire in Electric Transmission, and The World's



UNDERGROUND ELECTRIC-LIGHT CABLE.

Facts of Electric Service." It is a veritable encyclopædia of facts and figures and replete with exceedingly interesting details of the wonderful strides being made in the development of electrical appliances, etc.

SPECIAL REPORTS.

The matter on this page is prepared for the special information of electrical supply dealers, and is entirely new.

POSSIBLE CONTRACTS.

Alfred, N. Y. — The residents of this place are anxious to establish an electric-railway connection with Hornellsville.

Batavia, N. Y.—It is reported that a Rochester company is desirous of building a street railway in this place.

Berkeley, Cal.—The Claremont, University and Ferries Street Railroad Company will extend its tracks and reconstruct the system into an electric one.

Chesaning, Mich., is to be lighted with electricity.

Chester, Pa.—The Union Street Railway Company has been petitioned by the residents of Boothwyn to extend its lines to that place.

Chicago, Ill.—The City Elevated Railway Company has been organized to build a new elevated-railway system. William H. Davis is an incorporator.

A new elevated-railway system will be put under way by the City Elevated Railway Company which has been incorporated with a capital of $7,500,000. William H. Davis is an incorporator.

Columbus, O.—An Eastern syndicate has offered to purchase the system of the Columbus and Westerville Railway Company, and if its terms are accepted will equip and build the road complete with all modern electrical appliances.

Corning, N. Y.—An electric-railway system will be built in this city by the Citizens' Electric Railway Company. John A. Seeley, of New York, is interested.

Doylestown, Pa.—It is said that Philadelphia capitalists are interested in the project of building an electric line twenty-five miles long connecting this place with Bristol.

Fairhaven, Mass.—The selectmen have granted the Union Street Railway Company, of Bedford, permission to extend its tracks to Riverside Cemetery.

Eureka Springs, Ark.—There is some talk of installing an electric-light plant here.

Fremont, Ohio.—A new carbon factory will, it is reported, be erected here by the General Electric Company.

Glens Falls, N. Y.—An electric-light plant will be installed in the shirt factory of Heffron & Linehan.

Henniker, N.C.—An effort is being made to introduce an electric-light plant here.

Herkimer, N. Y.—It is reported that Messrs. M. D. McCullen and George W. Van Francken, of Schenectady, representing the Edison people, have been endeavoring to acquire control of the systems of the Herkimer and Mohawk, Mohawk and Ilion, and Frankfort and Ilion Street Railway Companies. If successful, an electric road will then be built from Frankfort to Utica, and thus the entire line from Herkimer and Utica will be operated by electricity.

Laurel, Md., is going to indulge in the luxury of an electric-light plant.

Lebanon, Pa.—An organization to be known as the Lebanon Valley Traction Company has been organized for the purpose of constructing, operating and leasing street railways in Lebanon county.

Lewiston, Me.—Lewiston and Portland capitalists will petition the next legislature for a charter to run an electric line from Lewiston to Mechanic Falls.

Lynden, Wash.—An electric-railway system will be built in this place. A subsidy of $20,000 in land and money has been raised.

McKeesport, Pa.—The Versailles Traction Company has decided to commence at once on the construction of its proposed system.

Manchester, N. H.—Horses will be abandoned on the Manchester Street Railway Company's system and electricity substituted.

Michigan City, Ind.—The Lake Cities Electric Railway Company has been organized for the purpose of building electric railways in Michigan City, Laporte and other towns in the lake region.

Millville, N. J.—Two companies have been formed for the construction of electric roads from this place to Bridgeton. One is the Millville Rapid Transit Company with a capital of $100,000, and the other is the Bridgeton Rapid Transit Company with a capital of $200,000.

Newark, N. J.—An extension of its system to the Montclair line is being considered by the Newark Traction Company.

New Bedford, Mass.—The Union Street Railway Company will extend its tracks to the Riverside Cemetery, Fairhaven.

New Haven, Conn.—An extension of its system several miles is being contemplated by the Fair Haven and Westville Railroad Company.

Norwalk, O.—There have been already subscribed $14,000 out of the $15,000 required for the extension of the Sandusky, Milan and Huron Electric Railway Company's system to this place.

Oakland, Cal.—Mr. E. C. Sessions is going to adopt electric power on his Fruitvale avenue line.

Perry, N. Y. — An electric-light plant will be erected without delay by the Perry Electric Light Company.

Portland, Ind.—An ordinance has been passed by the city council granting J. M. Gardiner permission to put in a complete street-railway system.

Portland, Oregon.—Surveys are being made for a route for an electric road to Portland Heights.

Portland, Me.—An electric-light plant will be erected by the Belknap Motor Company of this city for the lighting of Freeport and Yarmouth, Me.

Reading, Mass.—There is said to be a possibility of an electric railroad being built between this place and Wakefield.

Reading, Ohio.—It is reported that $40,000 will be expended on the construction of a water-works and electric-lighting system for this place.

San Francisco, Cal.—The Market Street Cable Company and the City Railroad Company have applied for the necessary authority to extend their lines.

The establishment of electric-light plants is projected for Fullerton, Neb.; Lena, Ill.; Stanton, Mich., and Mattapan, Mass.

Rockville, Conn.—It is reported that a syndicate of Bridgeport and Waterbury capitalists will apply for a charter to build an electric street railroad from Snipsic Lake through the city to Windermere and Ellington.

Sacramento, Cal.—The Sacramento Electric Power and Light Company has applied for permission to run an electric road through a number of streets.

San Francisco, Cal.—New roads are projected by Marc W. Connor and others; the San Francisco and West Shore Railroad Company, and W. H. C. Fowler and others.

Additional tracks, etc., will be laid by the Market Street Cable Company and the City Railroad Company.

South Monson, Mass.—A company has been formed for the purpose of constructing an electric railway to run from this place through Monson, Palmer and Wilbraham, terminating at Ludlow, with a branch to Thorndike, Bondsville and Three Rivers. A. M. Young, of Waterbury, Conn., is the principal stockholder.

Stockton, Cal.—Two corporations have been formed by the owners of the electric railway in this city and five local capitalists, to furnish electric power for general purposes and to run electric railroads from Stockton to Lodi and Woodbridge in this county and Wallace in Calaveras county, covering thirty-two miles. A large power-house, operated by water-power, will be built near Lodi.

Waverly, N. Y.—A petition has been presented to the board of trustees for permission to build an electric line through certain streets of the town.

Wheeling, W. Va.—The Home Dressed Beef Company is going to put in an electric plant.

Wilmington, Del.—The Wilmington City Railway Company will build an addition to its building at the middle depot, to be used for a shop and storage purposes.

Worcester. Mass.—Some 18 miles of track and overhead equipment will be constructed by the Worcester, Leicester and Spencer Street Railway Company.

THE GARTON ARRESTER.

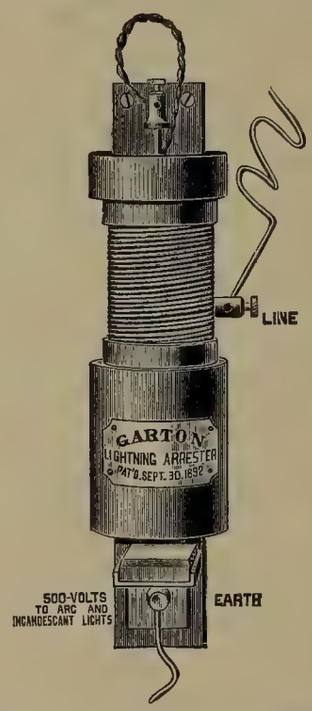
One of the most difficult problems that electricians have had to grapple with is how to perfectly protect electrical machinery from damage by lightning. Lightning has a weakness for such apparatus, and when it gets its work in, in such cases, it costs the operating company considerable money to repair the damage to armatures, etc.

The difficulty heretofore has been to produce an arrester that would always act when it should and insure absolute protection to the machinery it stands guard over. Many devices have been invented for the purpose, but not all of them have proved to be in practice what a reliable lightning arrester should be.

The Garton arrester is claimed to be a reliable one under all circumstances and at all times, and for street railways the company claims it has no equal. It is simple in construction and reliable in action. It consists of a coil of wire wound upon a spool of non-combustible material. Below the coil is an air-chamber made of the same material as the spool and forming part of it. In this air-chamber and resting upon a carbon plate which forms the bottom, is an armature fastened to a guide-rod which is made of non-magnetic material, but is a good conductor for the passage of the discharge. The centre of the coil being hollow the armature and guide-rod can rise and fall the full length of the coil.

The guide is fastened to a flexible conductor which goes to the inside end of the coil, and the outer end of the coil terminates in a binding-post, which may be attached to the line wire. Then at the lower end and just beneath the air-chamber is another carbon plate with a serrated surface presented toward the first carbon, forming the bottom of the air-chamber. This lower carbon plate may be adjusted at any desired distance from the upper plate, thus at will varying the air space. This carbon plate is held in place by means of a bracket, to which is attached a binding-post to which the ground wire is to be attached.

The passage of the lightning across the air space produces an arc through which the generator current flows to the ground, forming a dead short-circuit. The flow of current through the coil energizes the coil and instantaneously draws the armature into it, thus raising the armature from its contact with the top carbon in the chamber and establishing an arc in the air-chamber. The air-chamber being closed at the top by the rising armature and the oxygen in the air-chamber being burned out, the arc is destroyed and the current ceases to flow. The coil loses its energy. The armature again falls of



GARTON LIGHTNING-ARRESTER.

its own weight to its resting-place in readiness for another discharge, the whole process occupying a fraction of a second.

The generator can be short-circuited through this arrester without injury to either the arrester or the machine.

The arrester requires no attention after being set up, and is always ready for action.

Testimonials in the possession of the Garton-Daniels Electric Co., of Keokuk, Iowa, the manufacturer of this arrester, show that electric railways which had to shut down during thunder storms now continue uninterrupted operation by using the Garton arrester; and all users of the arrester speak highly of its action and reliability.

THE FAIR TO BE OPEN EVENINGS.

The strong opposition in the electrical trades against the proposed closing of the World's Fair at 7 P.M. each day has had its effect, as will be seen from the following correspondence:

CHICAGO, NOV. 11, 1892.—H. N. HIGINBOTHAM, ESQ., PRESIDENT COUNCIL OF ADMINISTRATION, WORLD'S COLUMBIAN EXPOSITION, CITY.—DEAR SIR: I inclose herewith petitions signed by practically all of the electric

companies represented in Chicago in reference to the rule adopted by the commissioners of the World's Fair to close the gates at 7 P.M.

It appears that the newspapers have also taken up this subject in opposition to closing the gates so early. I am satisfied that the signers of the petition are very much in earnest, and I therefore hasten to call the attention of the council of administration to the subject, hoping that they will take the matter up with as little delay as possible.

Very respectfully,

(Signed) R. C. CLOWRY,

Chairman Committee on Electricity, etc.

COL. R. C. CLOWRY, 105 WASHINGTON STREET, CITY. —DEAR SIR: I am in receipt of your communications, 11th and 12th inst., enclosing protests against the closing of the Fair at 7 o'clock, and in reply beg to say, that it is not the intention of the management, either in the directory or the commission, to close the Fair so that evening sessions may not be had.

It was thought best to make the rule to close at 7 o'clock, and then the council of administration could from time to time open the gates at 8 o'clock in the evening on such days as it is thought wise to do so, it being the intention to have the evening session from 8 until 11 o'clock on from three to six days each week, according to circumstances.

Kindly communicate the intention of the management, as expressed above, to the protestants, and if you think best, have same published in such electrical publications as you may think wise, and oblige

Yours very truly,

H. N. HIGINBOTHAM,

Chairman Council of Administration.

RETURN GROUNDS FOR ELECTRIC RAILWAYS.*

Mr. Pearson, of Boston: There is one point in connection with this report on track construction which has not been touched upon to-night, and which merits attention; and that is, the return ground. In small towns and systems where there are few cars running, the ordinary method of returning the current through the rails and supplementary wire will be sufficient unless the distance is great. On large roads where the traffic is heavy, more returns grounds than have been used heretofore will have to be installed. We found it so in Boston, and from a lack of return feeders a great deal of electrolytic action was caused in our supplementary wire, and we are now putting up a large amount of overhead copper for return grounds; I do not think it possible to put it underground, as it will corrode and rust away. There is no advantage in using iron, as the conductivity is only one-seventh that of copper.

The question has been asked me if we run the positive or negative current through the trolley wire. Originally we ran the positive through the trolley wire, but we found that the action on the supplementary wires was too great, and we changed it and put the negative to the trolley wire. I do not imagine there will be much less effect, as it merely transfers the action to another point.

Mr. Smith, of Waterbury: I would like to ask the gentleman if he has had any experience of trouble with water-pipes?

Mr. Pearson: I had not in my mind any particular trouble with water-pipes; but naturally, if you have a large volume of current going through the earth it will take hold of a water-pipe or a gas-pipe or any other pipe, and there will be an electrolytic action set up; and in any large railway system, if the attempt is made to use the earth for return ground by putting in ground plates in driven wells, or by putting them in the rivers and the return current is not provided with a good metallic circuit, it seems to me that the current must inevitably injure the water-pipes and all other pipes. The current when it leaves the car goes into the ground, and taking a water-pipe may go a mile on that pipe, then leave it for a better conductor; the result being that the pipe will be corroded at this latter point.

This is all I have in mind on this matter; I simply wish to bring to the notice of the convention something which I think must be taken into consideration in regard to the return current.

Mr. Richardson, of Brooklyn: I would like to ask the gentleman whether he has given thought to the idea of using a portion of the old rails which we have to take up, by putting them in the ground; on the basis, as he says, that in iron there is only one-seventh of the power of transmission as of the same weight of copper? I mean to take the relative value of our old steel rails, about thirteen or fourteen dollars a ton, and using five, six, seven, or eight, side by side, and making a continuous pathway for the return circuit, fastening them, of course, with proper fastenings, so as to make a continuous conductor, not necessarily under the roadbed, but alongside of it, or between that and the sidewalk, so as to provide a proper return, instead of depending on gas-pipes, water-pipes, or the earth.

Mr. Pearson: It seems to me the difficulty would be to make a joint. If you could weld the rails together or if you could solder them, I think possibly it would work; but I do not believe you could make the joints in any other way that would carry a large volume of current without heating and corrosion.

Mr. Richardson: Would that joint or joining need to be by copper plates?

Mr. Pearson: I think that would be a poor construction, as the iron and copper would form an electrolytic element and cause corrosion even if no current was passed through the joint. The passage of the current would also heat the joint and cause further oxidation.

Mr. Richardson: One other question: Is that simply a theory or has it been tested in practice?

Mr. Pearson: It is partly theory and partly practice. We attempted, in the early days of electric railroading, to use the rail for the return conductor, not putting in supplementary wires, and found it almost impossible to maintain a joint of any sort. Where you drive a large volume of current through the joint oxidation takes place and the joint soon becomes worthless. This condition will exist no matter how large the joint is made, and if you used dissimilar materials or metals a local electrolytic action will also take place. With steel in contact with iron the effect will be produced in a lesser degree than with copper and it will take longer for the trouble to develop. It does not seem to me practicable to use old rails for conductors.

Mr. Baumhoff, of St. Louis: Have you compared the relative consumption of fuel with the trolley wire connected with the positive pole of the generator and the consumption of fuel when the trolley wire is connected with the negative pole of the generator?

Mr. Pearson: No, sir, we have not; it would be rather a difficult thing to do. I cannot see why it should make any difference, as the total resistance of the circuit is equal to the sum of the resistance of the various parts, and the loss in potential is proportional to the total resistance. I do not see what difference it could make whether the resistance is greater on the negative or positive side of the circuit; it is merely a question of driving the current through a certain resistance.

Mr. Ramsey, of Pittsburg: I would like to ask Mr. Pearson in this connection whether or not he thinks it

*Abstract from discussion on report of committee on "A Model Electric Railway Roadbed and Underground Wiring," presented at the eleventh annual meeting of the American Street Railway Association, Cleveland, O., October 19-21, 1892.

worth while to consider the use of old cables discarded from cable roads for the purpose mentioned? It weighs about two pounds to the foot, or about five or six tons to the mile, and may be purchased at about fifty dollars per mile.

Mr. Pearson: We used considerable cable—old steel and iron cable—in getting across the rivers and connecting our supplementary wires from one side of the track to the other, but it cuts away very fast. For instance, in one place we put in seven ropes or cables, and soldered the joints thoroughly at each end, and in less than four months they were entirely gone. If you had soil which was comparatively dry and sandy, it might do for a time; in a place where the soil was moist and salty, I doubt whether you would get enough life out of it to pay for putting it down.

Mr. Richardson: There was one thing the gentleman referred to, I would like to know; why there should be any more difficulty because of using copper plates and rivets in connecting the rails for a mile or less in length; for instance, laying eight centre-bearing rails, each thirty feet long and connecting them as specified, why should there be any more destructive electrolytic action between the copper and iron than there is with the copper bond wires which are used to connect our rails together on the surface?

Mr. Pearson: I think as a rule, in track construction to-day, we use supplementary wires as well as bond wires on the rails; the former having a low resistance as compared with the bond wires and joints, the greater current passes on the supplementary wire and does not go through the joint. If you cut the supplementary wire and compel all the current to pass through the bond wire there will be trouble; but as long as you have a good supplementary conductor, so that the current does not pass through the bond wire, the joint will remain cool and there is no great tendency to oxidation, especially if tinned rivets are used.

Mr. Richardson: Do you think there would be any more heat generated with the rails four feet underground than with those at the surface?

Mr. Pearson: The heat would depend on the amount of current passing and the resistance of the joint. Of course the proof of the pudding is in the eating, and the only way to decide this question is to lay the rails as you suggest, several miles in length, and lay them in such a place that a large volume of current will pass through them.

Mr. F. S. Holmes, of New York: I asked an experienced engineer, a pioneer, I believe, in street-railroad work, some days ago what was his experience in ground plates; and he said that in case there was a sufficient number of ground plates along the line, he found that the ampères of current divided about equally between the rail return and the ground wire. Now, in an ordinary battery the positive pole is the pole that gives and is consumed, and the negative pole is the pole that receives deposit. The construction we have to-day where ground plates are used for return currents makes the trolley wire and the various plates and supplementary wire along the line of the railroad positive and the large ground plate at the station negative. This is wrong, because where this is done the supplementary wire and ground plates along the line are rapidly corroded and eaten away, while the negative plate at the station is uninjured. The conditions should be reversed, the station plate being made positive and the line-plates and supplementary wire and trolley negative to it. Corrosion will thus be largely confined to the station plate, which can be easily replaced, and the plates and supplementary wire along the road will remain nearly intact. Of course, to accomplish this the current will flow out by the ground, which will be positive, and back by the trolley wire, which will be negative.

BLASTING BY ELECTRICITY.

At the meeting of the American Society of Civil Engineers on November 2 last, Mr. William L. Saunders read an interesting paper on the American method of electric rock-blasting. We give below an abstract of this paper which will be of interest to our readers, because this application of electric currents is little understood by those outside of the business.

The magneto-electric current, used in America for blasting purposes, is produced by the rapid revolution of an armature, or a coil of wire, at the poles of a magnet. In other words, the American electric battery is nothing more than a small dynamo operated by hand. The current is at first short-circuited in the machine, and at that point, when it is at its greatest intensity, it is discharged into the long circuit which contains the exploders. In this way the electric current passes over a fine platinum-wire bridge, which offers so much resistance that the wire becomes red hot, and this heat explodes a small quantity of fulminate of mercury which is in the cap. Where blasting is carried on under water, and wherever the explosive is gelatine, gun cotton or forcite, a double-strength exploder should be used. This also applies to high grades of dynamite, especially in cold weather; it being a well-known fact that dynamite requires a high detonation to ignite it properly. The greatest explosion that can be made by a dynamite cartridge is produced when the detonation is sufficient to insure the immediate explosion of the entire cartridge. This is so important a point that it should be made more impressive by further comment.

The passage of an electric current is practically instantaneous when compared with the transfer of heat through any substance. It is well known that an explosion of powder is nothing more than the conversion of a solid into a gas. The gas occupies more space than the solid, hence in its tendency to expand it breaks the rock. Now, it is easy to see that the higher the grade of an explosive, the more sudden is its conversion into gas and the more effective is the blow which it delivers in the drill-hole. This question of suddenness of conversion into gas is at times more important than the number of volumes of gas produced by a certain number of cubic inches of the powder. It is thus seen how important it is, in breaking rock under difficult conditions where high explosive effect is required, to explode the entire charge instantly, and how important it is, when using a high grade of explosive, to produce a high initial explosion.

There are many differences of opinion as to whether an electric exploder should be placed in the top, bottom or middle of a charge. The writer thinks it is largely a question of what kind of a blast you wish to make, whether or not you are breaking rock for the sake of getting the rock out of the way, or whether you wish to dislodge it in large masses for dimension stonework. The common electric exploder is not water-proof, though it appears to be so. In a wet hole, especially where there is some pressure of water, the exploder may leak between the sulphur and the copper case, so that it is well to bear in mind that, for wet work, exploders should be used which have been dipped in rubber cement or other water-proof material. In connection with the manufacture of electrical exploders, much care should be observed to get them uniform. The bridge of platinum wire, through the incandescence of which the exploder is fired, should be exactly the same in diameter and length of wire in one exploder as in another; and as this wire is soldered at each end to the points of the wires which lead from the battery, it is important to use a uniform grade of solder, and to do the work of soldering by machinery, so that the same quantity is used in each case, and the soldering does not extend over the platinum bridge. If several electric exploders are connected in

series, and it is intended to fire the whole simultaneously, it is obvious that if the platinum bridge in one is thicker than in the other, or if it is longer, or contains a surplus of solder, there will be an inequality in the resistance, which may result in failure to explode.

The writer is not an advocate of the use of so-called blast-testers. It is certainly true that it is a great satisfaction to know that the circuit is complete, and that the blast is going to go, before the battery is used; but the so-called testing-machines do not always give such knowledge, and the delay caused by their use scarcely warrants the trouble.

The battery is the generator which makes electric blasting possible. The American battery is as distinct from that of any other country as the American system of blasting is distinct and superior to any other. It is because of the reliability of the American battery that electric blasting has replaced the fuse so generally in America, and it is owing to the unreliability of batteries used in foreign countries that the fuse is still preferred there. The American battery is a magneto-electric machine—that is, it is a hand dynamo—while the foreign battery is the old-style friction machine which was tried and long ago abandoned in America. The great advantage of the magneto machine is, in the first place, its reliability and indestructibility, requiring little or no attention, simple in construction and light in weight. The low-tension current which it produces does not spark and is not lost in damp places, requiring no special care in insulating all the joints, and thus adding very much to the reliability of the system. The first successful magneto-electric blasting-machine was the invention of Mr. H. Julius Smith, and is sometimes known as the "plunge" or "rack" battery. It is constructed on the principle of a regular dynamo, in that it is a magnet of the horseshoe character, of iron, wound about with coils of insulated copper wire. Between the poles of the magnet there is fitted to revolve an armature of cylindrical construction, carrying in its body other insulated wire coiled longitudinally as to the cylinder. The rapid revolution of the armature by suitable means generates and sustains in the machine an accumulative current of electricity of great power, which, at the moment of its maximum intensity, is switched off to the outside circuit, in which are the fuses, and in the interior of each fuse the ignition is accomplished instantly.

Another form of battery used in America is similar to the "plunge," but is fired by pulling a rod or tape instead of pushing a rack. This is known as the "pull-up" machine. Its general construction is similar to the plunge, the chief difference, besides that already referred to, being in the method by which the circuit is changed. Instead of striking a key at the end of the stroke, the current is thrown from the short circuit of the machine into the long circuit containing the exploders by simply breaking the short circuit.

The "Crescent" battery is distinctly different from all others in the method by which the current is discharged. In principle it is identical with the "plunge" or the "pull-up" so far as it consists of a magnet with an armature at the poles. In the "Crescent" this armature is revolved by a rack which is a segment of a circle. The power which generates the current in the "Crescent" is a strong steel spring, the operator simply pressing this spring to a point from which it is automatically released. The current is thrown into the line at the end of the stroke by breaking the circuit, the rack and the pinion on the armature shaft forming a short circuit. The circuit is broken by the fact that the pinion and quadrant are separated within a short distance of the end of the stroke and the current which had been produced, and which will in all cases take the shortest circuit, is now forced to take a path through the leading wires and exploders.

It is obvious that in all other blasting-machines the strength of the current must depend largely upon the personal equation of the operator. This is shown by the testing lamp, which, by the way, is a good device to have around every blasting operation. The testing lamp is nothing more than a common incandescent electric-light lamp, except that it is made with a small wire connection, instead of the horseshoe-shaped one common in light lamps.

The battery is used in the regular way as it is when blasting, and the full stroke of the current is thrown into the lamp, lighting it up. With all machines except the "Crescent," the light varies in intensity with almost every operation.

On the shaft of the "Crescent" battery there is a ratchet nut, which, when tightened, gives the spring more tension, hence, by adjusting this nut, not only may the capacity of the battery be kept up, but it may be set at any number of holes. The testing lamp shows a light from this battery of exactly the same intensity at each operation.

Uniform strength, or quantity of current at each operation is an important factor in electric blasting. In the first place, it is important, as previously pointed out, to have a surplus of force in your battery. A common cause of misfires, where several holes are in circuit, is a weak battery—and what is just the same thing—a weak discharge from a strong battery. A weak current will not produce sufficient redness in the exploder wires to make the blast, and as one exploder may differ in its resistance from another, a weak current sometimes discharges one or two holes, while the others do not go off, not because of any break in the connections, but simply owing to the fact that the little platinum bridge imbedded in the fulminate of mercury did not get hot enough.

The force generated by a blast should be confined within the hole, and there is no better evidence of the fact that it can be so confined than the work in the upper part of New York city, where large blasts are made directly in contact with the walls and foundations of buildings without damage, beyond an occasional tumble of plaster caused by the jar. The law has taken the contractor in hand in New York city to such an extent that he has been compelled to tamp his holes carefully, and the result is that almost a perfect system of blasting is now in force among the better contractors, and not a single piece of rock is thrown during a blast.

Some rare cases where it is found desirable to discharge several hundred or even several thousand holes simultaneously have involved the construction of special batteries. The use of electric-lighting wires has frequently been suggested for this purpose and in case of a very large blast there is nothing better. In ordinary blasting operations, however, it is not advisable to use the electric-light current for blasting. There must be more or less danger connected with its use, and it is well to eliminate absolutely the blasting of rock from any connection or association with the electric-light wire.

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The next meeting of this society will take place in Prof. Chandler's lecture-room, Columbia College, Forty-ninth street and Madison avenue, on Thursday, Dec. 1, at 8 P.M.

Prof. Edwin J. Houston, of Philadelphia, will deliver a lecture on the "Magnetic Field," which will be illustrated by lantern projections and experiments.

The following is a synopsis of Prof Houston's lecture:

Definition of field. Group of curious properties possessed by the magnetic field. Early knowledge of the world respecting magnetic phenomena. Various facts concerning the attractive and other forces of the lode-

stone. Magnetic effluvia—Boyle's early conception of the magnetic field. Experimental study of some of the more important properties possessed by magnets. Various magnets. Faraday's conception of lines of magnetic force. Various methods on the graphic representation of the magnetic field. General principles of magnetism deduced from a study of magnetic fields. General phenomena of magnetic induction. The part which induction plays in the production of magnetic figures. Magnetic permeability and susceptibility. Coercive force and magnetic retentivity. The magnetic and electrical flux. Paramagnetism, and diamagnetism. Methods of magnetization. Discovery of Oersted. Theories and hypotheses of magnetism. Fluid theories. Ampère's theory. Hughes' theory. Ewing's theory. Phenomena of the earth's magnetism. Causes of the earth's magnetism.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

Mr. R. S. Dobbie, of New York city, will deliver a lecture on "Arcs and Arc Lighting," before the department of electricity, on Friday evening, December 2. The lecture will be illustrated by apparatus, lantern photographs and experimental demonstrations.

NOTES OF GENERAL INTEREST.

Mr. L. F. Cook, of Tacoma, Wash., is experimenting with an electrical-railway system which he claims can be operated at 200 miles an hour.

The U. S. S. "Albatross," now at Mare Island Navy Yard, San Francisco, is being rewired by the Pacific Electrical Storage Company for 200 lights.

A press dispatch from Cleveland, on November 23, stated that the electric-lighting and power interests of that city had been consolidated, and that the General Electric Company was in control.

The San Antonio Light and Power Company has all the wires up for the lighting of Pomona, Cal., and a few arc and incandescent lights which were turned on as an experiment showed the system to be in complete working order.

All of the incandescent lights in Salinas, Cal., were rendered useless for a few days recently owing to the bursting of the driving-wheel of the engine in the power station. The arc lights are run by a separate engine and were not disturbed.

Through the breaking of a water-main a few days ago the basement of "The Rookery," Chicago, was flooded. Clark & Russell, the Westinghouse Electric and Mfg. Co., the U. S. Electric Lighting Co., George Cutter, and Rattenbury & Jones had large quantities of electrical goods stored, which were seriously damaged by the water. The Chicago Edison station was badly crippled for a short time through the lack of water for the boilers, and this caused trouble for the Western Union and Postal Telegraph companies who depend upon the Edison Co. for power. Tallow-dips were brought into requisition in scores of business offices to take the place of the soaked-out electric light. The trouble was soon overcome.

BOSTON NOTES.

DURING a visit to Boston a few days since, I strayed into the office of the Safety Brake Shoe and Construction Company, railroad contractors, 620 Atlantic avenue, and was greatly interested and surprised to see the utility and merit exhibited in this shoe. On a table were brake-shoes showing the different modes of attachment to the brake-beams as practised by the leading makers of trucks for street-railway service, and so constructed that they can be applied very easily. What appeared to me to be of much importance was the fact that only one make of shoe is used for all the different styles of necks—the shoes being interchangeable, including right and left use of same. This shoe has embedded in its face numerous wooden plugs of about one inch in diameter, which serves to aid greatly in the braking or stopping of a car. The shoe does not become smooth or glazed over, but has additional grip on account of these plugs. While the friction-bearing is greater, it actually requires less force or pressure to get the desired results. I was assured that these shoes do not become heated. It is well known that a hot shoe heats the wheel, which is often the cause of flattened wheels—a serious matter, as all electric street-railway men know. I was shown abundant evidence that this shoe is coming into practical use, especially in the electric-car service, and strong endorsements by well-known street-railway officials were also shown to me.

THE GODFREY ELECTRIC CONSTRUCTION CO., 92 Franklin street, is the successor to the construction business of the Holtzer-Cabot Electric Co. Mr. E. W. Godfrey is the treasurer and manager.

MR. W. I. BARKER, the Boston representative of the *Electrical Review*, of New York, died suddenly of apoplexy on the evening of November 23. Mr. Barker was well-known in the electrical trade, and his many friends will be pained to learn of his death.

THE AMERICAN CIRCULAR LOOM COMPANY, 620 Atlantic avenue, have nothing to complain about. Mr. A. F. Clark is very well satisfied with the past year's business, and well contented with the outlook for the future.

MR. A. F. MASON, of the Simplex Electrical Company, 620 Atlantic avenue, informs me that business has been rather brisk this fall, with unusually bright prospects for the coming year.

MR. G. D. HALL, of the Wainwright Mfg. Co., of Massachusetts, 8 Oliver street, reports increasing trade in its corrugated copper gaskets. These gaskets make a joint that is claimed to be perfect and will last for years. They are for steam, water, hot air, acids, etc., and are made in all sizes and shapes in copper, brass or steel. The company also manufactures corrugated tube feed-water heaters, surface condensers and expansion joints.

SMITH & WALLACE, the well-known manufacturers' and jobbers' agents for electric-railway supplies, 8 Oliver street, are doing their share of the aggregate work on electric railways. They are not far from being satisfied.

THE GERMANIA ELECTRIC CO., 620 Atlantic avenue, of which Mr. Frederic A. C. Perrine is treasurer, has recently put on the market an incandescent lamp-shade which requires no holder, and while it is simple in construction it is very ingenious in conception. The company also has a new switch with a friction contact of novel design. It is unlike anything in the way of switches heretofore brought out.

M. K. KENDALL & CO., 8 Oliver street, are contractors and dealers in electrical supplies of every description. They do electric-railway and electric-light construction work, making incandescent wiring a specialty. This firm succeeded the old firm of Kendall & Slade.

THE BRIGHAM ELECTRIC CO., 63 Oliver street, carries on a general electrical business. It is contractor for wiring and fitting houses, offices, hotels, etc., with electrical

apparatus of every description. Particular attention is given to electric-light work, dynamos, engines and motors, and repairs are made a specialty.

The R. Woodman Mfg. and Supply Co. does a large trade in railway and mill supplies, including patent speed indicators, perforating machines, etc. It makes special tools, punches and dies, and light machinery and novelties to order. Its address is 63 Oliver street.

The Massachusetts Chemical Co., 8 Oliver street, makes fine varnishes and spirits. Street-car companies using these materials would do well to communicate with the company. Mr. C. A. Baldwin is president and C. E. Farrington general manager.

Mr. H. A. Howard, manager of the New England office of the "C. & C." Electric Motor Co., of New York, is installing an electric light and power plant for the city of Boston, on Long Island, Boston harbor, which is the home for the city's paupers. The plant will have a capacity of 600 lights, and includes 3 dynamos and 5 motors. Another plant Mr. Howard is installing is that for the D. Webster King Glue Co., on High street, which includes one 30-kilowatt dynamo and two 15 H. P. motors of the "C. & C." Company's make. The plant is a very neat one and will probably be enlarged before long. It is so arranged that in case of accident to any of the machinery current can be obtained from the Edison street mains. The Boston & Maine R. R. is installing a 250-light "C & C" plant in its new grain elevator, which is said to be one of the largest in the country.

A. E. K.

NOTICE.

The General Electric Company has issued the following notice: "All communications regarding, and orders for, railway line material manufactured by the Lieb Machine Works should now be addressed to the General Electric Company, full arrangements having been made to this effect."

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, November 26, 1892.

Mr Morris W Mead, city electrician of Pittsburg, Pa., and well known in the electrical trade, was in town last week. He is as lively and jolly as ever.

Mr. Frederick Pearce, successor to Pearce & Jones, 77 and 79 John street, has just issued a new illustrated catalogue and price-list of all the goods he handles. Mr. Pearce manufactures and deals in telegraph and electrical instruments of all kinds, batteries, line-wire, tools and supplies of every description. His stock is very extensive and includes electric gas-lighting apparatus, burglar-alarms, district signal-boxes, door-pulls, etc., etc. There is nothing in the electrical line that Mr. Pearce does not make or deal in, and it will pay all possible purchasers to consult him before closing contracts elsewhere.

We have received from the R. D. Nuttall Company, the well-known manufacturer of and dealer in electric-railway supplies for all systems, 179 to 189 Grant avenue, Allegheny, Pa., a desk memorandum pad of neat design and construction. It is a capital idea and shows on the face of it that there is nothing slow about the Nuttall Company.

Mr. Thomas D. Lockwood, of the Bell Telephone Company, Boston, was in town last week.

C. F. Sise, of Montreal, president of the Bell Telephone Co., of Canada, paid New York a visit last week.

P. Claus & Co., 357 West 40th street, occupy extensive works at the above address, where they do the assembling and finishing of their popular dynamos. A representative of the Electrical Age during a recent visit found them busily engaged shipping several large dynamos of 650-light capacity. Among the orders secured lately by Mr. Claus was one for a 650-light dynamo and plant complete for the New York Cotton Exchange. This is a duplicate order. Mr. Claus installed the original plant four years ago, and the above order is looked upon as a recommendation of the success of the first plant. Messrs. Claus & Co. have also closed contracts for 2 dynamos of 350-light capacity, each for Havana, Cuba. A 250-light dynamo for Berlin and Jones Envelope Company, New York, with motors and equipment, a 100-light dynamo for Floral Park, L. I., one 100-light dynamo and equipment for Fred. Hollender & Co., New York. The firm have lately completed the installation of a 1500-light plant in the Manhattan Opera House, New York city. The daily press have spoken in the highest terms of praise of the elegant effects of this plant.

The Buckeye Electric Company, of Cleveland, O., has lately installed one dynamo of 400 lamps capacity, one with a capacity of 25 ampères at 350 volts, and one of 25 ampères at 60 volts. These dynamos are additions to several others sold by Mr. Claus, of P. Claus & Company, of this city, to the Buckeye Company, when it first began to manufacture lamps.

The Mica Manufacturing Company, 89 Fulton street, manufactures a large line of pure sheet-mica goods for incandescent lamp protectors, reflectors, etc., and in all quantities desired for all purposes for which mica is used. The company has every facility for turning out mica segments for armatures, commutators, dynamo and motor parts, etc.

Tucker & Gue, electrical engineers and contractors, 1 Madison avenue, are installing the complete electrical plant in the Metropolitan Insurance Company's new building. This plant consists of 5 United States dynamos of 700 16-C. P. lights capacity each; 3 Watts-Campbell Corliss engines—two of 150 H. P. and one of 60 H. P. Grimshaw white-core insulated wire and duplex tubing is being used throughout. The wiring was commenced on November 1, and since that time they have wired five floors; in all there are 13 floors to be wired. They will also furnish one 10 H. P. and one 4 H. P. United States Electric Lighting Company's motors, for running a large ventilating fan and several numbering machines used for numbering policies. Messrs. Tucker & Gue are old electricians and have had an extensive experience in the electrical field. Mr. Tucker has been engaged in electrical pursuits for 15 years, having started with the United States Electric Engine Company during 1876. Mr. Gue has been in the electrical field for five years. He is a graduate of Stevens Institute, which is famous for turning out highly trained engineers. Mr. Gue has had considerable experience with the installation of the United States Electric Lighting Company's system.

C. H. Disbrow is moving to 335 West 16th street, where he will have his office, storehouse and repair-shop. He makes a specialty of repairing armatures of all styles of dynamos and electrical apparatus of all descriptions. Mr. Disbrow carries on hand a large line of second-hand dynamos, motors, etc., and buys and sells all kinds of apparatus, from a telegraph instrument to a complete electric-light plant.

Owing to a strike among the firemen of the New York Steam Company on November 25, the Western Union building among many others was deprived of steam power for a time. The lack of steam caused the stoppage of the elevators, carrier-tubes and the dynamos, but the company's own steam plant was soon got into operation, and the inconveniences thus overcome.

The common council of the city of Rochester, N. Y., has adopted the report of the electrical committee concerning the petition of the newly organized Citizens, Light and Power Company for street privileges. The company must build one mile of conduit—half a mile during 1894 and the balance during 1895. The company is not altogether satisfied with the provisions of the ordinance, and requested that action be deferred for a time, but the common council refused to accede and adopted the resolutions unamimously.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

Names of Companies.	Capital.	Par.	Price.
American Dist. Tel., N. Y.	3,825,000	100 00	58 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	118 00
Brooklyn Edison Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100.000	100 00	90 00
Chicago Gas	25,000,000	100 00	96 25
Commercial Cable Co	7,716,000	100 00	175 00
Cons. Gas Co., N. Y.	35,430,000	100 00	126 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	109 50
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000.000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4.800,000	100 00	51 00
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50.000,000	100 00	110 75
General Electric Co., 5s	4.000.000		*103
General Electric pref.	4.223,700	100 00	117 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	25 25
Laclede Gas pref.	2,500,000	100 00	73 00
Laclede Gas 5s	10,000.000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60,000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			134 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	59 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535.000	100 00	98 25
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co., Va.	30.000	10 00	9 50
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125.000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5.000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1.000.000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	115 00
The Ongley Electric Co., N. Y.	250.000	100 00	85 00
The Siemens & Halske Co., Ill.	500.000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
U. S. Rubber Co.	26,947.000	100,00	40 25
Western Union	100,000,000	100 00	87 50
Westinghouse Elec. & Manf. Co.	7,000.000	50 00	36 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

Every holder of a bond or share in an electric company and every inventor or patentee, in fact all who are interested directly or indirectly in electricity as a business, should, so far as in him or her lies, demand that the World's Exposition be kept open evenings, to permit the exhibition of the various generators, with their several methods of distributing light, that visitors may examine. This Fair is for business from A to Z. It is intended for producers to meet purchasers and distributers for the profit which can be made by all, following an exhibition of goods combined with an expert description, and coupled with the opportunity given for immediate comparison. Sentiment has no standing in this matter; the pleasure-seekers who will visit Chicago can eat their ice-cream and pie, talk female politics, show their new clothes, air their religious views; in every way enjoy themselves, retire to dinner or to prepare for the theatre, prayer-meeting or sewing-circle without interfering with business. A committee sent to the Fair to decide on which system their State, city or company will adopt for light, could not possibly do their full duty if the electric portion of the exhibits is to be closed at dark and kept closed until daylight. There has been and still is altogether too much opposition to the proper presentation of meritorious improvements, and it comes as a rule from a legion of sources which do not even dream that the Fair is a purely business enterprise, and that the exhibitor comes to Chicago at extraordinary expense simply because by so doing he can meet more customers, sell more of his wares, and reap a correspondingly greater profit. The large majority of these sales pay tribute in some way to the shareholders for the discussion of whose investments this column has its existence. The few parent companies with their large capital will be on hand, but the thousand of smaller corporations and firms are the ones who should receive the most benefit. Many of these will not use their space, as their business knowledge does not enthuse them to consider the opportunity under the circumstances propitious to their bank account. There is no time to spare; if the rules are to close the gates at dark, possibly some arrangement may be made by which the electric (and a refreshment) department may be kept open during their business hours. With that the electric shareholders will secure enough customers to make an investment in the show profitable. The very large amount of capital invested in the various supply companies scattered over the country will not be enhanced in value unless the fullest scope is given to legitimate competition on this occasion, nor will the greater sums required for introducing the improvements suggested to inventors by

the goods exhibited be forthcoming if through a mistake of the committee electrical advancement meets with disaster. There is no comparison between electricity and any other exhibit ; it is by far the most important, and has the greatest immediate future, because it will assist in the profits of every other industry from Agriculture, the creation, to Zythum, the perfected result.

Those who have invested their money in electric plants calling for incandescent lamps, and having no connection with the General Electric Company, should be taking account of stock and opening communication with a view to a supply suitable to their system before a discussion has been reached, which may leave them so far down the line of orders that their dividends may be jeopardized. The guarantee of a party to deliver that which the law and the bank say he may not possess, will not support the widow and the orphan whose remittance depends on that source. Many of us have suffered from such approved promises. There is reason to believe the General Electric Company will be generous with a very large majority of shareholders until such time as its lines can be changed to conform to the new order of things; but one should not forget to remember that the "General" shareholders may hold their executive committee to a strict line of duty and demand the pound of flesh. The position is not pleasant when a requisition for a thousand new lamps comes back endorsed, "We can't supply you any more." Immediately the order is sent to the source of supply, only to be returned endorsed, "We don't know you." Dividends are eaten up mighty fast with a pull at each end of them. One may use the interchangeable arc lamp of which I wrote last week for a large portion of the service, but the inside incandescent commercial is a most vigilant customer, and in possession. It is considered business by a majority of men in business to pay bills when the contract is filled, not till then. The lamp question, like all others, will settle down in time, and there is no reason why you should not put every dollar you can spare into your local plant and grow up with it. Make a beginning this Christmas, and store it away; subscribe for the ELECTRICAL AGE and read it regularly, for between the lines you will see your investment increase, even in the dark.

TRADE NOTES.

The firm of Waterhouse Bros., Hartford, Conn., manufacturers of arc lamps for arc and incandescent circuits, has been reorganized under the name of Waterhouse, Gamble & Co. The new company, besides the Messrs. Waterhouse Bros., is composed of Mr. James N. Gamble, of Cincinnati, Ohio, well-known as vice-president of the Proctor & Gamble Co., and builder of the Ivorydale Works, and Mr. Wm. T. Partridge, of New York city. The offices of the company will be at Room 176, 45 Broadway under the management of Mr. Partridge, and the factory will remain at Hartford.

AKRON, OHIO, Sept. 22, 1890.

THE AKRON BELTING CO.,
AKRON, O.

Gentlemen : We take pleasure in testifying to the superior excellence of your belting that we have been running throughout our mills for nearly two years. With the experience of over twenty years in using many different makes of belting, yours has proved to be better than any other we have ever used, as it has given us no trouble whatever. Yours very truly,

D. M. FULLER, Treas. and Gen. Mgr.,
AKRON WOOLLEN FELT CO.

The Electrical Age's Illustrated Patent Record.

Issued November 22, 1892.

486,457. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass. Filed March 14, 1892.

486,477. Insulating-Chair for Rails. Frank E. Kinsman, Plainfield, N. J. Filed Feb. 23, 1892.

486,488. Electric-Arc Lamp. William O. Meissner, Chicago, Ill. Filed April 13, 1892.

486,498. Lightning-Arrester. Harry G. Osburn, Chicago, Ill. Filed Dec. 26, 1891.

486,506. Electric Switchboard. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 7, 1890.

486,507. Test System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb., 11, 1892.

486,524. Dynamo-Electric Machine. George Baehr, Brooklyn, N. Y. Filed Dec. 18, 1891.

THE
"CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

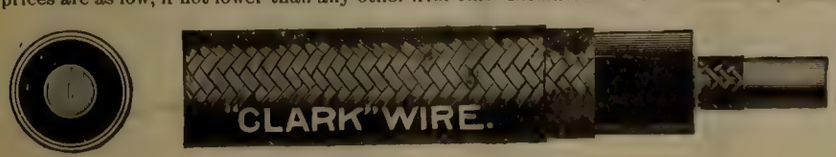
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.

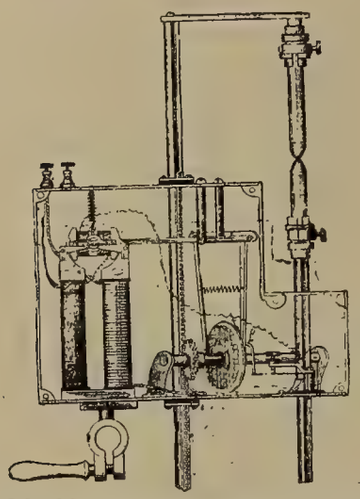


EASTERN ELECTRIC CABLE CO.,
61 to 65 Hampshire Street, Boston, Mass.
HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS.—Continued.

486,569. Electric Signalling Device. James J. Ross, Detroit, Mich., assignor of one-half to George R. Holden, same place. Filed Dec. 29, 1891.

486,575. Process of Electrically Reducing Refractory Compounds. Thomas L. Wilson, Leaksville, N. C. Filed April 20, 1892.



486,488.—ELECTRIC-ARC LAMP.

486,583. Trolley-Wire Hanger. David E. Lain, Yonkers, N. Y. Filed April 11, 1891.

486,604. Suspension Device for Incandescent Lamps. Stephen Porter, Boston, Mass. Filed Nov. 23, 1891.

486,624. Electrical Method of and Apparatus for Forming Tubes. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Sept. 16, 1891.

486,625. Electric Metal-Heating Apparatus. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, of Maine. Filed Oct. 21, 1891.

486,626. Electric Forging Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Jan. 13, 1892.

486,634. System of Railway Signalling. Thomas A. Edison, Menlo Park, N. J., and Ezra T. Gilliland, Boston, Mass., assignors, by mesne assignments, to the Consolidated Railway Telegraph Company, of New York. Filed April 7, 1885.

486,643. Current-Director. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Jan. 2, 1892.

486,644. Current-Regulator. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed March 21, 1892.

486,656. Carbon-Brush Holder for Dynamo-Electric Machines and Motors. James J. Wood, Fort Wayne, Ind. Filed May 3, 1892.

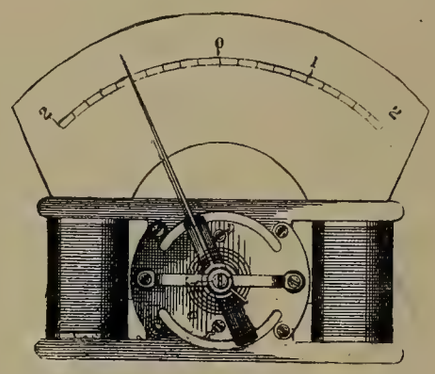
486,689. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed June 4, 1891.

486,702. Successive Non-Interference Signal Box. William E. Decrow, Boston, Mass. Filed July 25, 1890.

486,715. Electric Device for Vibrating Tables. William L. Imlay, Camden, N. J. Filed April 9, 1892.

486,729. Electric-Lamp Shade. Charles J. Miller, Philadelphia, Pa., assignor to the Novelty Electric Company, same place. Filed April 21, 1892.

486,757. Electric-Arc Lamp. James Brockie, London, England. Filed Aug. 6, 1891.



486,689.—ELECTRICAL MEASURING-INSTRUMENT.

486,807. Electrical Hose Signalling Apparatus. William Fowler, Colorado Springs, Col. Filed Feb. 8, 1892.

486,818. Electrical Metal-Working Apparatus. George D. Burton, Boston, Mass., assignor to the Electrical Forging Company, same place. Filed Oct. 26, 1891.

486,820. Electrical Annunciator. Franklin S. Carter, Burlington, N. J., assignor to Franklin S. Carter, Charles M. Wilkins and E. Ward Wilkins, Philadelphia, Pa. Filed June 14, 1892.

486,838. Electric Clock. Martin V. B. Ethridge, Everett, assignor of two-thirds to Henry E. Waite, Newton, and Joseph H. Eastman, Boston, Mass. Filed Jan. 18, 1892.

VULCANIZED FIBRE COMPANY,
Established 1873.
Sole Manufacturers of HARD VULCANIZED FIBRE.
In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.
FACTORY: WILMINGTON, DEL. **The Standard Electrical Insulating Material of the World.** OFFICE: 14 DEY ST., N. Y.

PLATINUM
FOR ALL PURPOSES.
Scrap and Native Platinum Purchased.
BAKER & CO.,
408-414 New Jersey Railroad Ave., Newark, N. J.

BATTERY ZINCS
RODS AND PLATES FOR BATTERIES.
H. LAMARCHE'S SONS,
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COMPLETELY ISOLATED.

The first day of December burst upon San Francisco with considerable violence. A very severe storm prevailed, one of the results of which was the telegraphic isolation of San Francisco from the rest of the world. It did not remain on the outside long, however, as the agile telegraph constructors soon restored communication.

THE PAST AND FUTURE.

As the year 1892 draws to a close we are all constrained to look back and ask in what respect are we any better off to-day than we were at the close of last year. In the electrical field, taking it all together, there certainly has been vast improvement in some directions. Business may not have been as active in some departments as those engaged therein could wish, but on the whole this has probably had a beneficial effect. Various reasons are ascribed as being the cause of such dulness. Some say the consolidation of the two great electrical interests is responsible for the state of affairs, while others lay the blame to political conditions. Reasons without number are suggested, but where so many complex forces are in operation it is a very difficult thing to point to a particular one and say with absolute assurance "That was the cause of the dulness in trade." The combination of all circumstances no doubt produced the result. On one point, however, all seem to be agreed at this time, and that is that next year promises to be one of prosperity. This is not the opinion of one man; it is the ruling one in the trade, and we trust that it will be realized in each and every case.

BOGUS "ELECTRICIANS."

The magic influence of the word "electrician" is on the wane. There was a time when men who engaged in unlawful deeds could successfully pull the wool over people's eyes by simply calling himself an "electrician;" but the people have learned something, and their regard for "electricians" is not so profound as it used to be. One of these self-styled "electricians" came into conflict with the law a few days ago in this city, but his title could not save him. He was caught in the act of tapping a telegraph wire with the object of getting advance information regarding the races. His prospective wealth did not materialize, however, owing to the officiousness of the officers of the law.

NEEDED REFORM.

Every one engaged in the electrical business, in whatever capacity or branch, if he be fair-minded, acknowledges that the upbuilding of that business is due, in the main, to the electrical press, which has always been very liberally disposed towards growing electrical enterprises. Every invention and improvement has been duly and faithfully chronicled, thus greatly aiding the one most interested in the advantageous disposal of the particular improvement or invention described, or what is equally as good, in the enlargement of his business by creating a demand for his goods. But how many of these beneficiaries give the credit for their prosperity—in part at least—to the trade journals? Comparatively very few, we regret to say. Those who do not support their trade papers, upon which so much of their prosperity depends, should ask themselves, as the season approaches for the turning over of "new leaves," if it would be any more than fair that they should do something towards the maintenance of the electrical journals.

A good many concerns who never advertise are, we notice, very liberal to themselves in sending to the electrical papers trade notices and other items for publication as news, but when they are asked to be represented in the advertising columns they recoil from such a proposition, and give all sorts of excuses. To these we would suggest the wisdom of giving this matter a little careful thought. The electrical press has always dealt liberally with them, and is willing to continue doing so; but they should remember that it is a duty they owe to themselves to aid in the support of their trade journals.

THE LUNDELL MOTOR.

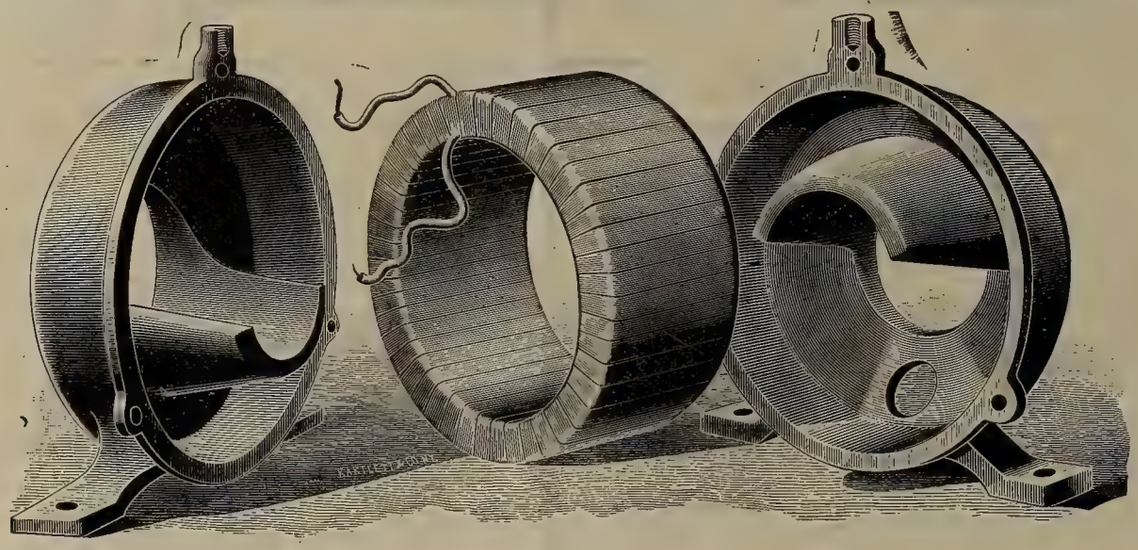
In the ELECTRICAL AGE of July 2 last an illustrated description was given of a new fan-motor then just being put on the market by the Interior Conduit and Insulation Co., of New York, which possessed some unique features of design.

Many of the same characteristics are embodied in the power-motor described and illustrated below, which the same company is now offering for favorable consideration.

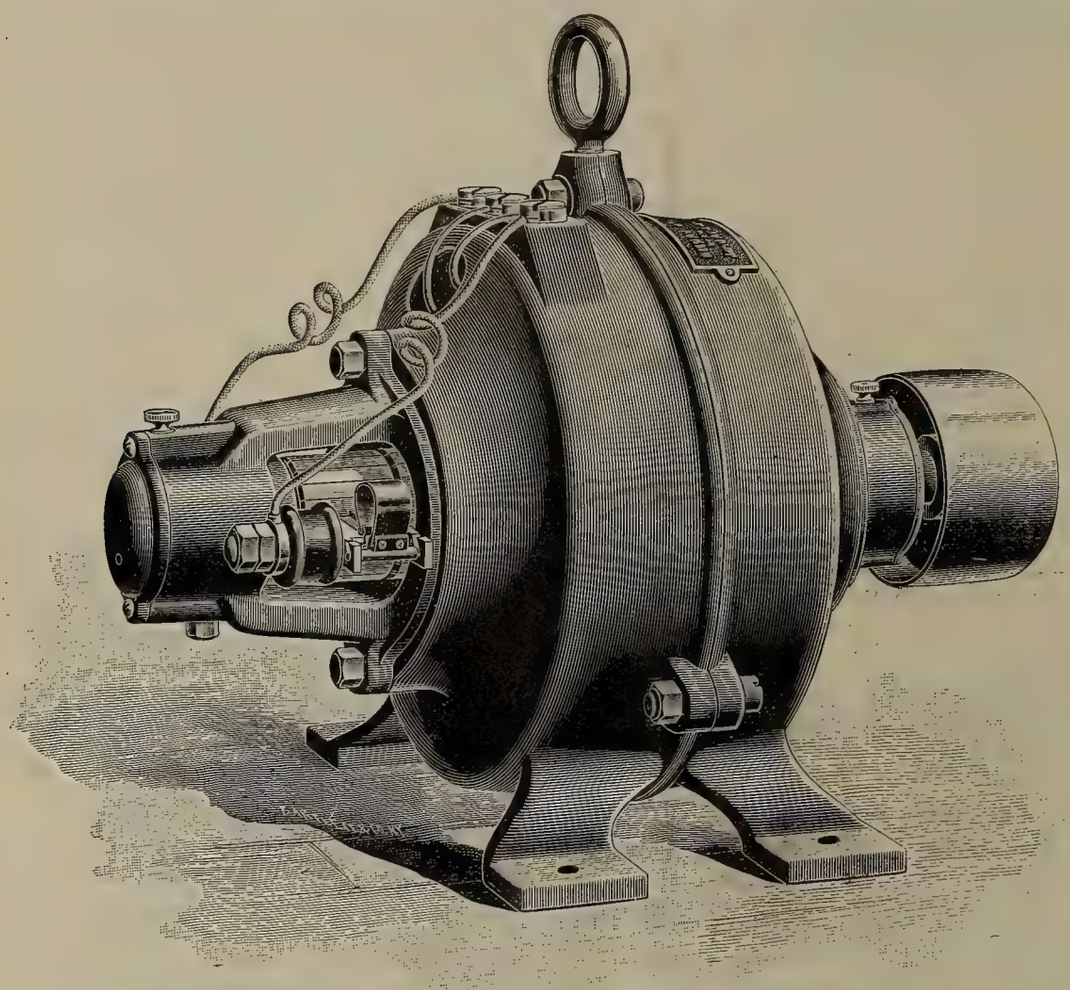
These motors are made in six sizes, ranging in power from ¼ of one horse-power to 5 H. P., being wound for 115, 230 or 500 volt circuits as desired.

The ampères taken at full load and 115 volts range in the 6 sizes from 2.2 to 45.

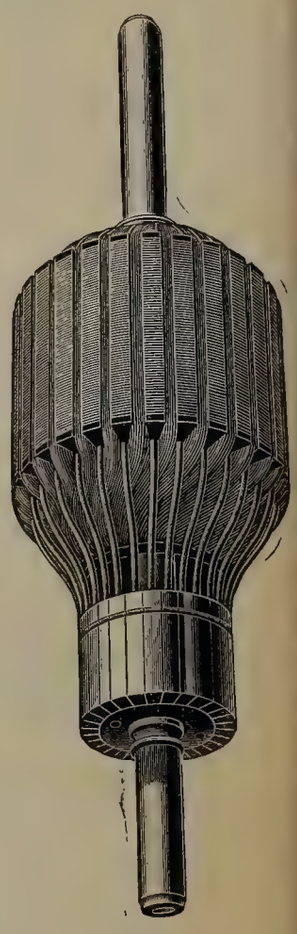
The Interior Conduit Company claims that in some respects these power-motors are superior to the fan-motors already alluded to, and that their merit consists in the high development of the factors of high efficiency, simplicity, compactness, light weight, cleanliness and neatness of appearance. In these motors the company has been enabled to incorporate some qualities not obtainable in the fan-motor size; as, for instance, by the simple fact of increased dimensions the form becomes



FIELD AND POLE PIECES.

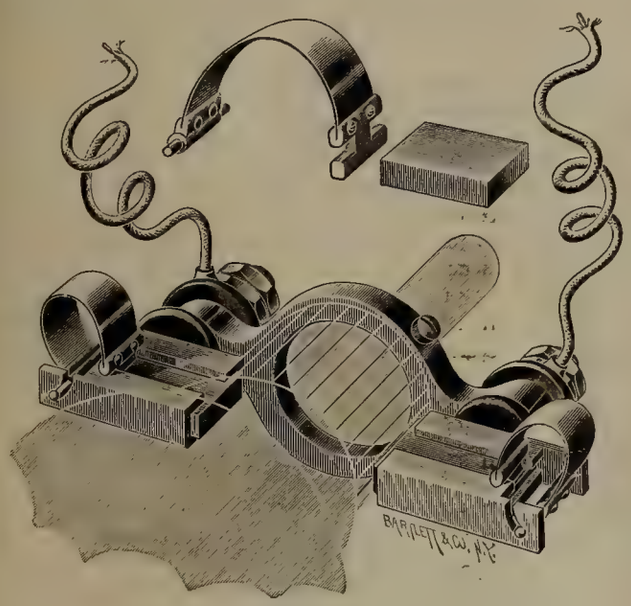


LUNDELL MOTOR.

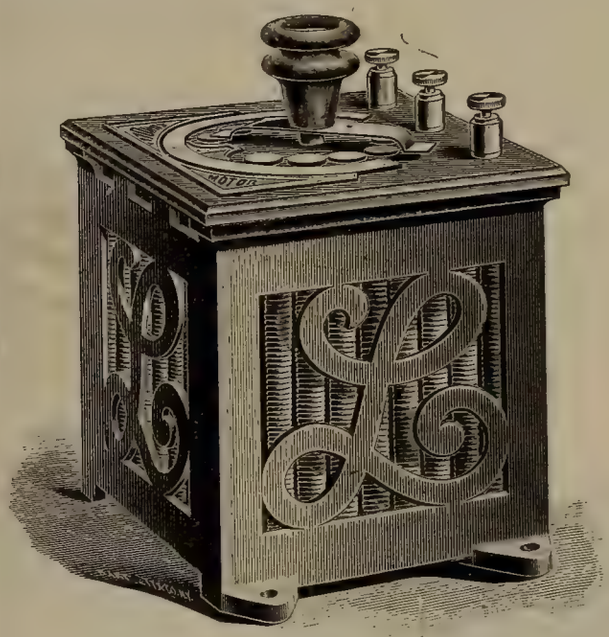


THE ARMATURE.

cylindrical and this permits the placing of the field-coil concentric with the armature instead of at an oblique angle. The concentric position of the field-coil permits the withdrawal of the armature without disturbing either the field-coil or the pole-pieces—a very great advantage in motors of any considerable power. A further modification is obtained in placing the commutator outside of the field-magnet shell, but well protected between the two limbs of a broad and strong bracket. This change of commutator position is made for the purpose of affording the ready access to brushes and commutator demanded by motors employing a current of any considerable quantity.

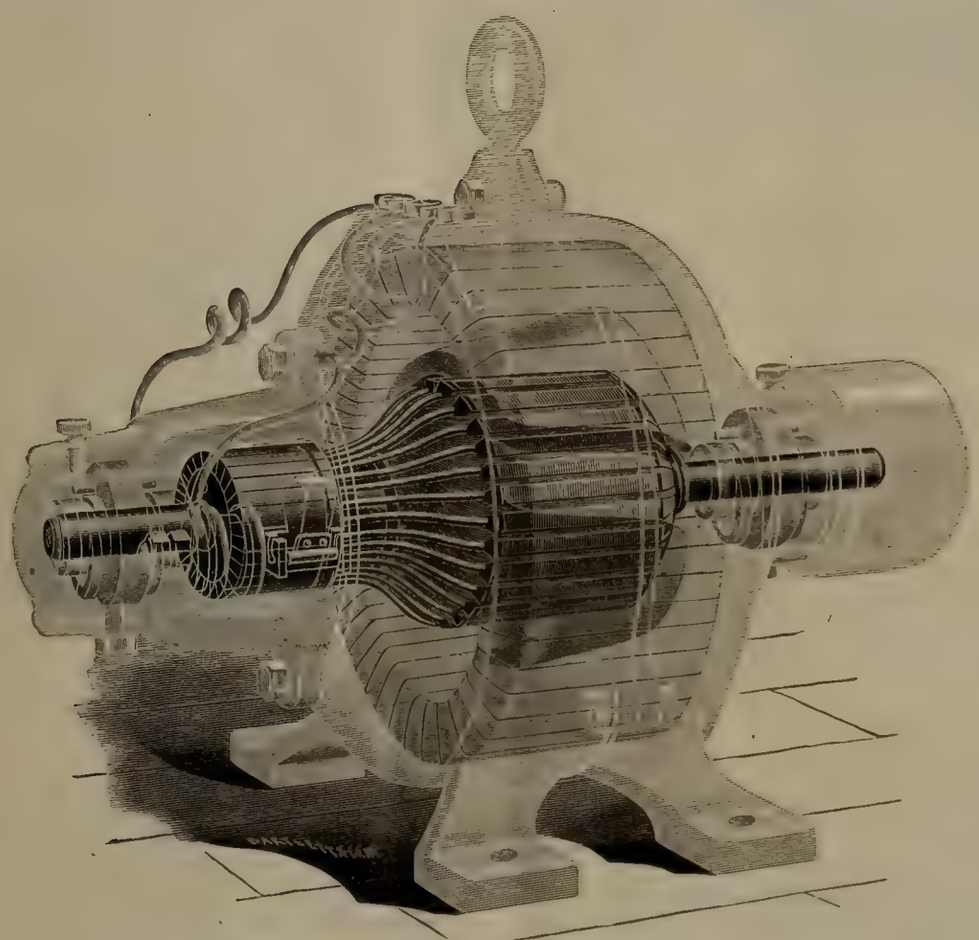


DETAILS OF BRUSH-HOLDER.



LUNDELL REGULATING AND STARTING BOX.

The brush-holder as well as the commutator are of superior design and workmanship, the former being extremely simple, enabling the renewal and restoration of a brush with great ease and in a second or two of time.



OUTLINE VIEW OF LUNDELL MOTOR.

The armature is of excellent design and workmanship; is substantially built and combines maximum cross-section with minimum length of wire. This, the company

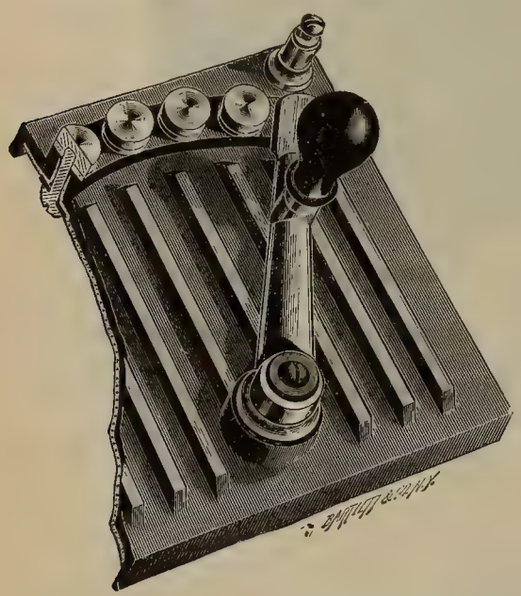
claims, secures high efficiency and low-speed variations between extremes of load. This is a shunt-wound motor, in fact, which practically fulfils the duty and office of a differential motor.

In regard to the bearings the same careful attention has been given as to other parts. They are self-oiling and provided with a vision-gauge by means of which the condition of the oil supply can be seen at a glance.

The bushings are made of the best material and are easily removed and renewed when worn out.

Each motor is furnished with a Lundell regulating and starting box or a Carpenter enamel rheostat as desired. The advantage of the latter is that it occupies a very small space; it is also fire-proof and water-proof and is mechanically strong and simple in construction.

Besides the motors above referred to the Interior Conduit and Insulation Co. has in process of manufacture a complete line of small powers ranging from the battery motor of $\frac{1}{12}$ H. P. at 4 volts upwards, including $\frac{1}{10}$, $\frac{1}{8}$ and $_1$ of a horse-power.



CARPENTER STANDARD RHEOSTAT.

SENDING PICTURES, ETC., BY TELEGRAPH.

The New York *Herald's* illustrated report in the issue of November 20 of the great foot-ball game at Springfield, Mass., on the day previous, between the Yale and Harvard teams, was widely commented upon for its completeness. Two particular illustrations of the many attracted the attention of those interested; they were charts showing the movements of the ball during the first and second halves of the game. The line representing the course of the ball was apparently a veritable tangle, but if it was traced from the starting-point it was seen that there was some method in its crookedness, after all.

From an electrical standpoint these charts had considerable interest, from the fact that they were telegraphed from Springfield to the *Herald*.

We give herewith one of the charts as produced in the *Herald* showing the course of the ball during the first half of the game.

The method of telegraphing these charts is quite simple and at the same time reliable and accurate. The original chart is made by the reporter who stands on the field of action. He has in front of him a sheet of paper divided into very small squares, and from the exact centre of the sheet he starts his pencil in directions corresponding with the flight of the ball through the air or in the hands of any one of the contestants. Those familiar with the game know that the ball is started from the centre of the field, hence the chart may be regarded as a map of the field itself. Every change of direction in the course of the ball, either through the air or when it is carried by hand, is accurately recorded by the lines on the original chart, and in order to show when it was kicked and when it was carried, broken and solid lines are used.

After the game is completed the story told by the chart is prepared for the telegraph wires. At the end of each and every vertical and horizontal line on the chart is an English word of three letters, and if we take any word on each of the two sides and follow the two corresponding lines to their junction the two words selected will represent the point where the two lines meet and no other. This same fact applies to all of the lines, hence it will be readily understood that all of the points on the chart representing the change of direction in the ball's course can be translated into English, so to speak, and in this form telegraphed to its destination. When it is received it must be translated into its original form—namely, into a chart. At the office of the newspaper receiving the telegram is a sheet of cross-lined paper, an exact duplicate of that used by the reporter on the field. The first two words of the telegram are taken and the junction of the lines represented by them is found and marked with the point of a pencil. The next two words are similarly followed out, and the junction point of their lines marked. Now these two pencil marks are joined by a straight line, which shows the direction of the ball from the starting-point to the first deflecting point. The whole despatch is translated in this way, and the result is an exact reproduction of the original chart. The advantage of these charts is that they show at a glance on which side of the field the brunt of the battle took place.

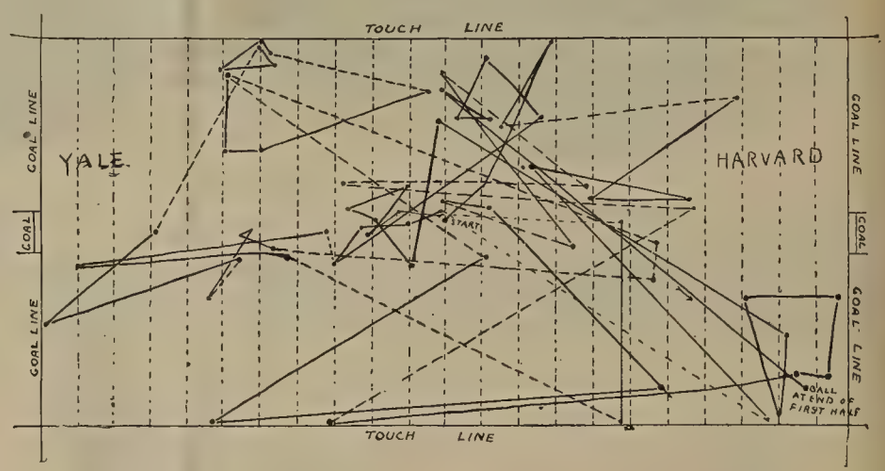


CHART SHOWING MOVEMENTS OF FOOTBALL.

The same principle can with as great facility be applied to the transmission of outline pictures of any description, and will no doubt find a very extensive application as soon as the newspaper fraternity learn its advantages.

The system is the invention of Mr. S. H. Horgan, manager of the art department of the New York *Herald*, and the success attending its use in connection with the foot-ball game above referred to has resulted in bringing to it considerable attention.

Dubuque, Ia., was visited with a very severe snow-storm on the morning of November 18, which subsequently turned into a blizzard and worked havoc among the electrical wires, telegraphic communication being entirely cut off and the telephone, fire-alarm and every other kind of electric service rendered entirely useless.

SOME OF THE SPECIALTIES OF THE RELIABLE MANUFACTURING COMPANY.

Many devices have been brought out for the application of sand to street-railway tracks for the purpose of preventing the sliding of the car-wheels after the brake has been set, and while possessing a number of good features have in most cases failed to give entire satisfaction and have been discarded. It is said that a large number of accidents have been caused by the slipping of the car-wheels after the brake has been applied which would have been prevented had the car been equipped with a reliable sanding apparatus.

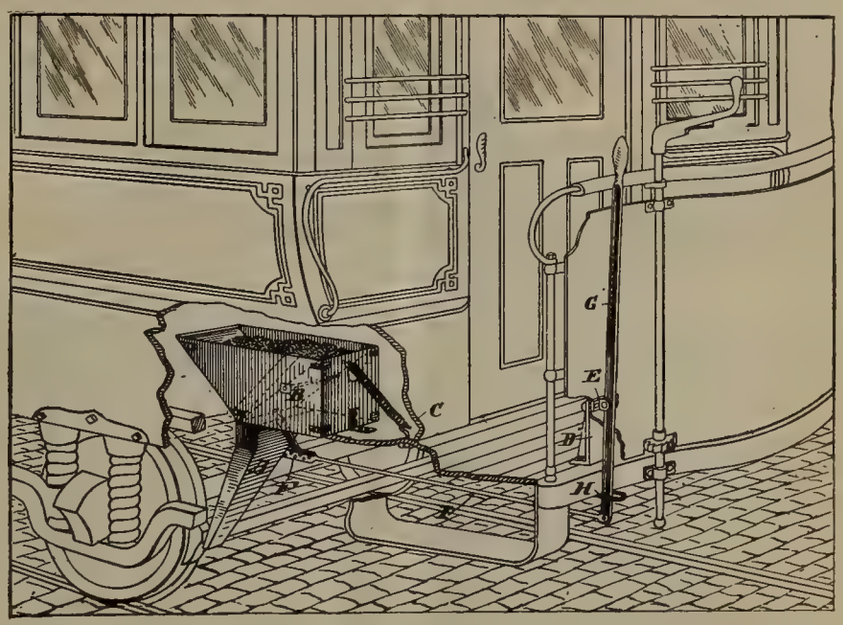


FIG. 1.—RELIABLE SAND-BOX.

There is a sand-box on the market for which absolute reliability is claimed, and furthermore that it is the first and only one ever yet tried that would run sand, salt or gravel, wet or dry, and do the work just at the moment needed. This sand-box is entirely free from any of the objectionable features which have been the source of failure in other apparatus. One side of the hopper is movable, has a vibrating or oscillating motion; when operated it opens out at the bottom and pushes forward at the top, throwing out whatever substance there may be in the hopper at the time. A chute, open at the top, is used in place of a pipe; this chute will not clog up. The delivering from hopper to rail is instantaneous. The motorman or driver can open the hopper to suit either fine dry or wet sand, salt or gravel, by simply moving the lever.

This apparatus is known as the Reliable sand-box and certainly seems to possess all the features essential for successful operation.

Fig. 1 gives a view of the Reliable sand-box.

Fig. 2 shows the mechanical workings of the Reliable mechanical track switch for horse or electric cars. The right pedal has been forced down by which the switch is thrown for the car to go to the right. A spring keeps the pedal in place and there is nothing complicated or liable to get out of order. These switches are designed to supplant the tip-switch operated by horses. They are of very simple construction and can be put in place very quickly. The switch-plate is about twenty inches square and placed in the centre of the track with one corner extending to the rail; it is laid on a wooden frame. The pedals are about 7 inches long, 2 inches wide and ½ inch high. These switches are almost water-tight, and require but



FIG. 3.—RELIABLE MECHANICAL TRACK SWITCH.

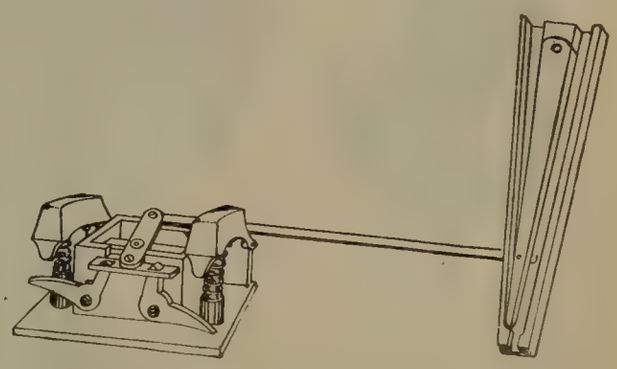


FIG. 2.—DETAILS OF TRACK SWITCH.

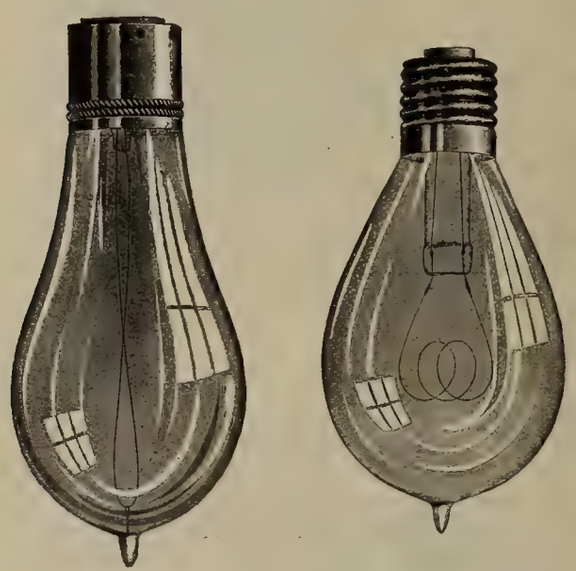
very little care to keep them from freezing in the winter. They offer no obstruction to vehicles and they are not liable to injury by vehicles passing over them. The switch is operated by plungers, which can be applied in different ways and made to suit any street-railway company standard.

Fig. 3 shows the Reliable track switch as placed in the street and operated by the motorman from the car. In this case the car is to go to the right, the motorman places his foot on the right plunger and the little wheel drops and runs on the pavement until it reaches the pedal on the switch-plate and throws the switch. To go in the left direction the left plunger is operated.

All of these devices are manufactured by the Reliable Manufacturing Company, at 53 State street, Boston, Mass., which also manufactures the Collett ratchet brake and other street-railway specialties.

LAMPS FOR RAILWAY AND POWER CIRCUITS.

The demand for a thoroughly high-class incandescent lamp, especially adapted to the lighting of street cars, or for use on power circuits, has been steadily growing during recent months. At the lamp works of the General Electric Company a series of experiments in the direction of satisfying this demand have lately been



ANCHORED FILAMENT. SPIRAL FILAMENT.

made, with entire success. The outcome of the experiments is three special types of lamp, which satisfy the exacting requirements of railway and power work. It must be borne in mind that the special requirements of a lamp destined for use in series on railway circuits differ materially from those of the ordinary lamps which are connected in multiple on low-tension circuits.

The first lamp is the straight unanchored-filament lamp, differing in no way in appearance from the ordinary incandescent lamp. This lamp is rated according to the amount of current consumed, and only those consuming the same amount of current should be used in any one series. In order to avoid the possibility of errors in order of shipment of this style of lamp, a special record is kept of the lamps shipped to different companies, and thus lamps of the same current-carrying capacity as those they may have received on previous orders are always sent to each company.

In the anchored-filament lamp the chance of breakage of the filament by sudden contact with the glass of the bulb caused by motion of the car is entirely obviated. The life of the lamp is, consequently, not liable to abrupt termination or even abbreviation.

The design of the spiral-filament lamp is the most novel and most pleasing. As will be seen from the cut, the filament is made in three spirals, mounted on a heavy glass centre, and requires no extra support.

Great care is exercised in the manufacture of the two last-named lamps in order to render the resistance exactly the same throughout each form, so that any "spiral" or "anchored" filament lamp may be used with others of similar form. Neither one, however, must be used in series with the others.

HORSE-POWER OF BOILERS.

When the horse-power of a boiler is referred to, a very vague idea of the real meaning of the term is given. Most people get the impression that when we say a boiler has a certain horse-power it means that the engine which it is constructed to supply steam to will exert that power when all the prescribed conditions exist. What the horse-power of a boiler really means is a question that is difficult to answer. It is neither logical nor appropriate to express the steam-generating power of a boiler in units of horse-power, but it seems to have become a habit which has grown upon mechanics that is hard to break off and discontinue.

The unit of horse-power for boilers is not, says a contemporary, fixed except by arbitrary agreement among the parties concerned, the basis differing according to the nature of the work done by the steam. Many boiler-makers rate the horse-power of the boilers by the number of square feet of heating surface contained in the boiler. Although this rule is followed by many, it is no criterion as between different styles of boilers—a square foot under some circumstances being many times as efficient as in others; but when the average rate of evaporation has been fixed upon by experiments in one boiler, there is no more convenient way of rating others of the same style. But by an outsider no exact rating of a boiler can be made from a knowledge of only its heating surface.

The following rules are observed in a good many boiler-shops, and may be useful: For cylinder boilers nine square feet of heating surface per horse-power are allowed; for flue boilers twelve square feet, and for tubular boilers fifteen square feet of heating surface per horse-power. Hence, if the total heating surface be known, divide it by 9, 12, or 15, according to the type of boiler, and the quotient will be the horse-power of the boiler. If a boiler is tested and a statement of its horse-power desired, without regard to whether it is to supply its steam to drive an engine or for other purposes, then it is agreed upon by the majority of experts to consider 30 pounds of water per hour, evaporated at 70 pounds pressure from 100 degrees, as a horse-power.

A standard was fixed by Watt at one cubic foot of water evaporated per hour from 212 degrees for each horse-power. This was at that time the requirement of the best engine in use. Most nations have a standard similar to and generally derived from Watt's "horse-power," but owing to different standards of weights and measures these are not identical, though the greatest differences amount to less than 1½ per cent.

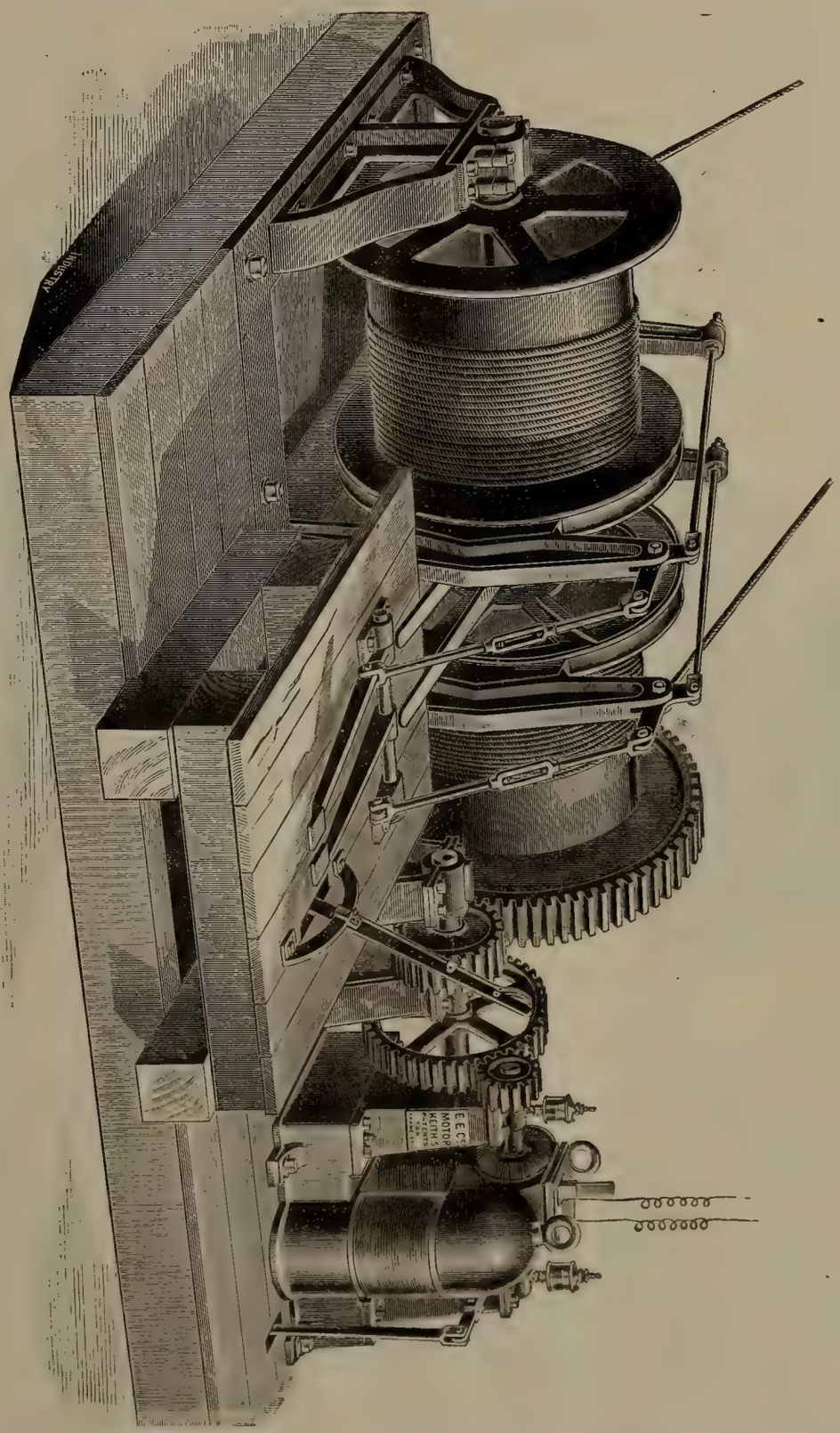
THE COMMERCIAL ELECTRIC COMPANY, of Indianapolis, a new concern organized for the manufacture of dynamos and motors, has awarded the contract for the equipment of its works to the Lodge & Davis Machine and Tool Company, of Cincinnati.

ELECTRIC MINE-PUMP AND ELECTRIC HOIST.

In the far Western States where mining operations are carried on, pumps are indispensable parts of the operating plant. Electricity is extensively used as the driving power of such pumps, and electric pumps are coming more and more into general use.

The Electrical Engineering Co., of San Francisco, makes a line of electrical machinery that is very popular in the far West. The apparatus this company turns out includes dynamos and power generators, electric mining pumps, electric-power pumps, dynamos or generators for mine pumping, electric-power rock-drills and electric hoists.

We give herewith two illustrations, one of combined electric motor and pump and the other of an electric double hoist made by this company. The combination



ELECTRIC DOUBLE HOIST.

motor pumps are extensively used in California in the mining regions, and in cities for operating hydraulic elevators.

The double hoist shown is in use at the Black Diamond coal mine, at Black Diamond, Wash., where it has been in successful operation for nearly two years. Its capacity is 80 H. P.

The electrical apparatus of this company is all made under the patent of Mr. N. S. Keith, a well-known electrician who resided in the East several years ago.

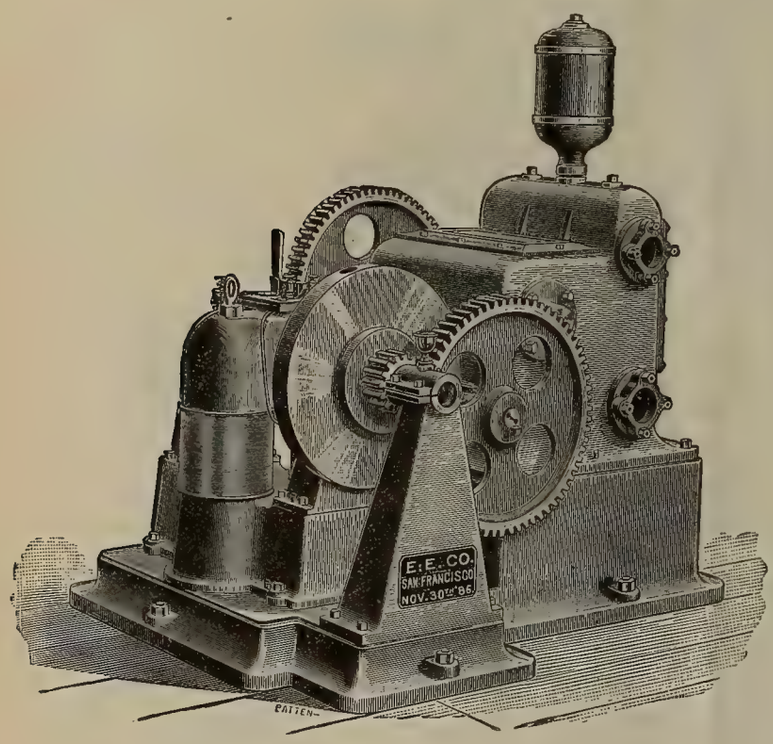
The Electrical Engineering Co. is manufacturer and contractor for the installation of all kinds of electrical apparatus. The company's office and works are at 21 and 23 Spear street.

AT THE WORLD'S FAIR.

MACHINERY HALL.

In Machinery Hall at the World's Fair as many different types as possible of engines and dynamos will be shown in actual operation, and the same is true of boilers.

The location of the Babcock & Wilcox, Campbell & Zell, Gill, Heine, National and Root boilers is on the south side of the hall. Space is reserved for foreign boilers. Within the main building, but adjoining the boiler-house, will be located the engines, taking up nearly all that side of the building. It is yet too early to compile a complete list of the steam-engine exhibit, but the largest of these and perhaps the principal ones which will be shown are as follows:



ELECTRIC MOTOR AND PUMP.

At the east end of the building have now been installed four Edison generators—two run by New York Safety engines, and two by Armington & Sims engines; also a compound Edison generator and engine. Other exhibits include: One 2,000 horse-power quadruple-expansion E. P. Allis & Co. engine, which will drive tandem, two Westinghouse 10,000 incandescent-light dynamos. Also one 500 horse-power engine, with Westinghouse dynamo direct-connected. One 1,000 horse-power double-tandem compound, Atlas Engine Works; also one of the same, 500 horse-power. Five Ball & Wood engines, aggregating 800 horse-power. One 350 horse-power cross-compound—Bass. One 1,000 horse-power four-cylinder triple-expansion—Buckeye Engine Company. There will be also five other Buckeye engines, three simple and two compound. One 1,000 horse-power Edison combined engine and dynamo. One 1,000 horse-power four-cylinder triple-expansion by Fraser & Chalmers. Two Ide engines, aggregating 800 horse-power. Two compound and one simple engine, aggregating 800 horse-power, by Lane & Bodley. One 1,000 horse-power double-tandem compound—McIntosh & Seymour. One simple, one compound, and one four-cylinder compound—Phœnix—aggregating 850 horse-power. One cross and one tandem compound—Russell—aggregating 800 horse-power. Six 1,000 horse-power Westinghouse combined engines and dynamos. Two compound Woodbury engines, aggregating 800 horse-power. In the space in which the large Allis and Fraser & Chalmers engines are there has now been located between these two a McEwen engine running two "C. & C." power generators of 80 kilowatts capacity each. All piping will be run under the floors, the space under the main part of the building being 6 feet and under the engines and dynamos 9 feet 6 inches. The Underwood Manufacturing Company furnished as an exhibit all the belts for the Ball & Wood engine plant, which plant runs 16 Brush dynamos. Fayerweather & Ladew, of New York, furnish a 72-inch belt, and the Page Belting Company furnish two 72-inch double leather belts and one 66-inch leather and four link belts. Charles A. Schieren & Co., of New York, furnish a 72-inch belt. About 25 belts have been contracted for as exhibits, and a number of others are being negotiated for.

Among the makers of pumps which will be at work in boiler-feeding and for other purposes, all of which pumps are to be exhibits, will be the Battle Creek Machine Company, the Laidlaw & Dunn Company, the Snow Pump Works, the Hall Steam Pump Company, the Smedley Manufacturing Company, the Blakeslee Manufacturing Company, the Deane Steam Pump Company, Holyoke, Mass.; Boyd, Porter & Co., Connellsville, Pa.; the Canton Steam Pump Company, the George F. Blake Manufacturing Company, the Knowles Steam Pump Company, A. S. Cameron, the Wilson Snyder Manufacturing Company, Pittsburg; the John H. McGowan Company, the Buffalo Steam Pump Company, the Barr Pumping Engine Company and the Goulds Manufacturing Company.

Natural gas has already been piped to Chicago, and the fuel to be used in the steam-plant at the Exposition grounds will be oil, which will be piped from the Lima, O., fields. The oil-receiving tanks have a capacity of 120,000 gallons, or a little less than two days' supply. These tanks are to be 2,800 feet from the boiler-house. Oil will be pumped to the boilers, and its admission to the fire-boxes will be controlled by suitable valves. This is expected to be much cleaner and more sightly than the use of coal, as there will be no smoke or ashes. The oil pump-house has its isolated electric-light plant.

CARRYING CAPACITY OF WIRES.

The safe carrying capacity of a wire is that current which it will convey without becoming painfully warm when grasped in the closed hand. In reference to this it must be remembered that this test cannot safely be made with the wires carrying currents for arc lights, and it is intended to be applied only with reference to the conductors of incandescent lights. These may be handled without risk; but with the conductors of the arc lights, where, as is usually the case, there are a number in series, a severe shock may be experienced on touching the wire, and if a ground connection existed by chance elsewhere, and some other conditions were present by which the full force of the current passed through the body, this shock might be fatal.

THE GIANT ELECTRIC MOTOR COMPANY, of Portland, Me., has installed an electric-light plant on the dredge now at work in the harbor, so as to permit night work. It is a perfect success.

A COMPACT GENERATING SET.

The direct-coupled generator and engine, in one compact set, is, under conditions of restricted space and position, the ideal electrical plant. We illustrate a small, direct-coupled generating set, recently perfected and manufactured by the General Electric Company. As perfected, it represents the result of two years of careful practical experience.

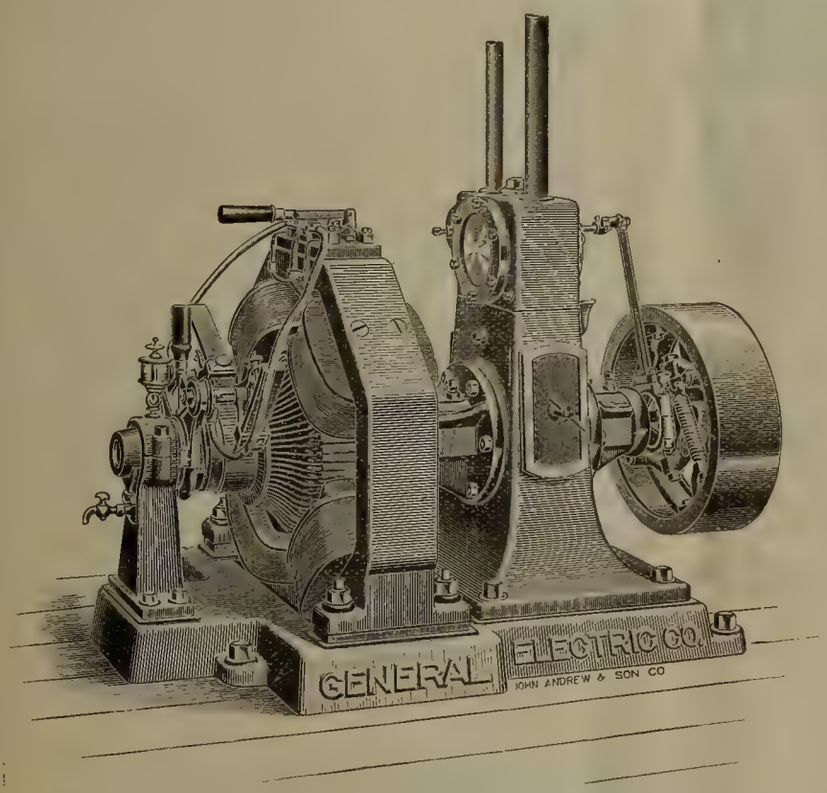
For marine installations, where a separate engine is indispensable to drive the generator, these sets are especially adapted. As cheap as, if not even less expensive than belted plants, they can be readily fitted to positions where a belt-driven dynamo and engine could not find a sufficiency of space. Compact and simple in arrangement, their suitability for small, isolated plants in hotels and buildings where belting is objectionable, is undeniable.

Under exhaustive tests, the engine shows the highest possible economy obtainable from machines of this size; and its simplicity is such as to reduce the attention necessary to a minimum.

The generator is of the familiar General Electric Company quadripolar type, compound wound, having automatic regulation, within two per cent. over the entire range from no load to full load.

The commutators are cross-connected, so that only two brushes, 90° apart, are used. The rheostat is of the new, iron-frame, incombustible type. The engine and dynamo are both provided with self-oiling bearings.

The sets are manufactured in 4, 8, 15, 30 and 50 kilowatt capacities.



DIRECT-COUPLED GENERATOR AND ENGINE.

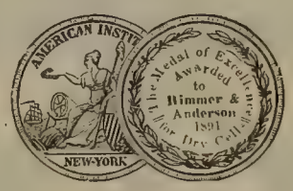
DRY BATTERIES.

There seems to be an erroneous impression abroad that dry batteries have poor lasting qualities, and that they soon give out and cease to produce current. The dry battery of the Himmer & Anderson Dry Battery Co., of 123 Chambers street, New York, shows extraordinary staying power.

The company has made valuable improvements in the chemical composition used in its dry batteries, with marked results in current output and general efficiency. The company claims that its improved cells have increased voltage and less internal resistance, which means, of course, an increased output of current or ampèrage.

A dry cell is the ideal current generator for small work. It can be carried in any position without detriment to the cell itself or the clothing, and for this reason it is preferred to the liquid cells.

The Himmer & Anderson folks tested one of the improved dry cells recently and the results are astonishing. On October 13 last the cell was short-circuited through an old bell with magnets of 2 ohms resistance, and it vibrated the hammer continuously for 43 days and nights, when it ceased, on November 25. On November 29 its voltage was tested and it showed .37 on a Warner pocket-gauge, and 1.1 volts on a Gaiffe voltmeter, and on a Weston direct-reading ampèremeter it gave a current of 1¼ ampères. It was afterwards made to ring a 2½ inch bell, which it did very vigorously compared with a Leclanche porous-cup cell.



AMERICAN INSTITUTE MEDAL.



DRY CELL.

In the office of the ELECTRICAL AGE is one of Himmer & Anderson's electric cigar-lighters, which has been in use since January 25, 1891, and it is still doing good service.

Speaking of the value of these cells, it is interesting to note that one of them was sent on approval to the Navy Department, Washington. It was there used for the purpose of heating and fusing the platinum wire used in firing guns, and it did its work so well and gave such satisfaction that the department has given a large order.

THE New York fire commissioners have issued a notice that strict observance of the provisions of the law concerning the employment of watchmen and time detectors in hotels, lodging-houses, hospitals and asylums will henceforth be enforced. There is some grumbling among the hotel men over this notice, who claim that there is a deal between the commissioners and the manufacturers of various time-clocks and automatic watchmen's tell-tales. This is indignantly denied by the commissioners.

STEEL-TIRED CAR-WHEELS.

There exists a great diversity of opinion among street-railway people as to the relative merits of various types of street-car wheels. Many claim that some one particular style embodies the best principles and others another, and so it goes on.

The steel-tired wheel has ably held its own in the controversy, being in extensive use all over the country and apparently giving every satisfaction.

We illustrate herewith a steel-tired street-car wheel manufactured by the Paige Car Wheel Company, of

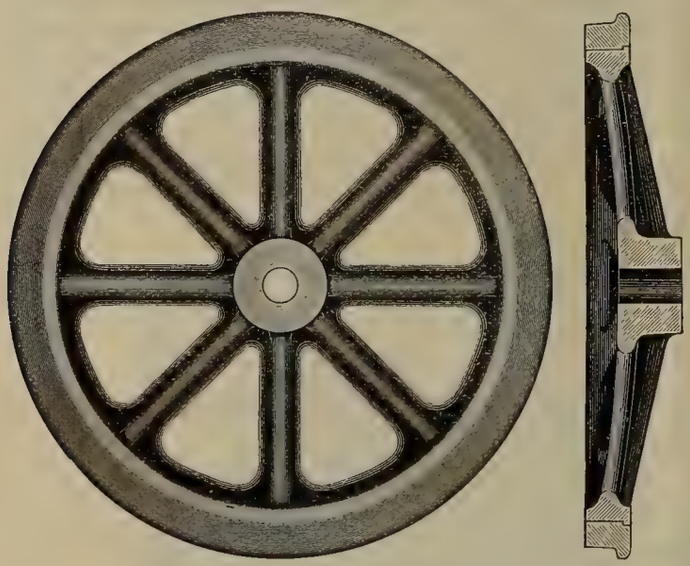


FIG. 1.

Cleveland, O., for use on electric, cable and horse railways. It is claimed that this wheel is as nearly indestructible as is possible to make it and at the same time the cost being comparatively small. As the tire is the only part that can wear out it is obvious that the cost for repairs for these wheels will be nominal. New tires can be put on without removing the wheel from the axle, the old one being removed by heating it to a high heat, when it will drop off by tapping slightly with a hammer, or by cutting through crosswise with a chisel, when its own weight will cause it to fall. The new tire is heated and the expansion allows it to be easily put on, and it becomes securely fastened by contraction when cooled. A special feature in putting on new tires is that no machinery is required for the operation, as the centres are turned and the tires bored to gauge; therefore the company can furnish duplicates ready to put on. No bolting is done in the construction of these wheels, and hence no bolt-holes are drilled.

Fig. 1 shows front and sectional views of these steel-tired wheels, and Fig. 2 gives a sectional view of the tire used on all sizes of electric, cable and street-car wheels. By reference to the illustration, it will be observed that the tire is bored tapering from *B* to *A*, the face of the centre is turned tapering to correspond with the tire; in this way the tire is prevented from moving outwards. The shoulder on the centre is fitted perfectly to the grooves on the inside face of the tire, preventing it from moving towards the inside. The centre of the wheel is cast-iron made of the same mixture as a car-wheel. These wheels do not weigh any more than the standard electric or cable street-car wheels, and they can be made in any size desired.

There is no question as to the general excellence of the steel-tired car wheel, and as the reputation of the Paige Car Wheel Company for turning out a superior quality of work is recognized all over, street-railway officials may feel assured that they will be consulting the interests of their respective roads by giving these wheels a thorough trial.

TALL CHIMNEYS.

The question of chimneys is one that concerns all managers of electric-light plants and street-railway power-houses. In the erection of such plants this question must be confronted, and the architect or contractor usually disposes of it; but even these persons are liable to err and frequently do make mistakes in this particular direction.

The following information on this important subject is from an authority in such matters, the *Engineering Record*, of New York, and will be of interest to all concerned:

A chimney 125 feet high, or, at the outside, 150 feet, produces a sufficient draught for the requirements of ordinary factory boilers. The force of the draught measured in inches of water-pressure with such a chimney, and with flues of proper construction connecting to the boilers, is from 0.5 of an inch to 0.75 of an inch, depending upon the temperature of the flue gases and attending conditions. A draught represented by 0.5 of an inch of water-pressure is sufficient to work a horizontal return tubular boiler far above the maximum capacity at which boilers of this type are rated. With the best class of bituminous coal, such as that found in the Clearfield coal region of Pennsylvania, or in the States of Maryland and Virginia it enables the coal to be burned in boilers of suitable proportions and with good firing at the rate of

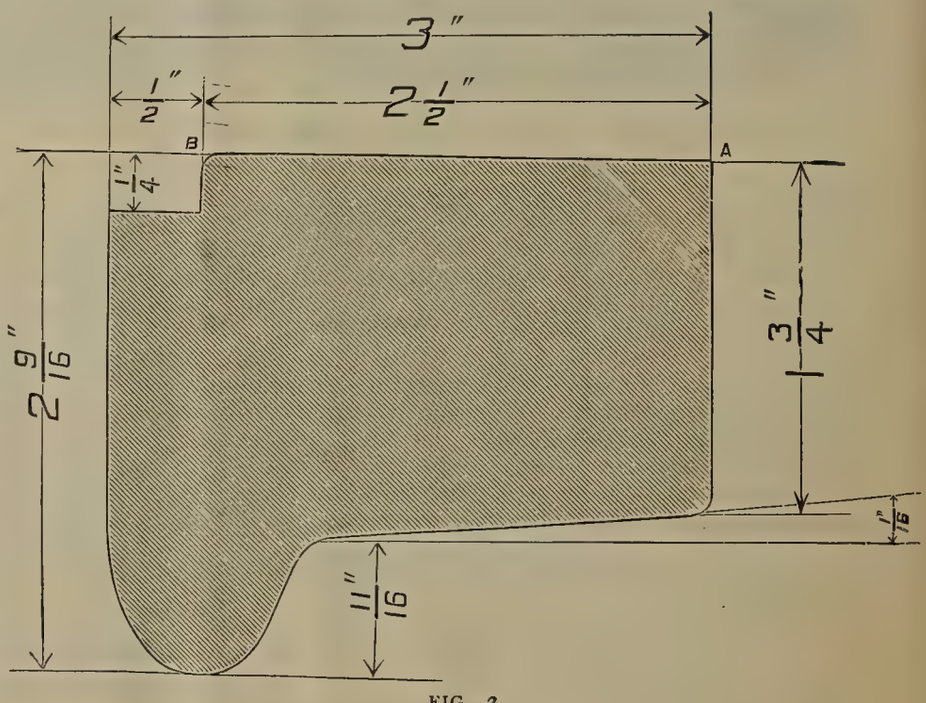


FIG. 2.

20 pounds for each square foot of grate surface per hour, and this corresponds to a rate of evaporation of something over four pounds of water per square foot of heating surface per hour. On this basis a boiler horse-

power (A. S. M. E. rating) is developed with from 6 to 7 square feet of heating surface. Boilers are seldom rated at less than 12 square feet of heating surface per horse-power, and, consequently, the force of draught indicated is sufficient to work a boiler of this type to about double its nominal capacity. If these statements are true, and there are abundant proofs that they are, a chimney 125 feet in height is sufficient to meet all the demands of stationary boilers in common use. A reserve force of draught which enables a boiler to be worked to double its rated capacity, not only suffices for ordinary good practice, but it would seem also to be sufficient for any abnormal conditions which in special cases might arise.

Most of the chimneys commonly used for mill purposes are less than 150 feet in height. Occasionally, however, one is found which is 200, or even 250 feet high, and we know of one instance of recent construction where the chimney is carried to the enormous elevation of 350 feet. Chimneys of unusual height are generally found applied to a plant of boilers of unusually large capacity, and the idea has gained some footing that it is necessary to have greater altitude for a large plant than for a small one. It may be that a chimney in a large establishment is more consistent as the architect sees it if its height corresponds to the magnitude of the buildings which surround it; but this consideration is one which does not appeal to the engineer. The engineer seeks to obtain ample draught-power for the boilers without unnecessary investment of money. A tall chimney calls for extra cost of construction. Between a chimney having a diameter of say 5 feet, and one having a diameter of 6 feet, there is a difference in capacity of 50 per cent., the areas in these two examples being in the proportion of 1 to 1½. The relative cost of the two structures does not vary much from the proportion of the circumferences of the two circles, and these are as 1 to 1⅕. An increase of capacity amounting to 50 per cent. in these two examples is thus attained by an increase of cost of 20 per cent. If, on the other hand, the capacity of the smaller chimney is increased 50 per cent. by adding to the height instead of increasing its diameter, it is necessary to make it at least twice as high. Considering the extra depth and area of foundation required, the additional thickness of walls necessary to support the addition and the increase of height itself, the cost of this method of increasing the capacity is more than double the cost of the original structure. We have in one case an addition of 20 per cent. to the cost, and in the other more than 100 per cent. to produce the same results. Between the two methods of obtaining the increased capacity of chimney, the engineer has but one choice, and that is to consider simply the main object for which the chimney is provided. Keep the height down, and adapt the size of the flue to the capacity required.

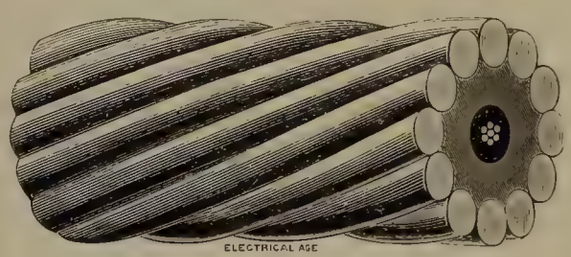
Looking at the practical end in view, moderately high chimneys of ample flue area secure all the draught that good boilers can successfully utilize. The chimney of extreme height and extravagant cost can do no more.

AMERICAN SUBMARINE CABLES.

The accompanying illustration is that of a piece of the submarine cable made by the Bishop Gutta-Percha Co., of New York, for the United States government. This cable is about 6½ statute miles in length, and contains one conductor composed of 7 strands of No. 22 B. & S. gauge of the best quality and manufacture. It is to be used for telegraphic purposes in connection with the weather-signal service between Thunder Bay Island and Middle Island, which are situated in Lake Huron, 12 and 15 miles respectively northeast of Alpena, Mich. The cable will be laid in two parts, one, about 4 statute miles in length, connecting the first-named island with the main land, and the other of about 2½ statute miles in length, between Middle Island and the main land.

The interstices in the conductor are filled with Chatterton's compound, and the whole is covered with three coatings of the best gutta-percha, which is so applied as to be entirely homogeneous to a diameter of .26 of an inch. The specifications required that the insulation resistance should be not less than 400 megohms per statute mile, after being submerged in water for 48 hours at a temperature of 70° F.

The core, formed by the conductor and its coating of gutta-percha, is next served with three layers of the best



AMERICAN SUBMARINE CABLE.

tarred jute of proper thickness, and outside of this served core are laid spirally 12 No. 5 B. W. G. Best-Best galvanized iron wires, which constitute the armor.

The cable weighs between 60,000 and 70,000 lbs, and will be delivered to the government on three reels. When the cable is laid the shore ends will be buried underground from a point where the water is 4 feet deep to the foot of the cable pole, where it will be brought up and connected into a cable box.

It is stated that the Bishop Gutta-Percha Co. got the contract on account of the superior quality of the work as shown by the sample furnished, although the company's bid was $1,000 more than any other. The fact is also demonstrated that American cable manufacturers are able to produce goods of at least as good quality as those made abroad.

NOTES OF GENERAL INTEREST.

The Taunton Electric Light Company, of Taunton, Mass., is adding a 500 H. P. engine and two new boilers to its equipment.

The city building at Marlboro, Mass., will be wired for a new system of lighting by the Brigham Electric Company, of Boston.

An electric plant is being installed in the boot factory of McIntosh & Co., at West Brookfield, Mass., for the lighting of their factory and to furnish power to J. T. Wood & Co., who occupy the adjoining building.

Rahway's (N. J.) new electric-light plant is in operation and giving entire satisfaction.

The Steelton (Pa.) Electric Light, Heat and Power Company is pushing work on the construction of its system with all possible speed. Poles are being set up and the plant is well under way

The equipment of the electric-light plant at Mt. Vernon, Ind., has been increased by the addition of a new 500 incandescent-light dynamo.

Water-power will be used to operate the dynamos in the proposed electric-light plant at Tileston, Neb.

The Thomson-Houston Electric Light Company, of Omaha, Neb., has commenced work on the construction of its system.

The Electric Light and Power Company, of Dixon, Ill., is adding a new 650-light dynamo to its equipment.

The Mutual Light and Power Company, of Montgomery, Ala., is having three 200 H. P. boilers built by the Heine Safety Boiler Company, of St. Louis, Mo.

SPECIAL REPORTS.

The matter on this page is prepared for the special information of electrical supply dealers, and is entirely new.

POSSIBLE CONTRACTS.

Johnson, R. I.—An electric-light plant will probably be established in this place by Philadelphia capitalists, who, it is said, will organize a company with a capital of $30,000.

Worcester, Mass.—The Washburn & Moen Manufacturing Company is going to erect a new brick building, 120 x 120 feet, in Quinsigamond village, to be used as a wire-mill.

Baltimore, Md.—The Reis Electric Company will erect its plant at Laurel, Md. It is reported that a new electric-light plant will be erected in this city. J. Frank Morrison is interested.

Glasgow, Ky.—An electric-light plant is to be erected in this place.

Covington, Ky.—It is quite likely that a company will be organized to construct and operate an electric-light plant.

Oxford, Md.—An electric-light plant will be established here by the Bowman's Bazaar Electric Light and Power Company.

Colville, Wash.—The citizens of this place are contemplating the establishment of a telephone system.

Alexandria, Ind.—The Alexandria Land and Improvement Company has received a franchise to build and operate an electric street-railway.

Amesbury, Mass.—It is reported that the Haverhill and Amesbury Street Railway Company will apply for a location around Kenoza lake.

Baltimore, Md.—It is said that electric cars will be running to Waverly and Towson by February 1.

Bristol, Pa.—A street railway will be run from Bristol to Newtown, passing through Hulmeville, with a branch to Bristol Cemetery by the Bristol and Newtown Street Railway Company. A. W. Gilkeson is an incorporator.

Brooklyn, N. Y.—An electric railroad will be built from the Thirty-ninth street ferry through to Flatbush and other points by the Kings County Electric Railway Company. P. H. Flynn is a director of the company.

Cadiz, O.—There is a movement on foot to build an electric road to Unionvale, a distance of four miles. J. D. Ripley is the promoter.

Columbus, O.—A new street-railway system will be operated in this city and Clinton, by the Columbus, Grand View and Suburban Street Railway Company, which has just been organized.

Elyria, O.—The residents of this place are anxious to have an electric street railroad to connect the east, west and south ends of the town. A valuable franchise can be secured by any person or concern willing to carry the project through.

Epson, N. H.—There is a project on foot to build an electric road to Northwood, and ultimately from Concord to Dover.

Fort Lee, N. J.—An electric railway connecting Fort Lee, Pleasant Valley, Coytesville and Leonia is projected.

Hartford, Conn.—Application has been made to the Legislature for permission to build an electric railroad from the northern boundary of Enfield south along the east bank of the Connecticut river to connect with the electric line at East Hartford. David Henny of this city is interested.

Haverhill, Mass.—A new electric railway to Canobie lake is projected.

Mount Vernon, N. Y.—A new street railway will be built from this city to New York by the Mount Vernon and New York Railroad Company.

New Orleans, La.—A new street-railway system will be built by the Canal and Audobon Street Railway Company which has just been organized. Ronald T. McDonald is one of the directors.

Reynoldton, Pa.—An electric line to Dravosburg will be put under way by the Dravosburg Electric Railway Company.

Saint Louis, Mo.—Citizens of Old Orchard, Tuxedo and Shrewsbury are considering a proposition from the Kirkwood, Webster and Saint Louis Railroad Company for the building of an electric road to those points.

Saint Paul, Minn.—An ordinance has been introduced into the city council by Mr. Pike requiring the Saint Paul City Railway Company to construct a cross-town electric line.

Salina, Kan.—An electric railroad will soon be under way in this place.

Sandusky, O.—The Sandusky, Huron and Milan Electric Railroad Company has decided to proceed at once with the construction of the line through to Norwalk.

Springfield, O.—There is a gigantic scheme on foot to build an electric road clear across the State, with Cincinnati and Cleveland as the termini.

Tacoma, Wash.—A new street-railway system will be built in this city by the Metropolitan Railway Company, which has just been organized. Frank Allyn is an incorporator.

Talequah, Ind. Ter.—The construction of an electric line to Fort Gibson is being contemplated.

Troy, N. Y.—The Troy City Railroad Company is contemplating the construction of a belt line.

West Haven, Conn.—The old scheme of building on electric railway to Merwin's Point has been revived.

York Beach, Me.—There is some talk of building an electric road to Kittery, to compete with the steam road.

Chester, Pa.—It is more than likely that the Union Railway Company will extend its lines to Upland.

Gardiner, Me.—The Augusta, Hallowell and Gardiner Electric Railroad Company will apply to the coming legislature for permission to extend its lines and to furnish light, heat and power.

Lowell, Mass.—Residents of Tewksbury Centre have petitioned the Lowell and Suburban Street Railway Company to extend its tracks to their place.

New York, N. Y.—The Manhattan Elevated Railroad Company has submitted a proposition to the rapid-transit commission to extend its Ninth avenue line through Cortlandt street to the ferry. It was very favorably received.

Providence, R. I.—The residents of Knightsville are endeavoring to secure an extension of the Union Railroad Company's system to their place.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, December 3, 1892.

P. & B. insulating compounds, manufactured by the Standard Paint Company, 2 Liberty street, is attaining an immense popularity and the extent of its use is remarkable. The company is receiving orders for quantities of 100 barrels at a time, and small orders for 25 and 50 barrels are common. The quantity of insulating compound used is astonishing, and the fact that so much of it is used is an infallible indication that it is really a good article. P. & B. insulating compounds are absolutely water, acid and alkali proof, and are used for general insulating purposes. Besides these compounds the company produces superior qualities of armature and field-coil varnish, water-proof insulating tape and insulating papers, and P. & B. paint which is used for preserving all kinds of iron or wood work, whether underground or overhead.

MR. ROBERT A. KEASBEY, 58 Warren street, the well-known dealer in magnesia sectional coverings for steam pipes, is applying over 2,000 feet of magnesia covering to pipes and boilers in the new station of the Edison Illuminating Co., Eastern District, Brooklyn. He is also putting into the new power stations of the Brooklyn City R. R., in South Brooklyn and the Eastern District, about the same amount of covering. This latter work is for the E. P. Allis Co., of Milwaukee, Wis., who has the contract for the installation of complete steam plants in both stations. Mr. Keasbey is also applying a large amount of magnesia covering in the steam plant of the Newark Electric Light and Power Co., on Ferry street, Newark, N. J. Mr. Keasbey is about to issue a very pretty calendar, and he will be glad to send a copy of the same to the superintendent of any electric-light and power station in New York state.

J. HOLMES and J. T. Hambay, alternate in the management of the New York office, 141 Liberty street, and travelling for the Beacon Vacuum Pump and Electrical Company of Boston, Mass., manufacturer of Beacon incandescent lamps. Mr. Hambay starts this week for a trip through New York state. Both of these gentlemen are hustlers, and they are meeting with excellent success.

THE ANGLO-AMERICAN ELECTRICAL MANUFACTURING COMPANY, 136 Liberty street, manufactures and deals in electrical apparatus of every description. One of its specialties is the Radiant incandescent lamp, which the company claims fulfils in the highest degree the requisites of a first-class lamp. The company issues ten illustrated catalogues, each one giving full particulars and details of the subject to which it refers. Mr. De Castro, the manager, was connected with the Western Electric Co. for 15 years, and only lately resigned to organize the Anglo-American company. The company is carrying a large line of electrical supplies, including Leclanche batteries. It is also handling Hirliman's improved porous cup batteries, and is agent for the largest English manufacturer of Bell telephones, receiving orders here for shipment to South American countries. The company is said to be the sole agent here for the Bell telephone exchange, Havana, Cuba.

HERMANN AICH, 43 Murray street, manufacturer and importer of enamelled heads for arc lamps and shades for incandescent lamps, notes that wherever these goods are used they are giving excellent satisfaction. The reason of that is because they are indestructible, not affected by moisture, and are easily kept clean. They cannot break, as they are made of thin sheet steel, which is enamelled.

MR. HOLMAN, of the F. Holman Electric company, 128 Pearl street, manufacturer of the popular "Paradox" reflector shades and other specialties, says that business is booming, and that he is right into it for all there is. Sold several gross of shades this week, and is filling an order for 15 gross to be shipped to London, England. He is way behind on orders for his other specialties.

C. D. P. GIBSON, well known in the electrical trade, is now located at 90 Nassau street, corner of Fulton, where he carries on a wholesale and retail trade in importing watches and diamonds. He is an artist in horology of 30 years' experience, his old stand being at No. 8 John street. In recent years Mr. Gibson became interested in electrical science through reading about the Planté and other storage-battery works, and having seen the first dynamo ever brought to this country from Europe. While Mr. Gibson was actively engaged in the manufacture of storage batteries in late years he still carried on his watch business, which was looked after by an assistant. After Judge Coxe's decision in the storage-battery case Mr. Gibson was advised by his attorney to cease the manufacture of storage batteries. He acted on this advice, and naturally returned to his original occupation, in which business Mr. Gibson has a high reputation. Mr. Gibson has the last lot of 5-minute repeating Waltham watches, with chronograph attachment, which he will close out at one-half their actual value.

P. CLAUS & Co., 357 West 40th street, has closed a contract to install two of its 650-light dynamos, marble switchboard, switches, instruments, etc., in the immense abattoir of Schwarzschild & Sulzberger on First avenue.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	58 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	475 00
Bell Telephone	17,000,000	100 00	209 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	118 00
Brooklyn Edison Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100.000	100 00	90 00
Chicago Gas	25,000,000	100 00	96 25
Commercial Cable Co	7,716,000	100 00	175 00
Cons. Gas Co., N. Y.	35,430,000	100 00	126 25
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	5 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	109 50
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120.000	15 00	16 00
Electrical Forging Co	2,000.000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4.800,000	100 00	51 00
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	102 50
General Electric Co.	50.000.000	100 00	110 75
General Electric Co. 5s	4.000.000		*103
General Electric pref.	4.223,700	100 00	117 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	25 25

Names of Companies.	Capital.	Par.	Price
Laclede Gas pref.	2,500,000	100 00	73 00
Laclede Gas 5s.	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Marshalltown Elec. Co. 6s, Iowa.	65,000		*98
Marysville L. & W. Co. 6s, Ohio.	60,000		*98
McLeod Railway Equip. Co.	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s.	2,000,000		*103
Metropolitan Traction			134 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	59 00
N. Y. and N. J. Tel. and Tel. 5s.	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 25
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 50
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co., Va.	30,000	10 00	9 50
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	106,300	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
U. S. Rubber Co.	26,947,000	100,00	40 25
Western Union	100,000,000	100 00	87 50
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	36 00
Westinghouse Elec. Co. pref. 7s.	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

There is no security on the market for investment which offers half the inducement or surety as Electrics, and there has not been a time equal to the present to embark in this line. Personally I advise investment in local companies where one can take a hand in his holding in preference to a few bonds or shares in one of the large corporations governed by an executive committee whose actions and decisions are a secret page to the small holder. Not only that, but few really know what their certificate represents or how many calls stand between it and the property itself. The matter of rights is somewhat new in America, which generally signifies that the shareholder has a right to subscribe as long as his money holds out, and then some outsider secures a certificate which gives him a right to collect his dividend first, and soon after that you will have to be extra astute to find out what you own. All this is obviated in your nice little hundred-thousand-dollar local company; your personal knowledge is your safeguard.

At all events don't let this year end without a few dollars invested in electrics; you will thank me for it when the next year brings along your dividends. Since my last the Chicago & St. Louis Electric Railroad Company has issued its first financial prospectus, but to the very great surprise (to put it mildly) of every electric investor and student it simply calls for some petty cash instead of offering its securities to the public, as every one expected it to do. This grand opportunity consists of 50,000 shares of the common stock to be full paid and unassessable at $5 per share, the par being $10. The terms of payment are 20 % on application; 30 % on allotment and 50 % thirty days after, or in other words for an eighty-cent silver dollar you can get your name on the company's books as a shareholder with all the broad latitude the position implies, then for another dollar and a half you get the allotment and on that you can borrow or trade as it is good collateral, and as the company is supposed to have asked for all the money it wants the other 30 % may never be called for and you become a blooming shareholder in one of the most magnificent enterprises in the world for the sum of two dollars and a half. There are thousands of people in London who subscribe for one share in every public company as it is offered, but they don't get in as cheap as this, and they do go to the annual meetings and exercise the same privileges as the holder of a majority of the stock, except as to number of votes cast. It is usually the single shareholder who causes the winding up of the business, if not managed to suit the courts. Every electric or street-railroad striker, or one who is in position when he may be one, should borrow a dollar if he has not one, and become a shareholder so he can learn the inside ropes. It is a cheap and most effectual method of doing it.

The interest and dividends as estimated by the *Daily Stockholder* for December amount to $28,109,441, which is an increase over December, 1891. Among the lot I find the General Electric Company pays its coupon No. 1 on its 5 % debentures. This is the beginning; where will the end be? The Westinghouse Company has declared its semi-annual dividend of 3½ % on its 7 % preference shares payable January 3, 1893. One of the curiosities of the Stock Exchange is shown in these two dividends; the General Electric 5s are selling regularly at 103 per cent. while the Westinghouse carries a steady and strong (very quiet) quotation of par to less than par. The common stock of the General Electric ranges from 110 to 120; Westinghouse remains firm at 35 to 40 for its $50 ordinary shares. I suppose these positions will be held regardless of dividends until the permanent control of the business situation is settled. New investments are still as plenty as venison in the market, offering inducements which short-circuit to success as soon as connection is secured with cautious, investigating capital. If they don't come to you, now is your time to go meet them.

TRADE NOTES.

Queen & Co., of Philadelphia, are making a great noise about their Cardew voltmeters, which they say are as reliable as ever, and guaranteed accurate to 1 per cent. Desiring to reduce the stock of these goods, which is unusually large, they announce a special cut in prices to hold good only until January 1. It will pay interested parties, especially central-station managers, to correspond with them and secure a copy of circular number 405, which gives further particulars.

When the Massachusetts Chemical Co., of Boston, first placed its insulating varnish "Insullac" upon the market its idea was to fill a long-felt want among electrical people for a varnish that should combine the high-resisting, waterproof, adhesive and other properties required, and at the same time sell it at a reasonable figure. That it has been entirely successful goes without saying, and it has more than surprised itself by its large sales. This company makes a fine line of other varnishes which are fast making a reputation for themselves and for the Massachusetts Chemical Co.

Another 100 H. P. New York Safety engine is being erected in Wm. Campbell's Paper Hanging Manufactory, 10th avenue, New York, for driving an electric-lighting plant.

The Philadelphia branch of the New York Safety Steam Power Co. has been doing a good business of late. Several prominent establishments have been equipped with "Safety Power" engines; viz.: The Bullitt Building, three 100 H. P.; The Provident Building, two 80 H. P.; Brown Building, one 30 H. P. and one 50 H. P.; The Times Annex, one 60 H. P.; Hotel Stratford, one 80 H. P. and one 125 H. P.; the new Deaf and Dumb Aslyum, Mt. Airy, Pa., four 60 H. P.

The Harrisburg Foundry and Machine Works, of

Harrisburg, Pa., are building for the Wilkes-Barre and Wyoming Valley Traction Company, of Wilkes-Barre, one 300 H. P. Ideal engine and one 300 H. P. Ideal tandem-compound ; also two of the same size for the New Britain (Conn.) Electric Light Company. A 300 H. P. Harrisburg Ide tandem-compound engine on brick base was recently placed with the Central Iron Works, of Harrisburg.

The Electrical Age's Illustrated Patent Record.

Issued November 29, 1892.

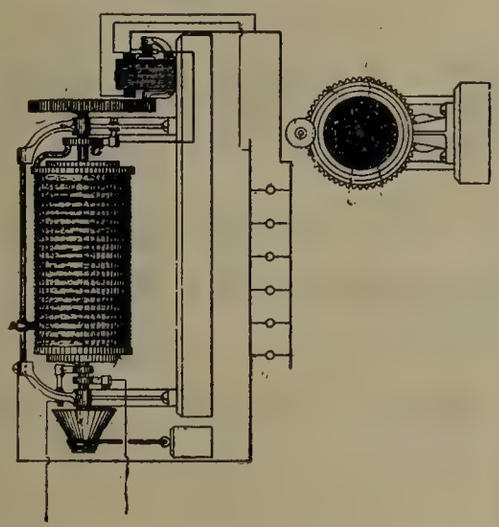
486,845. Machine for Covering Wires. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed May 10, 1892.

486,879. Magnetic Separator. Thomas J. Lovett, Chicago, Ill., assignor, by mesne assignments, to the International Ore Separating Company, of New Jersey. Filed Feb. 13, 1892.

486,888. Electrical Transmitting Apparatus. Albert D. Neal, Boston, and Howard F. Eaton, Cambridge, Mass.; said Eaton assignor to said Neal. Filed April 17, 1891. Renewed May 19, 1892.

486,889. Typewriting and Printing Instrument. Bert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.; said Eaton assignor to said Neal. Filed June 2, 1892.

486,902. Galvanic Body-Battery. John W. Schults, Wichita, Kan. Filed March 22, 1892.



486,916.—ELECTRICAL TRANSFORMER.

486,908. Burglar-Alarm Cabinet. Alfred Stromberg, Chicago, Ill., assignor of one-half to Marks Simons, same place. Filed July 9, 1892.

486,909. Automatic Telephone or Other Electrical Exchange. Almon B. Strowger, Chicago, Ill., assignor to the Strowger Automatic Telephone Exchange, same place. Filed Feb. 19, 1892.

486,911. Lineman's Wire-Grip. Claes A. Svensson, Buffalo, N. Y., assignor to Arlington D. Isham, same place. Filed Feb. 8, 1892.

486,913. Apparatus for Photographic Printing. Harry E. Tallman, Cleveland, Ohio. Filed Dec. 1, 1890.

486,916. Electrical Transformer. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 23, 1892.

486,926. Coil for Electrical Apparatus. Henry C. Buck, Somerville, Mass. Filed Dec. 5, 1884.

486,958. Electric-Arc Lamp. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 2, 1883.

486,974. Telegraph-Pole. Orville M. Knox, Oneida, N. Y. Filed Sept. 8, 1892.

486,985. Trolley for Conduit-Railways. Benjamin Olbricht, Brooklyn, N. Y. Filed May 17, 1892.

486,987. Electric Switch. William J. Schultz, Detroit, Mich. Filed June 27, 1892.

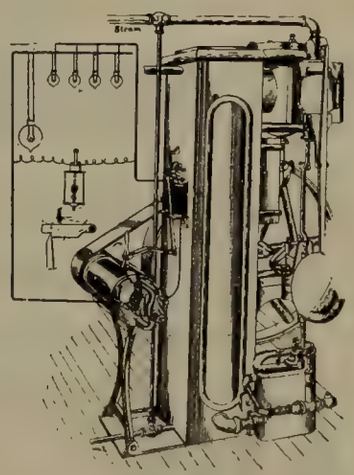
487,002. Safety Device for Electric Circuits. George Cutter, Chicago, Ill. Filed Feb. 19, 1892.

487,022. Adjustable Electric-Light Holder. Leroy S. Pfouts, Canton, Ohio. Filed Feb. 24, 1892.

487,046. Electric-Light Carbon. James Clegg, London, England. Filed April 10, 1890.

487,049. Incandescent Lamp. Johannes H. F. Görges, Berlin, Germany, assignor to Siemens & Halske, same place. Filed April 20, 1892. Patented in Germany, France, Italy, Belgium, Sweden, Norway, Austria-Hungary and Switzerland.

487,069. Device for Transmitting Motion for Electric Street-Car Motors. Walter E. Harrington, Atlantic City, N. J., assignor to Francis T. Chambers, Philadelphia, Pa. Filed Oct. 4, 1890.



487,109.—AUTOMATIC ELECTRIC-LIGHTING APPARATUS.

487,070. Electro-Magnetic Pulley. Walter E. Harrington, Atlantic City, N. J , assignor to Francis T. Chambers, Philadelphia, Pa. Filed June 2, 1891.

487,073. Magnetic Separator. Thomas J. Lovett, Chicago, Ill., assignor, by mesne assignments, to the International Ore Separating Company, of New Jersey. Filed Feb. 13, 1892.

487,074. Magnetic Separator. Thomas J. Lovett, Chicago, Ill., assignor, by mesne assignments, to the International Ore Separating Company, of New Jersey. Filed Feb. 13, 1892.

487,092. Electric Switch. John J. Nate, Chicago, Ill. Filed March 29, 1892.

487,093. Electric-Current Indicator. Charles P. L. Noxon, Syracuse, N. Y. Filed Nov. 24, 1891.

487,095. Auxiliary Fire-Alarm Signal Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 1, 1888.

487,096. Multiple-Switchboard System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 5, 1892.

PATENTS—Continued.

487,097. Telephone-Exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 16, 1892.

487,098. Telephone-Switchboard Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 21, 1892.

487,102. Development and Distribution of Electricity. John S. Stone, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Oct. 10, 1891.

487,109. Automatic Electric-Lighting Apparatus. Leonidas G. Woolley, Grand Rapids, Mich. Filed June 6, 1892.

487,114. Electric Locomotive. Conrad M. Conradson, Madison, Wis. Filed Dec. 2, 1891.

487,128. Burglar-Alarm. Harry W. Reynolds, Long Branch, N. J. Filed April 6, 1892.

487,154. Telegraphic Apparatus. Josiah A. Parker, St. Louis, Mo., and Leland L. Summers, Chicago, Ill.; said Summers assignor to said Parker. Filed Jan. 27, 1891.

487,176. Process of Electro-Depositing Alloys. Sherard O. Cowper-Coles, London, England, assignor of one-half to the London Metallurgical Company, Limited, same place. Filed Nov. 18, 1891.

487,185. Electric Belt. John H. Johnson, Dodgeville, Wis. Filed July 21, 1892.

487,213. Incandescent-Lamp Socket. Charles B. Elliot, Boston, Mass., assignor to the Revere Rubber Company, same place. Filed August 8, 1892.

487,219. Telephone. Hammond V. Hayes, Cambridge, and Wilton L. Richards, Malden, assignors to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1892.

487,220. Electrode for Arc Lamps. Charles W. Hazeltine, St. Louis, Mo., assignor to the Hazeltine Electric Company, same place. Filed May 6, 1892.

487,227. Electrical Type-Writer. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.; said Eaton assignor to said Neal. Filed May 27, 1892.

487,228. Electric Type-Writer. Albert D. Neal, Boston, and Howard N. Eaton, Quincy, Mass.; said Eaton assignor to said Neal. Filed May 27, 1892.

487,229. Printing-Telegraph. Albert D. Neal. Boston, and Howard F. Eaton, Quincy, Mass.; said Eaton assignor to said Neal. Filed April 21, 1891. Renewed Oct 10, 1892.

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THE LAMP SUIT.

The United States circuit court of appeals on December 7 heard the arguments in the suit brought against the Sawyer-Man Electric Company by the Edison Electric Lighting Company and the Edison General Electric Company to restrain the first-named company from manufacturing incandescent lamps. The situation at the present time remains practically unchanged. The interests involved in this suit are of vast importance, and the decision of the court will be looked for with much anxiety and interest in the trade. The plaintiff has a strong opposition which is full of determination, and as the decision in this case will practically settle the question as to whether the members thereof have the right to manufacture incandescent lamps, notwithstanding the Edison patents, its importance cannot be overestimated.

WE WOULD IF WE COULD.

In his annual report Postmaster-General Wanamaker again emphasizes the importance of improving the postal service in New York city and other large cities of the country by the use of pneumatic tubes or electric cars. The use of electric cars for transferring mail-matter between local stations, we believe, has been successfully carried on for some time in some cities where such modern facilities exist; but from the looks of things at present New York city will not enjoy the improvements outlined by the postmaster-general for a long time to come. New York is a big city; but its bigness hampers its progress in many ways. Perhaps the postmaster-general can offer some suggestions as to how we can get electric cars in New York, and after we get them, how more rapid transit can be attained. These are problems that have staggered practical men so far.

WONDERS OF THE WEST.

A company has been organized in a far Western state which, according to its modest prospectus, will accomplish some wonderful things with electricity. Its dynamo may be said to be the wonder of the age, and the great electrical manufacturing concerns should make haste to wind up their affairs, in anticipation of the great smash that would ensue if this new dynamo gets upon the market and catches them unawares. One of the most important features of the dynamo is that it has "two bundles of induced wire." The advantage of this combination of two single bundles cannot be overestimated, and will be readily appreciated by all very wise electricians. In the design of the dynamo "the independent force of magnetism is harnessed to help turn the armature forward as generator." This in itself is such a great stride in advance of present practice that the thought of it is enough to make the ordinary electrical engineer stagger. But this is not all. The company's street-car motor is a marvellous device, and solves, with awful suddenness, the great problems that have long perplexed the slow, narrow-minded electricians in the effete East. Any car equipped on this new system will be able to "run on to any switch, backwards or forwards," and it "can be thrown from the track and run on the streets, paved or otherwise." At this point it would be well to suggest to the inventor that rails might as well be dispensed with altogether. But undoubtedly his master-mind has gone over that ground, and he presumably prefers to lay the rails at first, and when the people become educated to riding on electric cars over cobble stones and unpaved streets, he will then discard them as useless.

Nor is this all; the half is not told. The much-abused "outer-axle" has at last become an object of much importance, and in this system the motor is to be placed thereon. At last the advocates of the "outer-axle" are vindicated! Finally, the company's "perfect system of insulation" enables it to deliver the entire energy of the dynamo "any distance below fifty miles without any appreciable loss."

Words cannot picture the complete revolution this company will cause, and all this will be accomplished really by "two bundles of induced wire."

INTERCHANGEABLE ELECTRIC LAMP.

In the ELECTRICAL AGE of December 3 was published a notice of the reorganization of the firm of Waterhouse Bros., of Hartford, Conn., under the name of Waterhouse, Gamble & Co. This firm manufactures interchangeable arc lamps for arc and incandescent circuits. The lamp is the invention of Mr. Addison G. Waterhouse, of Hartford, who has been identified with electric lighting from its inception and made many valuable inventions in connection therewith. The lamp is claimed to excel all other arc lamps by reason of superior electrical and mechanical construction. Its chief features are its adaptability for either arc or incandescent circuits; being weatherproof, no hood is required; perfect alignment; all parts are interchangeable; is strong, solid and compact; is of light weight, ornamental in design; free from defects liable to render it useless, and gives a steady and noiseless light.

All of the working parts are made in a single casting (Fig. 1), hence no insulating washers are required, and none of the parts can become loosened or get out of position. As all of the various parts are made by machinery or special tools they are interchangeable and can be readily and cheaply duplicated. The insulation is confined to four solid pieces of cement (Fig. 2), thus preventing short-circuiting and other annoying features. The magnets are double, strong, and adjusted in their position, securing perfect alignment. The armature hangs, and has its pull on the clutch in an exactly perpendicular line, in this way avoiding all side friction or necessity of transmitting motion through pivots, and securing a sensitiveness as near perfect as is possible.

A clutch assisted by an atmospheric clamping device, shown at the top of Fig. 1, it is claimed secures a steadier and finer feed than is found in other lamps, making this lamp particularly desirable on incandescent circuits. The plunger is very durable and made of soft, pliable material that precludes all possibility of sticking or hanging, and is practically free from wear or deterioration, in proof of which, a test of 750,000 strokes, equivalent to trimming a lamp once a day for over 2,000 years, is cited. The globe-holder is said to be a great improvement over other forms, being dust-tight for inside and well drained for outside use, and the globe can be cleaned without unscrewing it.

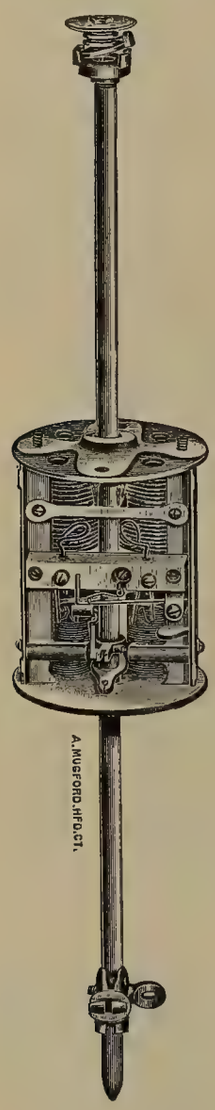


FIG. 1.

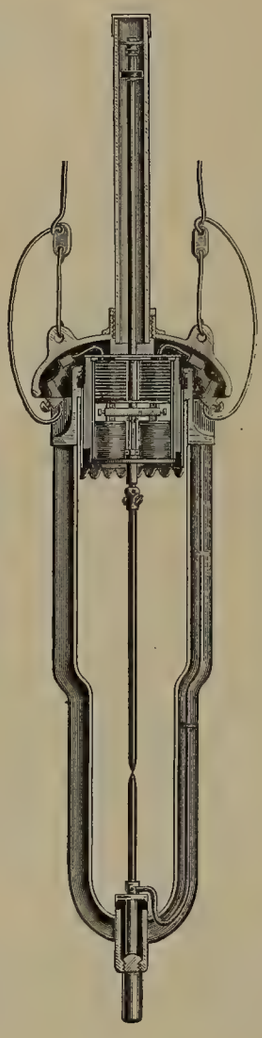


FIG. 2.

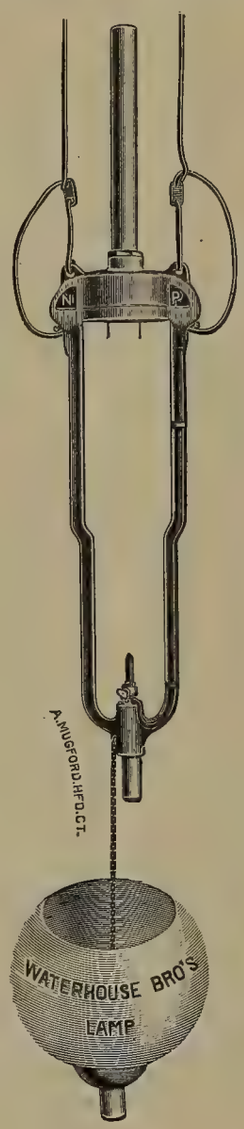


FIG. 3.

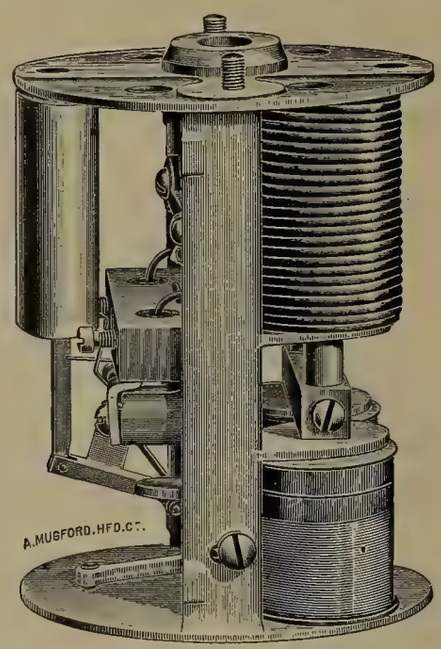


FIG. 4.

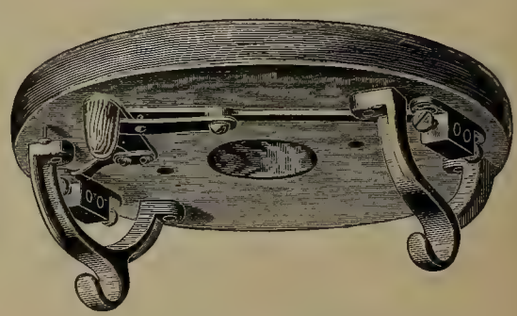


FIG. 6.

The lamp is made in two parts, the frame (Fig. 3) containing the two terminals and lower carbon-holder complete in itself and suitable for any current, and the works are contained in a case made of a single casting (Fig. 1). With the exception of the cut-outs, these works are the same for arc and incandescent current, so that either will fit in the same frame. In Fig. 3, will be seen the globe-holder which enables the globe to be conveniently cleaned without unscrewing it. In cases where it is desirable to change from arc to incandescent circuits or *vice versa*, the works (Fig. 4) can be placed in the frame without unhanging the lamp. Again, if it is desired to change from full to half arc or *vice versa*, the magnets are removed and another set (Fig. 5) substituted.

Carbons can also be changed from $\frac{7}{16}$ to $\frac{5}{8}$, as both sizes will fit. Fig. 6, shows a hanger-board with cut-out switch for arc lamps, and Fig. 7, a resistance-box for incandescent currents, made of cast-iron and slate, well ventilated all around.

The lamps can be adapted in size and shape to meet any condition found in practice, and they are admirably adapted for use on railway circuits.

The New York office of this firm is at Room 76, 45 Broadway, and under the management of Mr. W. T. Partridge, who will be pleased to welcome visitors and thoroughly explain the superior qualities of the lamp.

WHAT ARE LINES OF FORCE?

The mathematical methods and hypotheses of the French school of physicists, represented chiefly by Ampère, Arago, Poisson and Coulomb, consisted in the assumption that material particles in special states, called

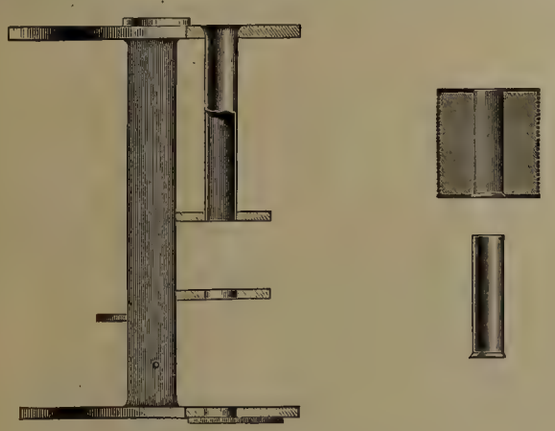


FIG. 5.—INTERCHANGEABLE ELECTRIC LAMP.

electric and magnetic, could act on one another at finite distances without any intervening mechanism according to certain laws of force varying with the distance. Faraday may be said to have raised the standard of revolt against this notion, and indeed he was able to quote in his support the great authority of Newton in rejecting the idea that matter could act on matter across interven-

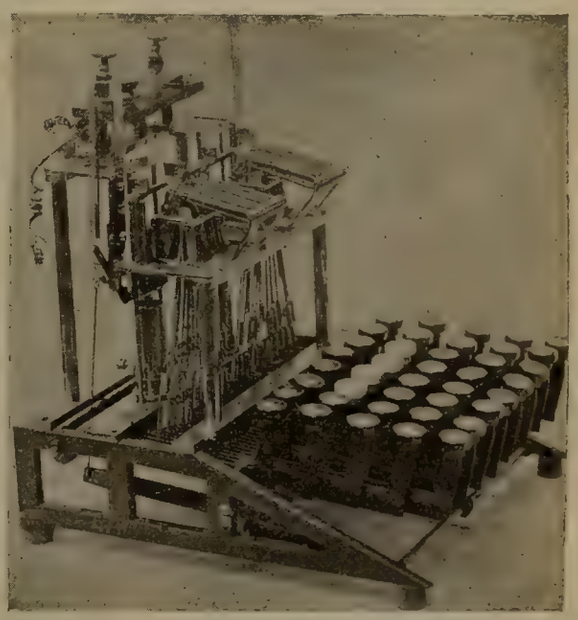


FIG. 7.—INTERCHANGEABLE ELECTRIC LAMP.

ing distance without aid from any mechanism. He never considers bodies as existing with nothing between them but their distance, and acting on one another according to some function of that distance. He conceives all space as a field of force, the lines of force being in general curved, and those due to any body extending from it on all sides, their direction being modified by the presence of other bodies. A magnet, an electrified conductor, or a wire conveying an electric current, are thus the focus and originators of a system of radiations of force-lines or loops, which are to be thought of as part and parcel of it. This force system is capable of deformation or change by the presence of other bodies, but it moves with the magnet, electrified body, or current-carrying wire. These force radiations penetrate surrounding bodies, and the apparent actions between bodies at a distance are in reality actions due to immediate action of the field of force of one body upon the other at the place where it is. Then rises for solution the important problem—What *are* these lines of force? Faraday answered the question by saying that they consist in some sort of operation or action going on in a *medium* along certain lines or axes, and Maxwell added to this the suggestion that the electromagnetic medium must be identical with the medium postulated to account for the phenomena of light.

AUTOMATIC TELEGRAPH TRANSMITTER.

The automatic transmission of Morse characters over telegraph lines is a problem that has been wrestled with time and again by inventors, but its practical solution has so far baffled all efforts. Messages are still transmitted over "Morse" wires by hand just as they were when



AUTOMATIC TRANSMITTER.

the telegraph was a new thing, and in this particular it can not be said that the march of improvement has made itself felt.

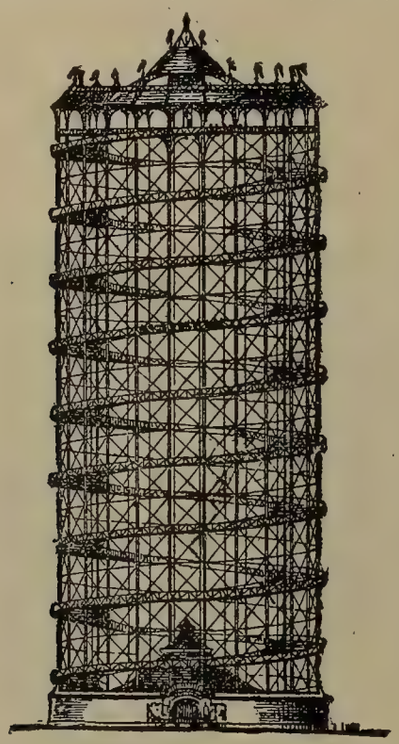
The hands of many telegraph operators become partially paralyzed from long and continuous work on the transmitting key, on account of the strained position of the hand, and consequent cramping of the nerves, and to prevent this disability by substituting an automatic transmitter has been the object of scores of inventors; but so far the practical machine has not yet been produced.

A machine of this class which is claimed to meet every requirement in a most satisfactory and practical manner has, however, been invented by Mr. C. Willoughby, the night chief of the Wheatstone department in the Western Union Telegraph Office, San Francisco, Cal., and a general view of the instrument is given herewith.

The transmitting keys are arranged after the fashion of a typewriter key-board and the operation of the machine is thus described by the inventor:

"Each letter is represented by a thin piece of steel, cut with raised surfaces to correspond with the Morse

character for such letter, and revolves around a centre. These steel letters are connected with their corresponding letter-bars in such a manner that the depression of any one key causes the corresponding letter to come into position before the electric carriage. The electric carriage is raised by means of a lever connected to the lever-bar. When the key is depressed a sufficient distance to raise the carriage above the letter, the raised surfaces of the characters are held in position until the carriage has passed down over them and the character is formed by the vibration of a tongue carrying the electric contact points. The downward motion of the carriage is retarded by an air-chamber, the escape of air being regulated by a thumb-screw, which enables the operator to make the signals fast or slow, as desired. As the carriage is raised to a height in proportion to the length of the letter, the short letters, such as *e*, *i*, *t*, etc., are formed



SPIRAL ELECTRIC RAILWAY.

in proportionate length as compared with the longer ones, and the signals are transmitted to the wire as evenly as if by hand. There is no electric motor or clock-work necessary to operate the machine, the simple depression of a key accomplishing all the work."

It is said to be possible to transmit Morse characters at the rate of 90 words a minute. Experts who have examined the instrument state that it will revolutionize the hand transmission method.

The practical value of the machine has been thoroughly tested, and we are informed that it did its work perfectly. On one occasion a line 350 miles in length—an iron wire—was used and the signals transmitted by this machine were received in a perfectly legible manner. It was also tried on a circuit with four repeaters, the wire being 2,700 miles in length, and the characters were received at the other end in perfect condition.

A company is being organized in San Francisco to manufacture and introduce these instruments, and it is thought that there will be a large demand for them for private wires, to be used in connection with recording receivers. The Morse characters transmitted by the instrument are said to be perfect in form, and a speed of 40 to 60 words a minute is easily attainable. The machines are intended for the use of experienced operators, and not for novices or to cheapen labor. At a speed of 50 or 60 words a minute an expert receiving operator can readily copy the matter directly on to a typewriter.

Mr. Willoughby, the inventor, is one of the unfortunates who is afflicted with telegraphers' paralysis, and it was with the object of rendering his services as valuable to his company as they used to be that he invented this machine. At least that was the incentive; of course this instrument will be a boon to all who are similarly afflicted.

ELECTRIC RAILROAD TOWER AT THE WORLD'S FAIR.

A tower of unique design is to be erected at the World's Fair at the eastern entrance of the midway plaisance. It will be 560 feet high and 200 feet wide and the ascent to the summit of the structure will be accomplished by electric cars which will run on a spiral roadbed. The road will have an 8 per cent. grade, and at night will be illuminated by incandescent lamps. The company having the matter in hand claims that the electric road will have a carrying capacity of 12,000 passengers an hour. Mr. W. H. Johnstone, of Philadelphia, is the president and general manager of the company.

THE PRONY BRAKE.

BY THOMAS R. TALTAVALL.

Since the general introduction of the electric motor for the purpose of propelling street cars we often see

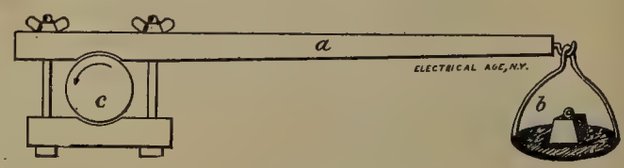


FIG. 1.

references to the Prony brake, but very few of the uninitiated know what a Prony brake is and what it is for.

The Prony brake is a mechanical device used to measure the torque or twisting force of the armature shaft of a motor, the shaft of a turbine, water-wheel or the fly-wheel of an engine. It is shown in its simplest form in Fig. 1.

At the left end of the inflexible beam or lever *a*, is a clamping device to clamp around the armature shaft whose torque we wish to measure, and at the right is pan *b*, to hold weights. Now if we tighten the screws of the clamp so that the latter will bear upon the shaft *c*, it is evident that there will be a tendency for the beam

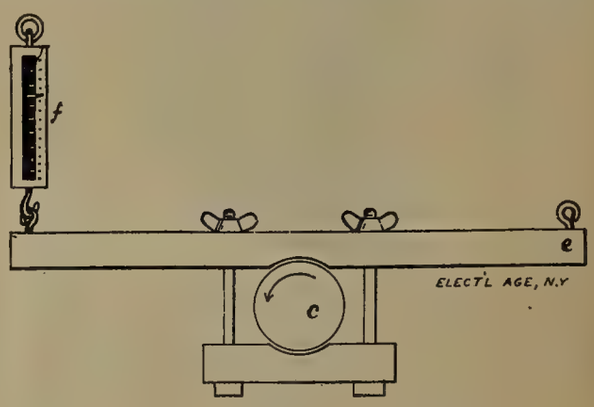


FIG. 2.

a, to revolve with the shaft. This, however, is prevented by placing weights in the pan *b*, and when the motor we are measuring is running at its normal speed and is taking the proper current, sufficient weight is placed in the pan to maintain the lever in a horizontal position. Under these conditions it is evident that the

twisting-force, or torque of the shaft is just balanced by the weight at the opposite end of the beam.

The proper pressure of the clamp upon the armature shaft is determined by increasing it until the motor is taking a given current and the shaft is revolving at a given speed. With these factors, in conjunction with that of the weight applied to balance the beam, the torque is deduced by certain simple rules.

Fig. 2 shows another and more convenient form of the Prony brake. The shaft *c*, in its revolutions in the direction indicated by the arrow tends to pull the left end of the lever downward, the right end, *e*, being immovably fixed, and acting as the fulcrum. The pull at the movable end is measured by the spring balance, *f*, and this method of measuring the twist or torque is manifestly much easier and quicker than when weights have to be placed and displaced as in the case of the former design of the brake.

NEW MINING LOCOMOTIVE.

The accompanying illustration shows a new mining locomotive designed by the General Electric Company to meet the growing demand for small, substantial, low-priced machines of this character. It will be known to the trade as the T. M. M. type, and consists principally of two standard railway motors mounted upon a heavy iron truck-frame. The truck-frame is built of cast-iron side-frames, bolted to heavy steel channel beams, which are securely fastened together by a wrought-iron angle-plate. The axle-bearing boxes are small and solid in construction, easy of access for oiling and replacing the brass linings. The frame of the locomotive is hung from the axle-boxes by means of steel springs, so that there is little pounding upon the track. By this method of construction it is possible to take the motors, together with the wheels and axles, entirely out of the frame. The motors used are of the standard railway type, either the W. P. 30 or W. P. 50, as required. For gauges narrower than three feet special four-pole motors have been designed, which will run on gauges as narrow as eighteen inches. The controlling mechanism used is the standard series parallel controller. The brake is a powerful form of steel screw and lever. No adjustment is necessary for the wear of the brakes used, as the steel screw takes up the lost motion until the shoes are worn out. The trolley is of the single-arm insulated type, and may be moved from one side to the other of the machine, as occasion may require. As the motors are self-protected, no cover for the locomotive is considered necessary, but one can be easily supplied. The cover increases the total height of the machine four inches. Sand-boxes are provided for both front and rear wheels. All of the controlling levers are placed on the platform of the machine within easy reach of the operator.



GENERAL ELECTRIC COMPANY'S NEW MINING LOCOMOTIVE

ELECTRO-MAGNETISM

The measurement of the intensity of an electro-magnetic field is a matter of great practical difficulty. However, as the movement of a wire in any magnetic field tends to set up a current in the wire, and as the field may be that of a permanent magnet, or even that of the earth, and since, also, the strength of any field is proportional to the number of its lines of force per unit area, while the current generated in a wire is also proportional to the number of lines of force cut by it, and to the rate of cutting, we may compare the strength of different fields by observing the current resulting from the cutting of them by a wire at equal speeds. It is advantageous to wind the wire into a small coil, and place it in the field with its plane perpendicular to the direction of the lines of force, and then suddenly turn it through a right angle, when its plane will be parallel to the lines of force, and none will be passing through the coil. The E. M. F. resulting will be proportional to the number of convolutions, the strength of the field and the area of the coil (that is, to the number of lines of force passing through the coil), and to the speed with which the lines are removed. Special galvanometers are constructed to give the values of such sudden momentary currents, by comparing which the strengths of the various fields can be measured.

OBITUARY.

DR. WERNER VON SIEMENS.

This distinguished scientist died in Berlin, Germany, December 6, at the age of about 76 years.

There was probably no better known person in electrical science than Dr. Siemens, and his name is very intimately associated with its practical application from the earliest days up to the time of his death.

Dr. Siemens was born in Lenthe, Hanover, 1816, and was educated at the Lubeck Gymnasium. In 1834 he joined the Prussian artillery, and gained the rank of lieutenant in 1837. While in the army he invented the process of gold-plating, the differential governor, and the electric automatic recording telegraph. In 1847 he was a member of a commission of the Prussian General Staff appointed for the introduction of the electric telegraph in place of the optical telegraph system then in use. In this connection he proposed the application of subterranean conductors, insulated by gutta-percha, and in 1848 he, with the help of Prof. Himly, succeeded in laying the first submarine mines with electric ignition. This was in the harbor of Kiel, and for the purpose of affording protection against the Danish fleet. In the process of insulating the wires with gutta-percha he invented a press for that purpose, which is still used in the manufacture of cables.

In 1848 he also built the first telegraph line in Germany, between Berlin and Frankfort-on-the-Main, and in the following year he laid a subterranean line between Berlin and Cologne. In 1850 he left the government service to devote his entire time to scientific study and private enterprises.

In 1847 he laid the foundations for the great telegraph works of Siemens & Halske, which are now known all over the world. Branch works were afterwards opened in London and St. Petersburg which soon developed into independent concerns under the management of his two brothers, Charles and William.

In 1860 the University of Berlin conferred upon him the dignity of Doctor of Philosophy, and in 1874 the doors of the Academy of Sciences in Berlin were thrown open to him. Later on other academies and societies did likewise.

Among Dr. Siemens' inventions and scientific discoveries are the development of methods for testing underground and submarine cables, the invention of polarized relays, of the Siemens' armature, and of the dynamo-electric machine, the pneumatic tube dispatch system, and the electric railway. Dr. Siemens was a member of the Prussian Order of Merit, and Frederick III. conferred upon him the patent of nobility.

QUEEN'S DEAD-BEAT REFLECTING GALVANOMETER.

The instrument illustrated herewith is a modification of the Wiedemann galvanometer, and is adapted for both differential and direct work.

The coils (A) are graded, having five changes of wire, and slip upon copper rods forming part of the damper.

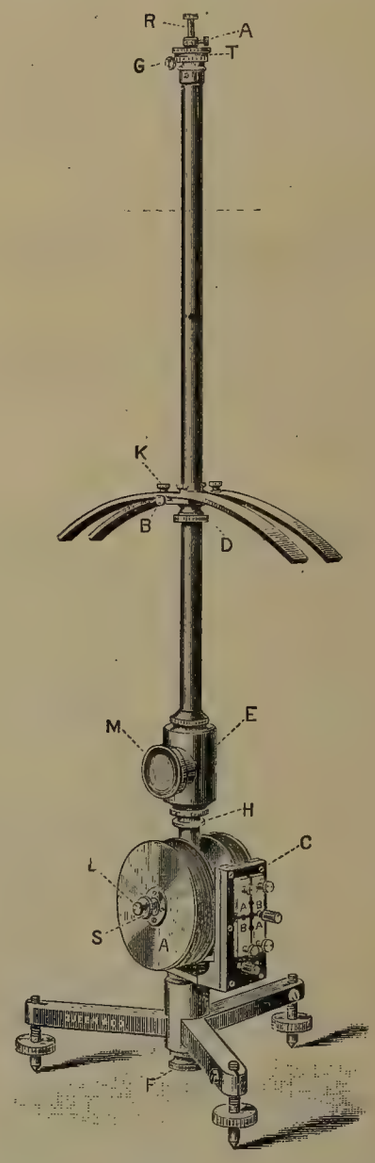
Automatic connections are made with the binding-posts on the switchboard (C) by means of small spring contacts upon the back of the board which press against platinized studs attached to the coils.

By shifting plugs on the switchboard the coils may be quickly connected in series, multiple, or differentially. To obtain perfect differential adjustment a horizontal movement of the coils is secured by turning the micrometer screw (S).

The vertical tube is 24 inches long, the suspension being quartz fibre instead of cocoon silk. Torsion is practically eliminated while great tensile strength is secured.

An essential feature of the apparatus is the arrangement of control magnet employed. In place of the usual single piece with the suspension-tube passing through it, the magnet is divided into two parts, each of half the usual cross-section, as illustrated.

The advantage of the construction is that should it be necessary to make very delicate observations in the



DEAD-BEAT REFLECTING GALVANOMETER.

vicinity of the instrument, the magnets may be temporarily removed without disturbing any adjustments, and then replaced in exactly the same position.

Owing to the mass of copper in which the magnetic system moves, the galvanometer is almost absolutely dead beat, and observations may be taken in rapid succession.

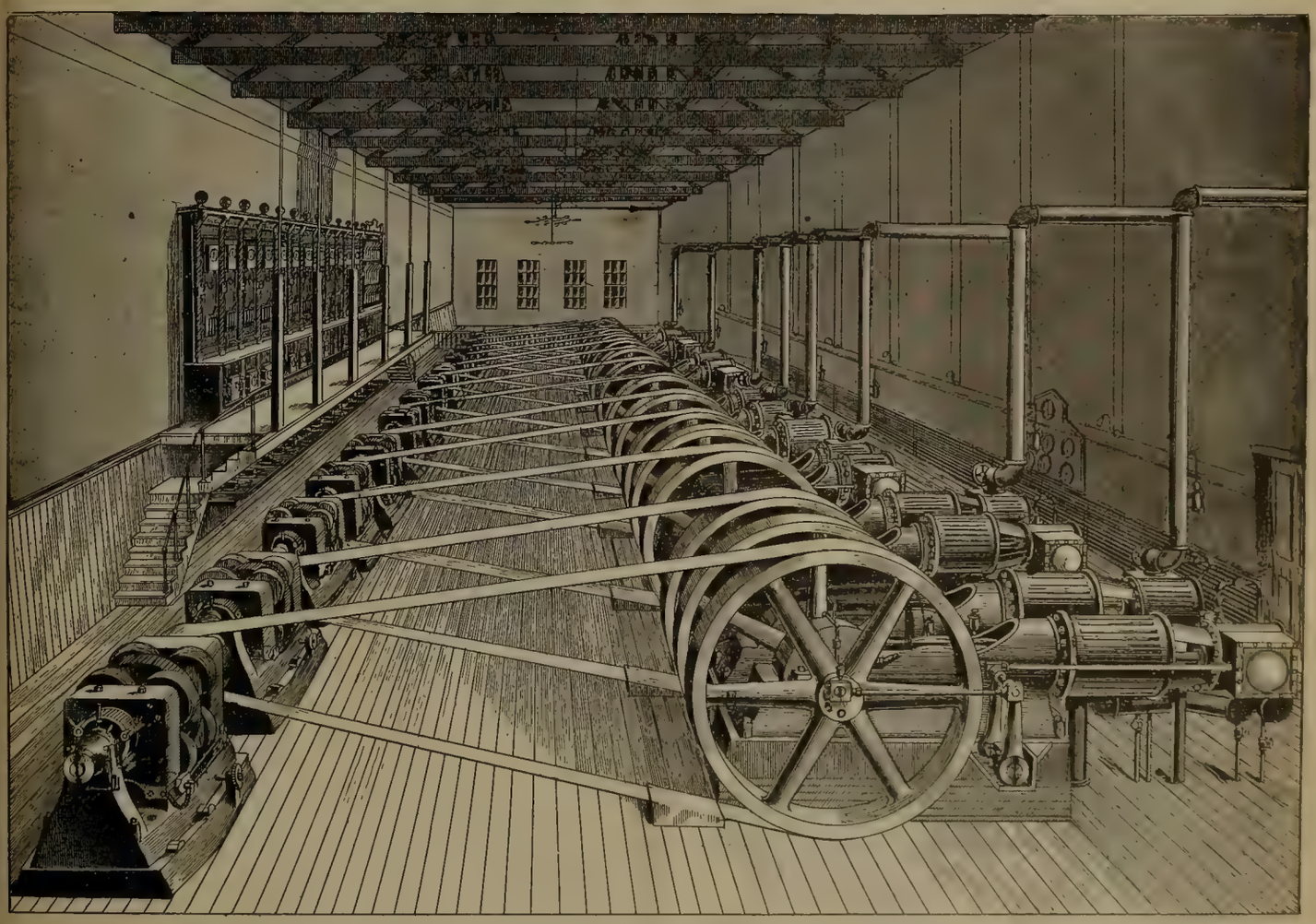
This apparatus is of recent design and placed on the market by Queen & Co., Philadelphia, from whom further particulars can be obtained.

The steam-power plant for The Kings County Farm Buildings will be furnished by the New York Safety Steam Power Company. It will consist of six 350 H. P. tandem-compound engines. The first engine will be started up about February 1.

POWER STATION, ROCHESTER ELECTRIC RAILWAY CO.

The Rochester Electric Railway Company is known all over the country for its enterprise, and it is to a large extent regarded as a standard in electric-railway practice.

We give herewith a view of the interior of the power-house of this road, which is operated on the Short system. There are thirteen Short generators of 150,000 watts capacity each, of the multipolar type, compound-wound. The commutators are made hollow to allow a free circulation of air to keep the parts as cool as possible. Each commutator is composed of 200 segments. The bearings are of the self-oiling type and it is said require a fresh supply of oil only once in six weeks. These



INTERIOR OF POWER STATION OF THE ROCHESTER ELECTRIC RAILWAY.

machines have given the best of satisfaction and perform their work well under the most trying conditions.

The switchboard is elevated 8 feet above the engine-room floor, on a gallery 7 feet wide, erected for the purpose. The upper part of the board is made of solid mahogany and is divided into sections by pillars, and the shelf is of marbleized slate highly polished. The fuseboard is placed under the gallery and is likewise of marbleized slate. All the feeders pass through it, and located beneath it are Wason lightning arresters. Ajax switches, made by Mr. C. S. Van Nuis, of New York, are used throughout.

The engine plant consists of 4 single-cylinder, 5 cross-compound and 6 triple-expansion engines, all made by the Ball Engine Co., of Erie, Pa., and aggregating 1,950 H. P.

The Jewell Belting Co., of Hartford, Conn., supplied most of the belting. Chas. A. Schieren & Co., of New York, however, are represented by a perforated belt, and two or three Cross belts are used. The steam plant consists of Heine safety water-tube boilers of 200 H. P. each fitted with Gallagher furnaces, and Babcock & Wilcox boilers.

There are two 1,000 H. P. Worthington independent condensers; 3 Worthington 500 H. P. feed-pumps, and 3 Berryman 500 H. P. feed-water heaters.

The building is completely lighted by electricity, and in every way is a model station.

THE TELEGRAPH IN CHINA.

Mr. Romyn Hitchcock, in a recent number of *Engineering News*, gives some interesting facts concerning telegraph lines and railways in China. There is but one line of railway in China, and that is only 100 miles in length. The strongest opposition to the introduction of the railway came from the educated classes and officials, mainly on selfish grounds.

There are now 17,000 miles of telegraph wire in operation throughout the country at a cost of over $6,000,000. At first the people were very much opposed to the introduction of the telegraph, but when they realized that the government required it they were compelled to submit to the inevitable.

"But it was no small matter to reconcile the people to the poles," continues Mr. Hitchcock, "which the geomancers declared would disturb the powers of the air and bring calamity upon the country. In Hunan, for example, 10,000 persons came together and burned over 2,000 poles as an intimation of the feeling in that province.

The government discreetly abandoned the enterprise there, and Hunan is one of the two or three provinces which are still without telegraphic communication. Hunan is the strongest anti-foreign province of China, and was the original source of much of the trouble which was experienced by foreigners in the interior last year. Whether the opposition to the telegraph in Hunan was inspired by superstitious fear of the consequences, or by the ruling gentry, who hate foreign innovations of any kind, is perhaps uncertain.

"The wonderful development of the telegraphic service shows, however, that the officials are quite able to carry out an enterprise in spite of popular superstitions; and in the case of railways they even go so far as to remove family graves, which is doubtless the most serious cause of offence to popular prejudices imaginable.

"At Tientsin there is a telegraph school where operators are trained and educated. Chinese characters, of which there are about 10,000 in use for business purposes, are transmitted by numbers according to the Morse system. But a far better system is that of Mr. C. Paulsen, who has prepared a code in which each character is represented by an English word, and it is this system which will doubtless be adopted in future.

"The operators are divided into several classes, the lowest grade receiving 10 taels a month, and the others 14, 24 and 45 taels respectively. A tael being worth about $1.27 gold, the pay is liberal enough.

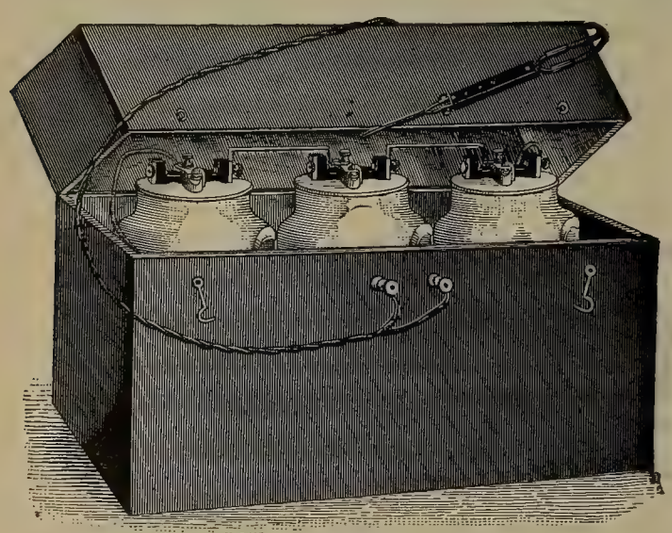
"As a whole, the telegraph system is profitable. The government owns some lines which are not paying expenses; but those which are doing the best and most profitable business have become private lines, in accordance with the policy of the government.

"A line was opened in 1891 through Kansu and Shensi, and the Yunnan line was joined to the French system of Tung King."

SURGICAL AND DENTAL MOTOR-OUTFIT AND CAUTERY BATTERY.

The Edison Manufacturing Company has just placed on the market a most complete outfit for dental and surgical use, which we illustrate below.

The surgical-motor outfit consists of a motor with a flexible shaft and hand piece, adjustable standard and

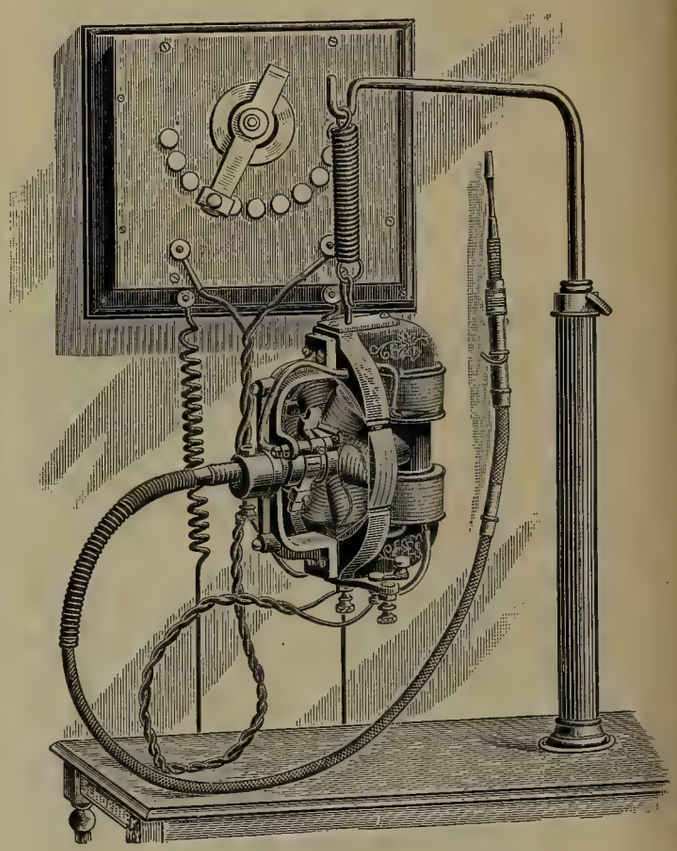


CAUTERY BATTERY.

regulating rheostat for controlling the speed of the motor.

The motor, which is of the slow-speed type, is very powerful, and is driven by 6 Edison-Lalande cells, type P, which will run it for 200 hours without any attention. It is fitted with self-oiling bearings and the workmanship leaves nothing to be desired. The regulating rheostat deserves special attention, as the contact arm can be easily removed for the purpose of cleaning it.

There are a large number of physicians and dentists who will, no doubt, find that this outfit fills a long-felt want for an efficient motor, worked by a battery that can



SURGICAL AND DENTAL MOTOR OUTFIT.

always be relied upon to be ready when needed. This same battery can also be used for cautery purposes, and for running miniature lamps for diagnostic work.

We also illustrate a new cautery battery suitable for light work, such as nose and throat operations, which the same company has recently gotten out, and which will last the ordinary practitioner for a year without needing renewal.

It consists of 3 Edison-Lalande cells, type P, fitted in a polished lead-lined box, with cautery cord, handle, and one electrode.

Both these outfits can be seen in active operation at the offices of the Edison Manufacturing Company, 110 East 23d street, New York city, N. Y.

BROOKLYN'S ELECTRIC ROADS.

A few electric cars are being run on the De Kalb avenue line, Brooklyn, as far as the Brooklyn bridge, but it will be quite some time before the road will be in regular operation. The track from the bridge to the ferries is being reconstructed, and there is considerable work yet to be accomplished in the completion of the power-house and its equipment. The few cars that are now being run may be looked upon as a test of the working of the system rather than any attempt to operate the line by electric power.

THE Montreal board of trade has requested the mayor and city council to advertise for tenders for the street lighting instead of acting on the report of the light committee favoring a new contract with the Royal Electric Company without asking for tenders.

SMOKE CONSUMPTION.

The smoke problem is one that concerns all manufacturing cities and towns, and while many efforts have been made to abate the nuisance few of them have been attended with any practical success.

There are many difficulties in the way of realizing the desired result, but that it can be successfully accomplished all well-informed engineers admit. The necessary conditions and requirements are all pretty well understood, and it now remains for some one to practically accomplish what we know to be true in theory.

The Engineers' Society of Western Pennsylvania, at its meeting in Pittsburg on the 15th of November last, received the report of the committee appointed to consider the smoke question. The committee consisted of Col. T. P. Roberts, W. L. Scaife, Chas. Hyde, Prof. John Langley, Daniel Ashworth, T. H. Johnston and Captain A. E. Hunt.

The following abstracts from the report will be of interest to our readers, and may be the means of giving some one a clue to the practical solution of the problem.

Combustion, says the committee, is a process of oxidation, and consists in a chemical union between the carbon and hydrogen of the fuel with the oxygen of the air. Hydrogen and oxygen unite to form water. Carbon may unite in two proportions, forming two oxides, called respectively carbon monoxide and carbon dioxide. This latter is often called carbonic acid, and represents the final result of the complete combustion of carbon. These products are fixed gases, and since at the temperature of the flame water can only exist as steam, we may consider all the products of the complete combustion of a fuel as being invisible gases, which escape into the atmosphere. A jet of illuminating gas burning in an apartment very nearly realizes this condition. But the hydrogen and carbon of a fuel are not simply mixed together; they are combined, forming a class of compounds known as hydro-carbons, of which natural gas and petroleum are familiar examples.

Now, hydrogen ignites at a lower temperature than carbon. Moreover, being a gas it mixes readily with the air, and hence is more combustible than carbon. When a hydro-carbon is heated to a temperature considerably above a red heat it begins to separate into gaseous hydrogen and solid carbon; the chemical oxidation which constitutes combustion cannot take place until this preliminary separation begins. Now it will be seen that if the supply of air is ample both the hydrogen and carbon will burn completely into carbon dioxide and water, and only odorless and invisible products of combustion will result; but if the air supply is not ample or, what amounts to the same thing, if the air is not nearly instantaneously mixed with the vapor of the hydrocarbon, then the hydrogen being more combustible than the carbon will take most of the oxygen present and leave the carbon in the form of small particles, which, while hot, radiate light, but which soon float outside the borders of the flame, cool down and appear as soot and smoke.

Improper supply of air is then the sole cause of the production of black smoke. But there is another kind, a light yellow smoke, which is produced from another cause. If oil or fat is dropped on the top of a stove which is barely red hot much light white smoke will result, but there will be no flame and no combustion; this is because the oil is vaporized or, in technical language, suffers destructive distillation. All the elements of the oil are still present, and if a lighted match is applied to the column of smoke it will ignite and burn with a bright flame. Similarly, when bituminous coal is charged on the top of a fire it cannot all be heated instantaneously, but portions of it will suffer destructive distillation as it gradually approaches a dead heat, and a thick yellow smoke will be given off from all parts of the freshly added fuel where the temperatnre is not high enough to ignite it. This yellow smoke consists mainly of small globules of oily and tarry bodies, which give to coal smoke its adhesive and greasy character.

If we could always have a flame playing over all portions of the top of a fire, and at the same time an ample supply of hot air thoroughly mixed with the fuel gases, there would never be any notable quantity of either yellow or black smoke passing up the chimney. Theoretically the complete abolition of smoke can be secured by having a top flame and a top supply of hot air; but just here is where the practical difficulties begin, for however ample may be the admission of air to the ashpit, and however well cleared may be the surface of the grate-bars, the passage of air through 4 or 5 inches of incandescent fuel completely deprives it of free oxygen, so there is none available to ignite the freshly charged coal.

But air admitted simply through slits in the fire-door, while helping to keep up a top flame, yet being cold and imperfectly distributed, will chill some portions of the fuel gases below the igniting point, and consequently imperfect combustion, with the production of black smoke, will result. Hence, an essential requirement of devices for smoke prevention is an ample, timely and thorough mixture of air with the combustible gases distilling from the fuel.

The style of furnace known as the "regenerative" is the best known plan for reheating the air which is to be supplied to the fuel through the air-door. It, however, is not suited for boilers and for many other applications of fuel. The former are probably the greatest smoke-producers in Pittsburg and Allegheny and are daily becoming more numerous, owing to the increasing use of steam for elevators, heating, lighting and power in buildings throughout these cities. Much of their smoke is due to badly constructed furnaces and to the fact that the boiler capacity is insufficient to properly fulfil the duty required of them.

In order to preheat the top air before it reaches the fuel gases it is sometimes admitted through openings in the brickwork at the side of the fire, or through slits in the fire-bridge. This is a partial remedy only, because the air is rarely sufficiently heated or mixed thoroughly enough with the distilling products of the coal.

Regarding mechanical stokers the report says:

These are mechanical arrangements, more or less complicated and costly, designed to supply the fuel not intermittently but constantly and to spread it in thin layers over the fire. There are several very good stokers now on the market which accomplish the desired result with greater or less success, according as they are permitted to feed the coal slowly or rapidly. If the feeding is made slow enough the suppression of smoke may be theoretically complete. But to feed slowly means that a boiler must not be crowded. Hence the use of a mechanical stoker and the suppression of smoke may mean an increase of the number of boilers to do the work formerly done under hand stoking with the generation of smoke.

Mechanical stokers are especially adapted for large plants where they can be so arranged as to displace manual stoking. Their cost will prevent their adoption in many small plants, although here and elsewhere numbers have been applied to single boilers. Where either vertical or horizontal space is restricted, it is sometimes impossible to apply mechanical stokers. Like all plans of successful firing, they require intelligent manipulation or they will smoke and give trouble. Pittsburg coal, in the form of nut or slack, is well adapted for automatic stokers. One of their advantages is that an inferior fuel can be successfully burned by them.

There are in use a number of devices by which jets of

steam are arranged to force currents of air above or below the fire. They are simple in construction, inexpensive in first cost and repairs, require very little space, and can be readily applied to existing furnaces. The best of them, even when slack is used, can reduce to an almost invisible vapor in less than half a minute dense black smoke from a boiler.

The committee refers to the use of the steam jet in one of the Pittsburg mills. After several years of use of natural gas, the owners of the mill were forced to return to coal. They found, however, that with coal their boilers would not supply sufficient steam. Accordingly they concluded to try steam jets to increase combustion and evaporation. After some experimenting they finally adopted a jet somewhat of the Bunsen burner type, which is now in successful operation on two batteries of flue boilers—the jets being placed above the fire-doors and immediately below the boilers. The fuel is slack, and yet almost no smoke is visible, even during heavy firing. The same firm has also applied to eighteen puddling and four heating furnaces steam jets of a different design. In these the ashpit is made tight and the steam and air enter below the grates. These furnaces are of the usual type, except that special openings are made for air above the fire and through the bridge wall. When the fire-doors are closed no black smoke is visible while the steam jets are in operation. The smoke appears above the stack whenever the fire-door is opened, but disappears immediately on closing the door. Each puddling furnace has two jets of steam and each heating furnace five jets, all about one-tenth of an inch in diameter. Nut coal can now be used in the heating furnaces and slack in the puddling furnaces, whereas lump was used formerly in both. The jets have been in use for nearly a year and the mill-owners state that they have not injured the boilers, nor the furnaces, nor the iron, but have saved money by reducing the quantity and quality of the fuel required. Unfortunately the steam jet makes a great noise. This is not very objectionable in a rolling-mill or machine-shop, but will probably prevent its introduction into office buildings, where otherwise it might be useful.

NEW BOOKS.

ORIGINAL PAPERS ON DYNAMO MACHINERY AND ALLIED SUBJECTS. By John Hopkinson, M.A.D.Sc., F.R.S. New York: The W. J. Johnston Co., Ltd., 1892. 249 pages, 98 illustrations. Price, $1.00.

This collection includes all papers written on electro-technical subjects by the distinguished author, most of which have marked eras in the advance of electrical science. Perhaps no other contributions to electrical literature since the days of Faraday have been of as an important character as those contained in the present volume, and this is true whether considered from a theoretical or from a practical standpoint.

In the first paper that invaluable aid to the study and design of dynamos, the characteristic curve, was first announced, and the subsequent three papers are devoted more or less to developing its applications.

The fourth and fifth papers, on the theory and design of continuous-current dynamos, furnished the fundamental principles upon which the design of such dynamos is now based.

The sixth paper established the important principles in regard to coupling alternating-current machines; the next three papers are on the transformer, and the remaining two are on the theory of the alternate-current dynamo and electric-light houses respectively.

The majority of the papers contain no mathematical formulæ, and several others so little as not to prevent their being understood by a non-mathematical reader.

These papers, with the authorization of Dr. Hopkinson, are for the first time published in a collected form and rendered accessible to the general public, and they should furnish a fruitful source of inspiration to those in search of knowledge at first hand.

NEW PUBLICATION.

World's Fair Electrical Engineering is the name of a new illustrated monthly magazine which will make its first appearance in Chicago on January 1, 1893. The size of the magazine will be about 6 x 9 inches, and as its name implies, it will cover the field of electricity at the World's Fair. This is its main object, we take it, although it will discuss and consider electrical affairs in general as well.

PERSONAL.

Mr. L. H. Hart, who has for the past year acted in the capacity of business manager of the *Electrical World*, has resigned his position with that paper to embark in an enterprise that is full of promise. Mr. Hart will be associated with two other gentlemen well known in the trade in the publication of a monthly journal to be named *Heating and Ventilation*, which will thoroughly cover these two fields of industry. The first number of the paper will appear the early part of January, and we hope Mr. Hart will meet with all the success he anticipates. He is popular in the electrical trades, and that sentiment no doubt will be a great help to him in his new field of operations.

Mr. Fred. De Land, for a number of years the western representative of the *Electrical World*, has resigned to accept the position of editor of the new monthly magazine to be published in Chicago under the title of *World's Fair Electrical Engineering*.

SIGNALLING AT SEA.

A press despatch from Buffalo on December 8 gives an account of an invention of C. V. Boughton, of that city, for the interchange of signals and communications between vessels at sea. It is called the "Telephotoes," and it is reported that experts pronounce the system a success. The despatch describes it as follows: "The instrument consists of a series of wires and electrical connections, operated by a key-board, by which 106 incandescent lights are controlled and made to produce the signals of the Morse telegraph alphabet. The wires number over 5,000 and occupy a space of only 11 by 12 inches. The dots of the telegraph characters are represented by two illuminated lamps, the spaces by twelve unilluminated lamps, and dashes by twelve illuminated lamps. The inventor claims that 32-candle-power lamps can be seen at a distance of ten to fifteen miles. Mr. Boughton has secured patents in this country and Europe."

A complete instrument will be, it is said, built and placed at the disposal of the United States Government, to be exhibited on the model of the war-ship "Chicago" at the World's Fair.

CATALOGUE.

We have received from the Lithanode and General Electric Light Co., Limited, 64 Millbank street, Westminster, London, Eng., a copy of a completely gotten-up pamphlet descriptive of the company's "Lithanode" and accumulators. Lithanode secondary batteries are adapted to all electrical purposes.

THE Chicago city council has directed the commissioner of public works to prevent the Edison Electric Illuminating Co. from digging trenches or otherwise injuring the streets for the purpose of laying electric wires.

SPECIAL REPORTS.

The matter on this page, under this head, is prepared for the special information of electrical supply dealers, and is entirely new.

POSSIBLE CONTRACTS.

Colusa, Cal.—The residents of this place are anxious to have an electric-light plant established.

New York, N. Y.—The Continental Insurance Company has purchased the property 44, 46 and 48 Cedar street, and will tear down the old building, erecting a high office building equipped with all modern improvements.

Beverly, Mass.—A new company, known as the Gloucester, Manchester and Beverly Street Railway Company, has been organized to build an electric road between Beverly and Gloucester. William H. Jordan, of Gloucester, is an incorporator.

Brooklyn, N. Y.—The town board of Flatbush has decided to consider the application of the Kings County Electric Railroad Company and the Brooklyn City Railroad Company for permission to build trolley lines through the town.

East Hartford, Conn.—The Construction and operation of an electric street-railway system is being agitated.

Globeville, Col.—John and Rolla Head have asked for permission to build a horse-car line on Watervliet avenue.

Hartford, Conn.—The Hartford and Wethersfield Horse Railway Company, whose system is to be converted into an electrical one, will build electric lines to Windsor, South Windsor, Newington, New Britain and other points.

Meadville, Pa.—The question of a street railway for this place is being vigorously agitated.

New Britain, Conn.—It is said that New Britain and Hartford capitalists will build an electric line from this city to Hartford and Plainville.

Orange, N. J.—A new electric line to connect Orange with Montclair is projected by Watson Whittlesey.

Philadelphia, Pa.—A new street railway four miles long will be built from this city to a point in Delaware county near the Spread Eagle Hotel, in Haverford township, by the Philadelphia and Willistown Railroad Company.

Mayor Stuart has at last signed the ordinances permitting the Fairmount Park and Haddington and the Elwood and Fairmount Park Passenger Railway Companies to operate trolley roads.

Phœnixville, Pa.—An electric line running from this city to Spring City and Royersford, Montgomery county, will be built by the Schuylkill Valley Electric Street Railway Company. George F. Pierson, of Philadelphia, is an incorporator.

Riverside, Cal.—There is talk of an electric road to connect Rialto, San Bernardino and Riverside.

Vicksburg, Miss.—The projected electric road for this city is at last on an assured basis, and work on its construction will be commenced within sixty days.

Yankton, Dak.—There is a good prospect for the building of a street-car line in this city.

Monterey, Cal.—The system of the Monterey and Pacific Grove Street Railway Company will be reconstructed into an electric one.

New Orleans, La.—The New York syndicate which has acquired control of the street railways in this city, will abandon animal and substitue electric power.

Stillwater, N. Y.—The Stillwater and Mechanicsville Street Railway Company has applied for permission to adopt electric power for the propulsion of its cars.

Troy, N. Y.—It is quite likely that the Troy and Lansingburg Street Railroad Company will change the White line between this city and Cohoes into an electric one, and thus have all of its lines operated by electric power.

Holyoke, Mass.—Residents of Chicopee and Willimansett have requested the Holyoke Street Railway Company to extend its tracks to those places.

Nantucket, Mass.—The Nantucket Beach Street Railway Company has petitioned the selectmen for permission to lay tracks through a number of streets.

Orange, N. J.—The New Jersey Traction Company has under contemplation a number of extensions in this city and vicinity.

Leavenworth, Kan.—It is reported that W. F. Putman, backed by eastern capitalists, will expend $300,000 in converting the system of the Leavenworth Rapid-Transit Railroad into an electric road.

Baltimore, Md.—The Ellicott City Electric Railway Company will lay single tracks through a number of streets.

Springfield, Mass.—The Springfield Street Railway Company has purchased a piece of land for $20,000 on which it will erect a power-house.

New York, N. Y.—The Union Railway Company has petitioned the common council for leave to make extensive additions to its system.

New Bedford, Mass.—The Union Street Railway Company will build next spring a new car-house.

THE EDISON LAMP CASE.

Judges Wallace, Lacombe and Shipman, in the United States Court of Appeals, heard further arguments on December 7 in the suit of the Edison Electric Light Company and the Edison General Electric Company for an injunction against the Sawyer-Man Electric Co., to restrain the latter from making incandescent lamps. The Edison Company was represented by Clarence Seward and Grosvenor P. Lowrey, and the defendant company by Elihu Root, Edmund Wetmore and L. E. Curtis. Mr. Curtis said that $25,000,000 was represented in and back of the Sawyer-Man Company. He declared that the Edison General Electric Company had no standing in court, because the New York state laws and the United States laws prohibited any such combination as the Edison companies had formed, a combination which was trying to create a monopoly and control the trade. He also asserted that the Edison Company would, in the event of its victory, refuse to sell its lamps to people who used the Westinghouse machines.

Mr. Lowrey denied that the Edison Company would refuse to sell its lamps to the Westinghouse people. He said that the Westinghouse Company was formed to carry on a practically infringing business, and that it had founded its business upon a denial of other men's rights. He said it was not a case for equity, and that the Westinghouse Company would simply suffer the consequences of its own acts. Arguments were closed on the 8th.

THE Washington Park Club, Chicago, has contracted for a New York Safety Steam Power Co.'s 50 H. P. engine and Edison electrical plant.

ELECTRIC GAS-LIGHTING TORCH.

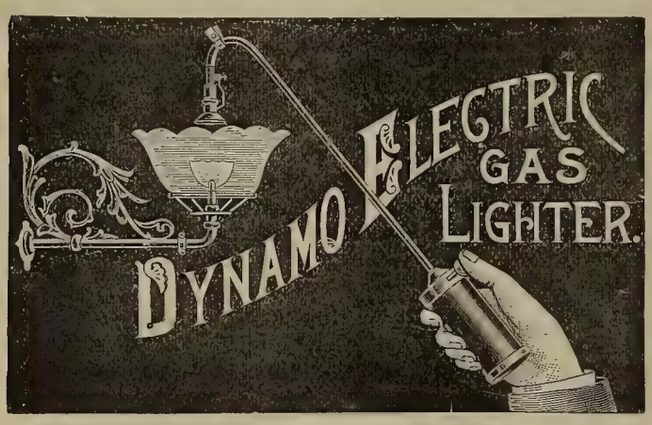
This is a device for the purpose of igniting gas jets. The five patents covering portable dynamo electric gas-lighters were bought by Mr. A. L. Bogart, of New York, about a year ago, and he has since then made several improvements on the apparatus which render it about as near perfection as it would seem possible to make it. The spark is produced by the operation of a diminutive



STYLE A.

dynamo located within the hard rubber handle of the torch, the dynamo being of ingenious and delicate construction. In the dynamo formerly used the brushes caused troublesome friction which had a retarding effect on the revolutions of the armature. This, however, has been overcome, and Mr. Bogart now uses for the brushes a number of very fine copper wires, imported from Europe, which are very elastic and tough. It has been practically demonstrated that these brushes reduce the friction to a very small fraction of what it was when the old flat brushes were used, and the generator revolves with greater freedom in consequence by the simple pressure of the thumb on the thumb-piece on the side of the handle, as shown in the illustrations.

The brushes are riveted to the inside of a rubber shell and electrically connected with conductors also located inside of the shell. By one application of pressure on the thumb-piece this shell revolves with great speed,



STYLE B.

sometimes as high as 3,000 revolutions per minute, and continues its revolutions for several seconds, thus generating a continuous spark of considerable length.

The stem extending from the handle is made in different lengths, the standard sizes being 24 and 26 inches, but they can be made of any length desired, to order. It consists of a tube through which the conductors are carried to end of the stem, where the spark is produced by jumping across the space between the electrodes. At the end of the stem in style B is attached a gas-collector in the shape of an inverted cup. The gas in escaping from the jet accumulates in this receptable and is ignited by the spark when the dynamo is operated. In style A the collector consists of a metal bulb.

Mr. Bogart manufactures two styles of gas-collectors. Style A has a straight stem, so as to ignite the gas from below, and style B has a curved stem for the purpose of holding it over the shade, thus igniting the gas from above. At the extreme end of the straight stem the tube is slotted for the purpose of turning on the gas previous to being lighted, and turning it off. The curved stem is also provided with a similar device for turning the gas on and off.

Those using the old style portable gas-lighters can have them remodelled by Mr. Bogart, and have the improvements put in and made perfectly operative.

NOTES OF GENERAL INTEREST.

THE Oakland (Cal.) Gas Light and Heat Company has purchased from the General Electric Company a 1,000-light incandescent dynamo and a 100 arc-light dynamo.

THE residents of Pasadena, Cal., are dissatisfied with the present method of suspending the arc lamps from poles with cranes, and demand a return to the mast system.

IT is reported that a telephone line connecting Fresno with San Francisco, via Hollister and Gilroy, will be built by the Sunset Telephone Company.

THE new power-house of the National Electric Tramway and Lighting Company, of Victoria, B. C., has been completed, and is said to be one of the finest plants on the coast.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, December 10, 1892.

THE enamelled reflector shades of Hermann Aich, 43 Murray st., for incandescent lamps, meet every requirement in a shade. They cannot be broken, are always bright, and are unaffected by dampness or acids.

DURING the storm on the morning of December 8 a "live" wire was broken and fell into the street near the bridge entrance in Brooklyn. A horse attached to a wagon stepped upon the wire and instantly gave up the ghost.

DR. HARTWELL, of Woodbridge, L. I., mentioned in the presence of an ELECTRICAL AGE representative, that he had tried all the various makes of dry batteries, and found the Himmer & Anderson battery the very best, and that he would always use them.

H. I. CLEVELAND and C. D. TAYLOR have formed a copartnership under the firm-name of Cleveland & Taylor, and their headquarters will be at 5 & 7 Dey street, Room 6. They are both practical electricians and will do electricial work of all descriptions.

COMMISSIONER GILROY resumed, on December 9, the work of removing electric poles and wires from the streets, maintained in violation of the rules of the board of electrical control. Several gangs of men will engage in the active operations. Many private telephones will be affected as well as some pool-room connections.

THE repair ship "Mackay-Bennett," of the Commercial Cable Company, which was at this port recently on dry-dock, was found by the surveyor to be in a remarkably good condition. The surveyor, in his report to the New York marine underwriters, says that in all his experience he never found a vessel in more perfect condi-

tion; and he also comments on the excellent discipline on board. The Commercial Cable Company does all things well.

C. D. SHAIN, the well-known electrical engineer, 136 Liberty street, has through his popularity secured the agency for Siemens & Halske, of Chicago, his territory covering the New England states, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia and West Virginia. Mr. Shain is also agent for the Weston instruments; Carpenter Enamel Rheostat Company, of Bridgeport, Conn.; Sunbeam incandescent lamps, etc. Mr. Shain gives expert attention to the installation of electric-light and power plants, and contracts for plants complete.

BIDS for lighting streets, avenues and parks in this city by gas and electricity during the year 1893 were opened by the gas commissioners on December 8. The following are the bids of electric-light companies: United States Company, 351 lamps at 40 cents a night and 17 at 50 cents; Brush, 229 lamps at 40 cents, 72 lamps at 45 cents, and 42 lamps at 50 cents; Thomson-Houston, 286 lamps at 40 cents and 45 lamps at 50 cents; Mount Morris, 314 lamps at 40 cents; Harlem, 194 lamps at 40 cents and 19 at 50 cents; Edison, 57 lamps on Fifth avenue at 50 cents; Manhattan, 52 lamps at 40 cents and 17 at 50 cents; North River, 633 lamps at 45 cents.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	56 00
American Telegraph and Cable	14,000,000	100 00	86 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	208 00
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	118 00
Brooklyn Edison Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y.	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	90 00
Chicago Gas	25,000,000	100 00	99 50
Columbia Chronophone	500,000	25 00	35 00
Commercial Cable Co	7,716,000	100 00	175 00
Cons. Gas Co., N. Y.	35,430,000	100 00	125 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	4 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	109 00
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	50 00
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	113 75
General Electric Co., 5s	4,000,000		*100
General Electric pref.	4,223,700	100 00	116 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	25 00
Laclede Gas pref.	2,500,000	100 00	69 50
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60.000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			135 00
Morristown L. H. &P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 00
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co	10,394,600	100 00	59 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535,000	100 00	98 25
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co.	39,767,200	100 00	12 00
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co., Va.	30,000	10 00	9 50
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125.000	100 00	100 00
Shaver Corporation. N. Y.	100,300	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	115 00
The Ongley Electric Co., N. Y.	250.000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	‡ par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
U. S. Rubber Co.	26,947,000	100,00	43 50
Western Union	100,000,000	100 00	89 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	35 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	50 00
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

FINANCIAL.

The big boom in stocks so fondly hoped for and which is required to carry the brokers over the holiday season has so far failed to materialize, and in consequence there is much weeping and wailing and gnashing of teeth among those who have depended on an active December. Meantime the supply houses are full of business, and the construction and equipment companies have so much on hand that they are obliged to utilize unskilled labor. Improvements in the adaptation of electrical appliances meet the educated eye at every turn, and they come so fast that it is impossible to keep up with the grand march. Light, on the other hand, at least so far as greater New York goes, suffers by comparison with almost every town in the Union. One of the first things a visitor notices when he has occasion to go through any of the side streets is the lack of light and, of course, safety. As a consequence Broadway and a few of the avenues constitute his whole knowledge of our great metropolis during this season of short days. In Brooklyn the sneak thieves and burglars are so thick that the police have made a house-to-house visit warning the people to look out. All of these conditions are directly chargeable to the lack of light, and to the investor it means that the want will be supplied and paid for. The various local light companies are now doing a good paying business, but the increase will demand more capital, and the competition has been such that the fair commercial price has been reached. This offers an opportunity for the employment of a greater amount of money than before, while its earning power may continue about the same, but will grow as time rolls on. The money which had been set aside to speculate with this month had better be invested before the first of January and left until next November or December. There is no danger of loss.

The monetary convention now sitting in Brussels seems to have concluded to let the present status alone, for no two will be apt to agree on a full plan. This will leave us in quiet possession of the wealth which our mountains send down to us, and if we can't spend it abroad it will naturally drift into the leading industry of the country—electricity. Congress will scarcely do any business this session to interrupt the present quiet state

of affairs. The state legislature will have nothing before it which can disturb the condition of financial affairs, in which the masses are interested, outside of the usual and regular course. I hope it will pass a teachers' pension bill of some kind. I believe in the teacher next to my God, and assert that they permeate every road in our lives; through their efforts we are able to lay and carry out plans for life. Every science has its schools, and just now electricity is being taught in all of them. All of the higher colleges, academies, etc., have their electrical department, and we get all of these blessings direct from the public-school teacher. The pension law the world over governs the granting for service; so there can be no mistake in this case. Give it to them by all means, and make it as near the current salary as possible.

I have not been able to glean any information regarding the progress of the Co-operative Electric Company. I hope it has not fallen through, because it offers an opportunity for every member to introduce his inventions and discoveries provided they meet the approval of his company.

The new offerings on the market seem to be falling off; possibly the times are not deemed propitious. There are still opportunities, however, in the market which pay net 8% and can be had after full and exhaustive examination. There is one franchise at $15,000 and another at $20,000, both extending over many years, and exclusive. Just now when the New York fire commissioners are forcing the hotels to comply with the law and introduce an absolute fire-alarm, one comes along that is as near perfection as possible. It is called the chronophone. It does everything except taking a man out of bed, dress him, and land him in the street. This company simply wants capital to manufacture, and is seeking some factory where the facilities will be as good as cash to it. The General Electric Company has declared its first semi-annual dividend of 3½ per cent. on its preference shares. This puts it in direct line as a permanent investment.

PORTER AND LEAVITT MOTORS.

During a recent visit of an ELECTRICAL AGE representative to Providence R. I., he called on Messrs. Porter & Leavitt, the well known manufacturers of small motors. Mr. Leavitt courteously showed him around the factory, which was found to be thoroughly and completely equipped with every appliance necessary for first-class work. Mr. Leavitt directed especial attention to the method of constructing the motor frames, showing how carefully they were hollowed out, thereby producing a perfect running machine. The tools used in this establishment are of the finest quality of steel. After a thorough inspection of the factory and its equipment a sewing machine operated by a Porter and Leavitt motor, in conjunction with a Bradbury-Stone storage battery, was shown. It did its work splendidly, the machine making an excellent stitch through four thicknesses. Later in the day, accompanied by Mr. Leavitt, a visit was made to a shooting gallery, where two bunches of pipes are made to revolve by a small Porter & Leavitt motor, operated by a Kolon battery. The apparatus has been in operation for a long time and as yet has shown no inclination to stop. The Porter & Leavitt motors are finely finished in black enamel with brass trimmings, and are provided with a grooved brass pulley. Every part is accurately made to standard gauge on the most improved machinery. This insures each part being strictly interchangeable. Besides their No. 1 motor, which is adaptable for the use of students and amateurs for illustrative and experimental purposes, the running of small music boxes, all kinds of models, mechanical toys, etc., etc., Messrs. Porter & Leavitt manufacture larger sizes of motors for heavier work, of $\frac{1}{16}$, $\frac{1}{12}$ and $\frac{1}{8}$ H. P., respectively. Every care and attention is bestowed in the construction of these motors to have them strictly first-class, and the manufacturers are satisfied that they have brought them to a state of perfection upon which it would be hard to improve.

W. R. FLEMING & CO.

The rapidly increasing business of this firm in the Central and New England states has made it necessary for them to open a branch office in Boston to look after that trade. They have obtained offices in the Hathaway Building, 620 Atlantic avenue, and have secured the services of Mr. Walter W. Jones as manager. Mr. Jones is a man of long experience in the highest grades of steam engineering work, and is well known throughout the New England states. He has already secured several contracts and has other large work in hand. Since the reorganization and re-equipment of the Harrisburg Foundry and Machine Works the class of work turned out, as shown in both simple and compound Ide and Ideal engines, it is said, compares with, if not exceeds, the best shown in engineering work of similar lines. There has been almost constant work day and night to keep up with increasing orders and contracts, and further extension of plant is contemplated to take care of present and prepare for future work. Both the Harrisburg Foundry and Machine Works and Messrs. W. R. Fleming & Co. are to be congratulated on the character shown in their work and in the merited as well as substantial increase in their business.

TRADE NOTES.

A. M. MORSE & Co., contracting engineers, St. Louis, report among recent sales a 350 H. P. "Buckeye" cross-compound-condensing engine to the Laclede Gas Co., of St. Louis.

AN electric-lighting plant with General Electric Co.'s apparatus and New York Safety Steam Power Co.'s steam-plant—80 H. P. engine, etc.—is being installed at Highland, Illinois.

THE Hotel Arragon, Atlanta, Ga., has been outfitted with a steam-plant consisting of two 50 H. P. "New York Safety Steam Power Co's" engines and General Electric Co.'s apparatus.

THE LACLEDE GAS CO., St. Louis, will increase at once the capacity of its electric-lighting and power station by the addition of a 2,500 and a 1,000 light incandescent machine and a 350 H. P. compound-condensing engine. The latter will be a "Buckeye" of the cross-compound medium-speed type, and will be belted direct to dynamos.

MR. A. P. CROWLEY, General Electric Company, Providence, R. I., says that the company has one of the largest and finest motor circuits in the country installed in the city of Providence. There are about 200 motors aggregating between 800 and 900 H. P. Mr. Crowley is an excellent representative of this company, and while he is genial, does not allow pleasure to go before business.

E. G. BERNARD COMPANY, Hall Building, 7 First street, Troy, N. Y., electrical and mechanical engineers, have lately purchased the Powers' arc switches, porcelain cleats and specialties. This company is contractor, manufacturer and dealer in general electrical supplies. The officers are E. G. Bernard and W. D. Weaver. Their motto is "experience, honesty, durability and promptness."

J. H. HOUGHTON, 201 Congress street, Boston, is agent for many engine manufacturers, including the Lidgerwood Mfg. Co., the Atlas Engine Works, and the Ball automatic engine. He also represents several boiler establishments. He handles engines and boilers of every description and for all purposes, including electric railway and electric-light operations. Descriptive catalogues can be obtained from him.

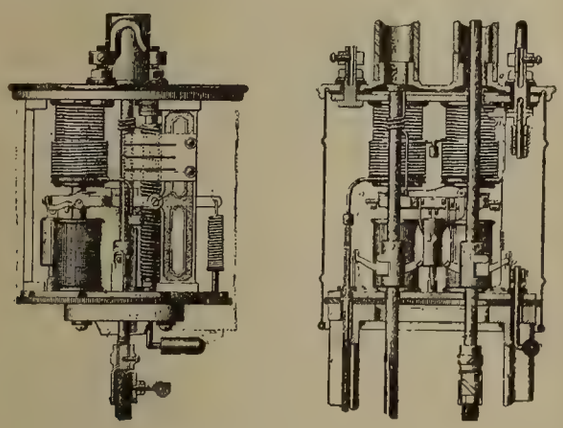
The Electrical Age's Illustrated Record of Patents.

Issued December 6, 1892.

487,242. Electric-Motor. Franklin H. Beers, Newark, assignor to himself and William M. Tallman, Plainfield, N. J., and Erastus Hayes and Al. R. Brandly, New York, N. Y. Filed Feb. 26, 1892.

487,285. Electrical Heater. Willis Mitchell, Malden, assignor, by mesne assignments, to the American Electric Heating Company, Boston, Mass. Filed March 15, 1892.

487,302. Method of Electric Welding. Elihu Thomson, Swampscott, Mass, assignor to the Thomson Electric Welding Company, of Maine. Filed Oct. 2, 1890.



487,315.—ELECTRIC ARC-LAMP.

487,306. Resistance-Box. John Waring, Manchester, Conn. Filed April 28, 1892.

487,307. Connection for Commutators and Armature-Wires. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 5, 1892.

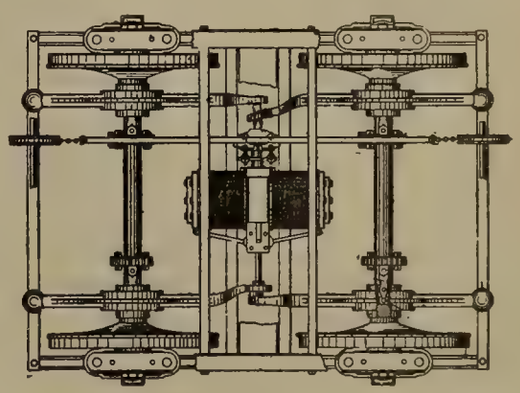
487,315. Electric-Arc Lamp. James J. Wood, Fort Wayne, Ind. Filed July 25, 1892.

487,324. Galvanic Battery. James L. Gethins, Boston, Mass., assignor to the Gethins Electrical Manufacturing Company, of Maine. Filed May 15, 1891.

487,329. Electric Motor for Cars. Charles A. Jackson, Reading, Mass. Filed Aug. 3, 1891. Renewed Sept. 29, 1892.

487,332. Clamp for Electric Conductors. Henry Lindahl, Chicago, Ill., assignor of one-half to John S. Gustin, same place. Filed Feb. 5, 1892.

487,356. Apparatus for Distribution of Electricity. Thomas Tomlinson, London, England. Filed May 25, 1891.



487,329.—ELECTRIC MOTOR FOR CARS.

487,360. Incandescent Electric Lamp. Eugene W. Applegate, Omaha, Neb, assignor to the Applegate Electric Light and Power Company, Chicago, Ill. Filed Feb. 29, 1892.

487,369. Telephone-Holder. Everett C. Lewis, Woonsocket, R. I., assignor of one-half to Leroy B. Pease, same place. Filed April 29, 1892.

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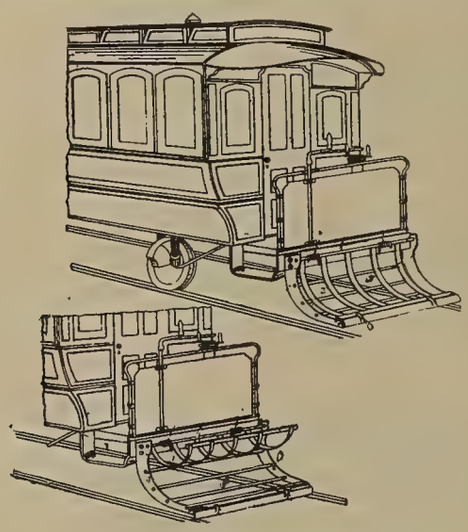
HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS—Continued.

487,437. Electric Bell. Peter Wagner, New York, N. Y. Filed Oct. 2, 1891.

487,448. Jail. David K. Osbourne, St. Paul, Minn. Filed Aug. 6, 1891.

487,462. Connection-Plate for Dynamos. James J. Wood, Fort Wayne, Ind. Filed April 18, 1892.



487,547.—CAR FENDER.

487,477. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass. Filed March 14, 1892.

487,479. Incandescent Electric Lamp. Gustav A. Frei, Springfield, Mass. Filed April 11, 1892.

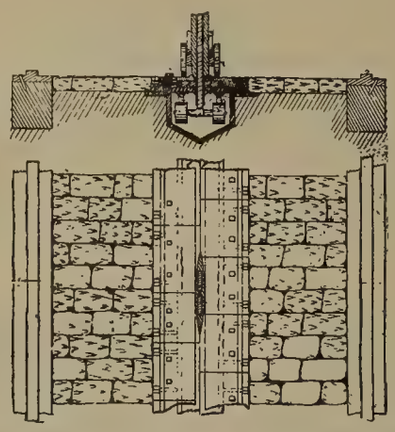
487,519. Thermostat. Franklin O. Elliott, Catawba, N. C. Filed Aug. 20, 1892.

487,543. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Original application filed Oct. 12, 1886. Divided and this application filed Jan. 9, 1890. Patented in England, France, Belgium, and in Canada.

487,547. Car-Fender. Philippe Wentzel and Henry Bletzer, Boston, Mass. Filed Sept. 12, 1892.

487,550. Non-Magnetic Watch-Balance. Charles F. Carpenter, Louisville, Ky. Filed Feb. 6, 1891.

487,607. Method of Arc and Incandescent Metal-Heating. Charles L. Coffin, Detroit, Mich. Filed Aug. 6, 1892.



487,654.—CLOSED CONDUIT FOR ELECTRIC RAILWAYS.

487,654. Closed Conduit for Electric Railways. Albion A. Vanderpool, Newark, N. J., assignor of one-half to David H. Barnett, same place. Filed March 18, 1890.

487,655. Electro-Therapeutic Process and Apparatus. Joshua M. Wardell, Cadillac, Mich. Filed Feb. 20, 1892.

487,676. Electric Signalling Apparatus. Morris Martin, Malden, Mass., assignor to the Municipal Signal Company, Portland, Me. Filed Feb. 20, 1892.

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ELECTRICAL AGE

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A MERRY CHRISTMAS.

We extend to our friends the season's greetings and wish all a merry Christmas. Hang your stockings up early, as Santa Claus has adopted electricity as the motive-power for the propulsion of his sleigh, to expedite matters. His antiquated reindeers are peacefully browsing on the hill-tops of Greenland.

ARMATURE INSULATION.

The meeting of the American Institute of Electrical Engineers, set for Wednesday of this week, promises to be of extraordinary interest. The subject of the paper is one that in itself will insure the attendance of a large and interested audience. Armature insulation is a very important and difficult part of dynamo and motor construction, and the subject will be considered in all its phases. We will publish the paper in our next issue.

AGAINST THE W. J. JOHNSTON CO.

The Supreme Court, general term, has affirmed the judgment, with costs, in the case of the W. J. Johnston Company against Walter T. Hunt and the Electrical Age Publishing Co. The plaintiff sought to restrain Mr. Hunt from working for the Electrical Age Publishing Co., but Judge Truax, at the special term, on the 12th of May last, dismissed the action in favor of the defendants. This judgment was appealed from with the result above stated.

THE END OF THE LAMP CASE.

After several years of legal warfare the question as to the absolute ownership of and right to manufacture incandescent lamps has been finally settled and the Edison interests have come out victorious. A decision in the case of the Edison Electric Light Company and the Edison General Electric Company, appellees, against the Sawyer-Man Electric Company, appellant, was handed down by the United States Circuit Court of Appeals on December 15, sustaining the injunction obtained by the Edison Company restraining the Sawyer-Man Company from making, using or vending the incandescent lamp patented by Edison, which has been the subject of the long legal contest. The decision, however, places some restrictions upon the successful parties which will, in a measure, protect those who will be directly affected by it. The court decides that the injunction order appealed from should be so modified as to cover only those lamps made in infringement of the second claim of the patent. It should also contain a provision reserving the right to the defendant to move hereafter for the vacation, suspension or modification of the injunction upon proof of specific instances of refusal on the part of the General Electric Company to supply lamps on reasonable terms to the owners of electric-light plants which were installed before the circuit court decided the validity of the patents. The date of this decision is July 14, 1891. Those concerns which manufactured lamps while the patent was in dispute, the court says, took a risk, and should their interests depreciate on account of being deprived of the use of the lamp it is their loss, and they must suffer the consequences. The court also says that those who obtained their lamps from infringers are likewise infringers, but those who obtained them before the decision of the circuit court sustaining the validity of the patent have much stronger equities than have the manufacturers and infringers. As to the legality of the combination known as the General Electric Company the court holds that whether it is legal or not the fact remains that the complainants hold the patent. It is now thought probable that the General Electric Company will at once proceed to stop the manufacture of lamps by those concerns who are now classed as infringers. The Westinghouse people, on the other hand, maintain that their new lamp will be entirely free from the Edison patent, and that the decision will not affect their plans as regards the World's Fair contract.

IMPROVED ELECTRIC CAR TRUCKS.

Few patrons of electric street railroads realize that the easy riding they enjoy on electric cars compared with what is experienced on horse cars is due more to the great improvements in the construction of the truck or trucks under the cars than anything else.

The Peckham Motor Truck and Wheel Company, of Kingston, N. Y., was one of the first concerns to pay particular attention to this branch of electric street-railway development, and there can be no better evidence that it has well succeeded in its objects than the fact that its trucks are used with the greatest of satisfaction on many of the most prominent electric roads in the country.

One of the latest improvements of the company in the construction of its trucks is the No. 5 wrought steel cantilever extension truck-frame. It is constructed with the company's patent No. 5 radial gear and elliptic springs, and is designed expressly for single-reduction and gearless motors. Hot rivets are used entirely in the construction of this frame; consequently there are no bolts to become loose and otherwise cause annoyance. These frames are supported upon the journal boxes by "graduated spiral springs," and there is no rubber used whatever in their construction.

Fig. 1, shows a complete truck equipped with the side-frame above described and flexible "cushioned" truck

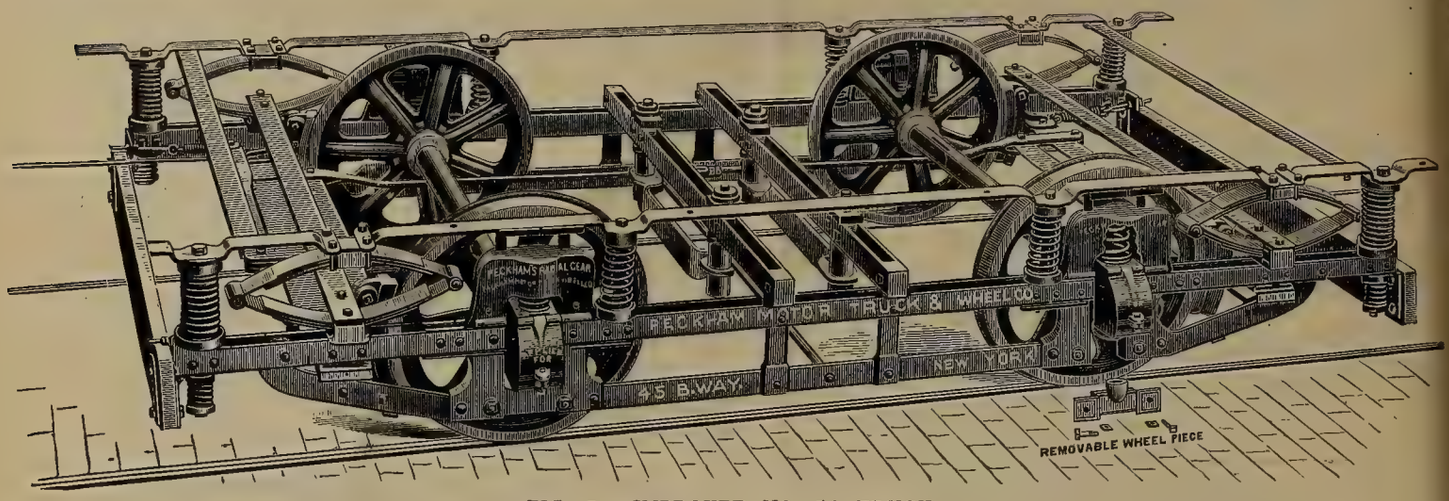


FIG. 1.—IMPROVED NO. 5A TRUCK.

and motor bearings. These are known as 5A trucks. They are guaranteed to prevent oscillation of 28 feet cars, and the graduated coil springs are so graduated and disposed as to give sufficient elasticity to the truck with both light and heavy loads. The springs rest upon ball bearings, which arrangement relieves both the truck-frames and the ball bearings of all side strains.

A ball-and-socket joint is also used in suspending the motor hanger (Fig. 4), so as to afford freedom of motion



FIG. 3.—BROOKLYN CITY R. R. CAR ON PECKHAM'S 5A TRUCK.

to the heel of the motor, and thus keep it in line with the axle. These trucks are also equipped with the company's self-lubricating, dust-tight journal-box, which ef-

fectually excludes dust from the axle bearings, and thus extends their life. The length of the top frame of this truck is 14 feet; of the spring base, 12 feet, 6 inches; and of the wheel base, 6 feet, 6 inches. The trucks are equipped with rigid or interchangeable wheels, as desired. One of them, equipped with Westinghouse single-reduction motors, is represented in Fig. 2. It is used on the Jersey City line and doing excellent service. The dimensions are the same as those given above. The weight of the truck is 3,600 lbs., and that of the motors 5,000 lbs., making the total weight 8,600 lbs.

A car equipped with a Peckham 5A truck is shown in Fig. 3. This car is in operation on the Brooklyn City Railroad Company's lines, and its easy and smooth running and the freedom from oscillation are very noticeable features. The length of the car-body is 20 feet, and the length over all is 30 feet, 5 inches.

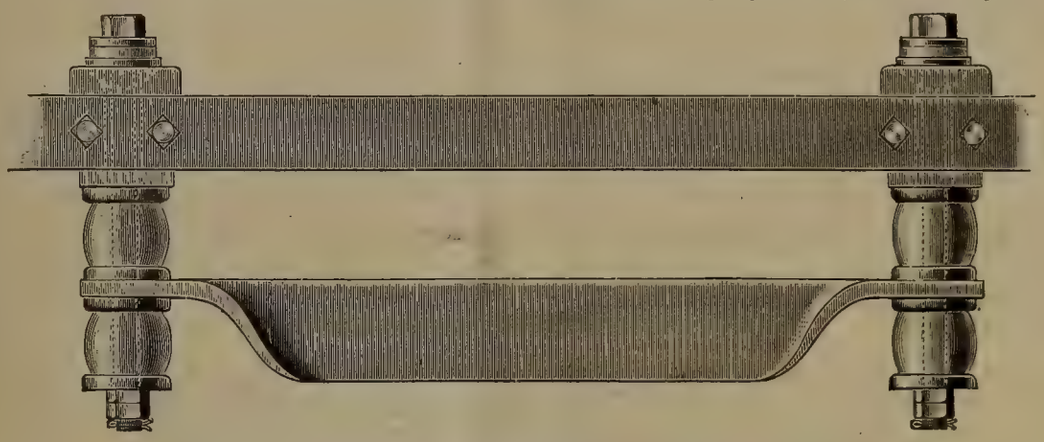


FIG. 4.—RADIAL MOTOR HANGER.

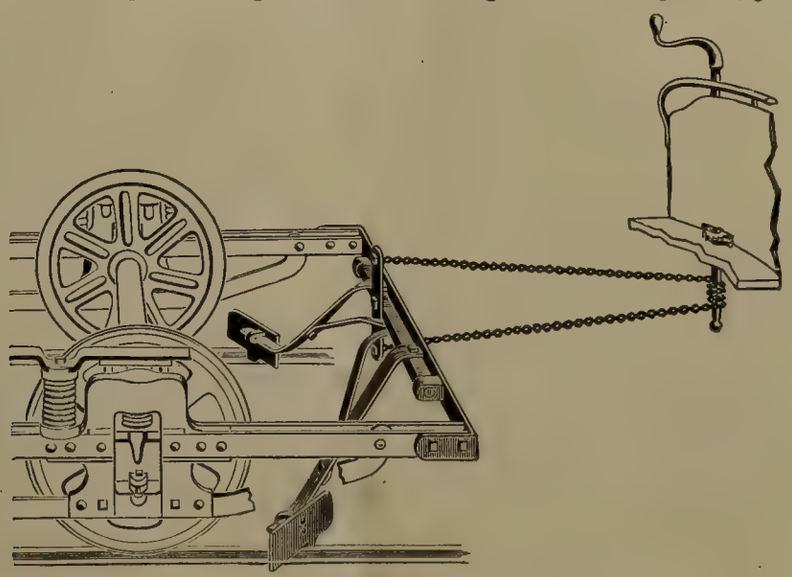


FIG. 5.—"DANDY" TRACK SCRAPER.

Fig. 4, shows the radial motor-hanger, made by the Peckham Company. The motor connecting-bar is suspended from the main supporting steel bars by two suspension bolts, the heads of which rest upon ball-and-socket bearings, which allow the suspension bolts to

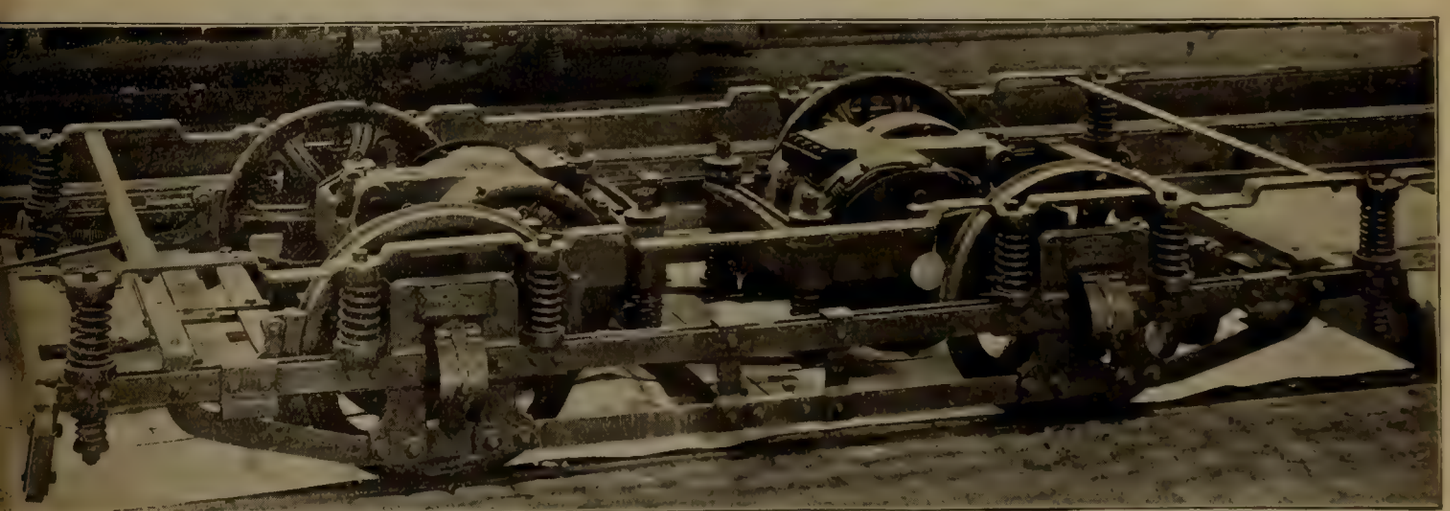


FIG. 2.—NO. 5A TRUCK MOUNTED WITH WESTINGHOUSE S. R. MOTORS.

move freely in any direction, thereby relieving the heels of the motors secured to the motor-bar from all side strains, and insuring a true mesh to the gears.

In the line of car specialties the company has a device that is worth the careful consideration of managers of electric roads. It is the "Dandy" track-scraper, and is said by those who practically use it to be a "dandy" indeed. It is designed expressly for the cantilever truck made by the company, and is claimed to be the only track-scraper secured directly to the truck. It is non-oscillating, always ready for operation, and always in line with the wheels. It is operated from the platform, and can be lowered or raised at will. This scraper is very effective in removing dust, mud, ice or snow from the rails. Its application and operation are clearly shown in the illustration, Fig. 5.

ELECTRIC LIGHT ON A WHALEBACK.

The special advantages of the combination generating set, comprising dynamo and engine compactly erected on one base, described in the ELECTRICAL AGE of December 10, are strikingly displayed in the plant which we illustrate herewith.



WHALEBACK "PILLSBURY."

This plant is the first electrical plant ever placed upon a steamship of the whaleback type, and was installed on the "Pillsbury" when building at West Superior, Wis. Considerations of space entered largely into the question of this installation, and a small room, eight feet square, was all that could be spared. This precluded the employment of a belt-connected plant, and a generating set of the General Electric Company's type was therefore adopted.

The dynamo, of the four-pole type, is of 150 lights capacity, and is directly coupled to a fifteen horse-power engine, both having a common bed-plate. Behind the engine and attached to the wall is the white marble incombustible switchboard. The dynamo-room is located in the after portion of the vessel on the first lower deck.

The vessel is wired in the usual manner, for one hundred and fifty lights, the best grade of wire for marine purposes being employed.

This installation, and that on the sister whaleback, the "Washburn," were effected by the Isolated Lighting Department of the Northwest General Electric Company.

MEASUREMENT OF LIGHT.

A beam of light has two other qualities besides that of illuminating a dark surface. It can easily be shown to possess more or less heat rays; also, that if certain compound substances are interposed in its path chemical decomposition takes place. Were the three portions of the beam, viz., the thermal, the luminous, and the actinic or chemical rays always united in the same proportions, we should have no difficulty in constructing a photometer accurate in its measurements and independent of the want of sensitiveness in the eye; for we could on the one hand use a thermometer, or a thermopile and a delicate galvanometer; or on the other hand a piece of sensitized paper such as is used in photography. But unfortunately the proportions vary considerably.

Tyndall has ascertained, as the result of a long series of carefully performed experiments, that the luminous rays from several sources of light bear but a small proportion to the obscure or non-luminous rays, the exact proportion of the former being, from

An oil flame	3 per cent.
A gas flame	4 " "
A white-hot spiral	4.6 " "
An electric-arc light	10 " "

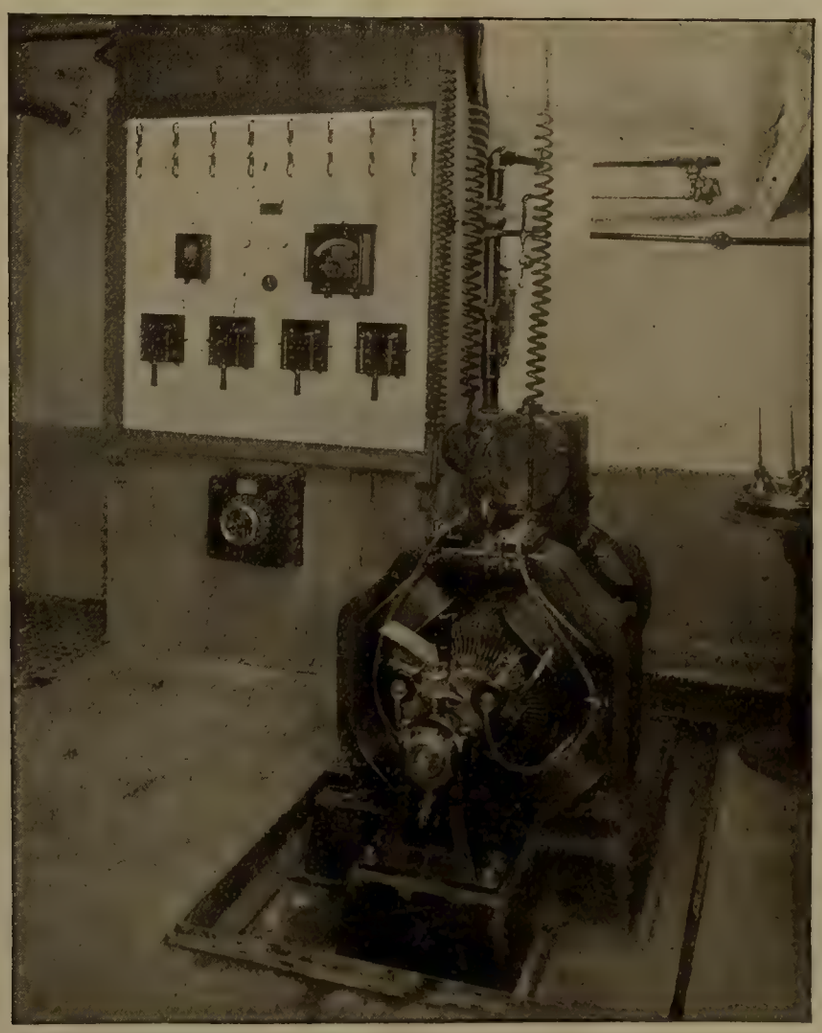
The arc light appears here as the richest in luminous rays; it is also the richest in actinic rays, but the poorest in thermal rays. The various proportions differ, however, to some extent with different carbons, etc. The experiments demonstrate that, if either the thermal or the actinic rays are to be utilized for ascertaining the luminosity of electric lamps, they can only be compared together, or among themselves; they cannot fairly be compared with an oil or gas flame.

WHAT IS FORCE?

Force is commonly defined as that which changes or tends to change a body's state of rest or motion. This comprises all such physical magnitudes as weights, pressure, tension, strains, etc. By the weight of a body we denote the pull exerted by the earth upon it, or by it upon the earth, for these two are equal and in contrary directions. We have noted that, if unopposed, the weight of any body whatever will alter its state of rest or motion in the vertical line by 981 units of velocity per second. Thus the change of motion caused by gravitation is independent of the mass of the body experimented on, but the pull of the earth, or the force of gravitation, is not independent of mass. For all experience shows that if we suspend by a string a small mass, the string assumes a state of tension, which prevents gravitation from causing change of state; but if we suspend a larger mass the string can no longer bear the strain, and breaks, allowing gravity to produce its change of state in the body. We are thus led to see that the description of a force must express the mass of the body as well as the acceleration it will, if unopposed, produce in the body. Thus a force of 10 lbs. must mean a force which would produce in a mass of 10 lbs. the same acceleration as gravity, that is, an acceleration of 32.2 feet per second per second, and this is shown experimentally to be the same as would produce in a mass of 1 lb. an acceleration of 322 (=32.2×10) feet per second per second, or in a mass of 322 lbs. an acceleration of one foot per second per second.

For scientific purposes we take our centimetre, gramme and second as fundamental units of reference, and define our unit force as the force which will produce in 1 gramme unit acceleration, or a velocity of 1 centimetre per second per second. This unit of force we call a *dyne*, and the weight of a gramme in the latitude of Paris and at the level of the sea is 981 dynes.

Work is said to be done whenever a mass is carried through space in opposition to a force. Thus Watt took as standard the work done in raising a pound against the attraction of the earth through 1 foot, and this he called a "foot-pound." It must be noticed that no work is done in moving a body at right angles to the force acting on it, as, for instance, in carrying a body horizontally, unless it be done against the resistance of the air or friction, since, could the body be started on a perfectly smooth and level surface *in vacuo*, it would move on forever without the expenditure on it of any work whatever.



ELECTRIC LIGHT PLANT ON WHALEBACK "PILLSBURY."

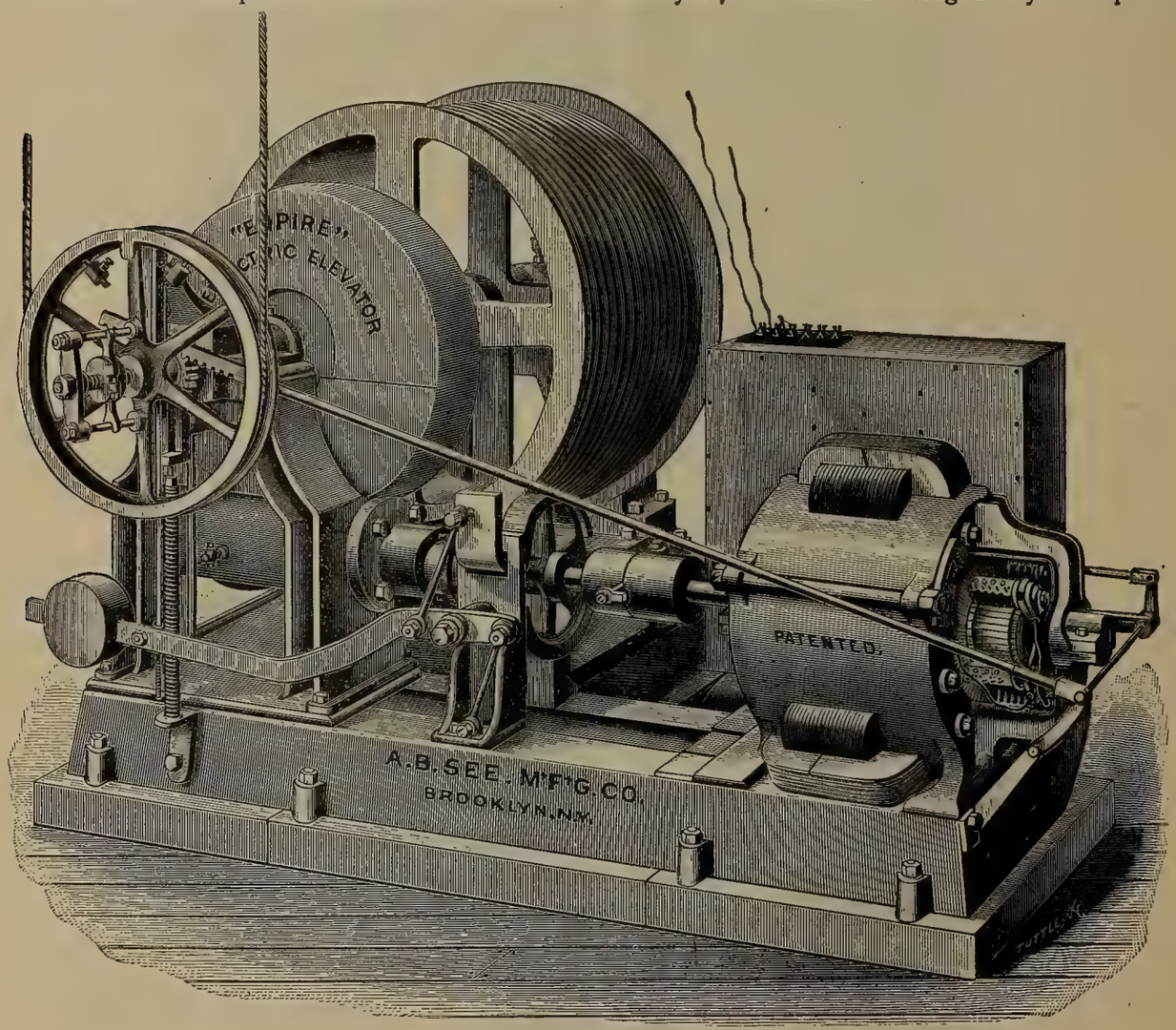
A STRIKE of the telegraph operators on the Chicago, Rock Island & Pacific Railroad was inaugurated on December 8. Members of the Order of Railway Telegraphers, to which the operators belong, assert that the company has been warring against their organization, and that it would not consider a draft of rules submitted by the order. This treatment, it is stated, led to the strike. General Manager St. John, of the railroad company, stated that out of 380 operators east of the Missouri only 38 left their instruments. On the other hand Grand Chief Ramsay of the O. R. T. states that 500 men went out all over the Rock Island system, which is nearly 3,500 miles in length.

"EMPIRE" ELECTRIC ELEVATOR.

The A. B. See Manufacturing Company, of 116–120 Front street, Brooklyn, manufacturer of passenger and freight elevators, has just completed the installation of one of its electric elevators in the Kelly building, corner of Cortlandt and Washington streets, New York, which has been opened as a hotel. An ELECTRICAL AGE representative had the pleasure of running the elevator on the trial trip, and found it a comfort to ride in the car. It started smoothly and evenly, without the slightest perceptible sign of a jar. The electrical part of the machinery is composed of one of the Elektron Manufacturing Company's 7 H. P. motors, connected to the A. B. See Company's rheostat and switch, enclosed in an iron case. The rheostat is composed of a number of coils of wire connected to a number of contact points over which travels a switch. An ordinary wire rope is used for running the elevator. It is connected directly to a special snap-switch of double contact which throws the current in the resistance coils to the motor. The current also passes through a solenoid which in turn operates a switch over the contact points of resistance, gradually cutting the full current into the motor. The elevator runs at a speed of 156 feet per minute.

These elevators are known as the "Empire" electric elevators and are constructed on the best principles known to modern science. The workmanship and material are of the highest character. There is an extra strong iron base to which the machinery is secured, thus keeping all the working parts in line. A central stop is employed that brings the check-rope to a central position in starting and stopping, hence there is no necessity for levers or wheels in the cars, or buzzers, and flashing lights to indicate the position of the switch. The switch-box is of iron, very complete, and with all parts easily accessible. It contains all of the wearing parts and clips that transmit and regulate the current so constructed and arranged as to be easily replaced in a few minutes. A special feature of the elevator is that no matter how quickly or slowly the rope is pulled nor how inexperienced the operator, it will always start and stop smoothly and gradually. As the movement of the switch is automatically controlled by the A. B. See Company's special electrical device, it cannot be thrown partly on or off by the operator.

A very large number of these elevators are already being used in New York and Brooklyn, and the ELECTRICAL AGE representative was shown a number of letters stating that the cost of running an elevator operated by a 7 H. P. motor averaged fifty cents per day.



"EMPIRE" ELECTRIC ELEVATOR.

The "Empire" electric elevators are manufactured solely by the A. B. See Manufacturing Company, under its own patents, and are thoroughly tested before leaving the factory. The company is always willing and pleased to furnish estimates and full particulars relating to the cost and installation of its elevators. Messrs. Alonzo B. See and Walter L. Tyler, C.E., are the members of the company.

EVERY electrician and worker among electrical appliances knows that a reliable non-magnetic watch is a necessity. For many years Paillard non-magnetic watches were too high in price to reach the average wage-earner, but now that they are made at as low a price as a good watch can be sold for they are rapidly coming into public favor. The watch of the future must be exempt from the effects of magnetism. Paillard non-magnetic watches are all that is claimed for them.

DECISION IN LAMP INJUNCTION CASE.

A decision was handed down by the United States circuit court of appeals for this circuit, Judges Wallace, Lacombe and Shipman sitting, on December 15, in the case of the Edison Electric Light Company against the Sawyer-Man Electric Company sustaining the decision of the circuit court granting a preliminary injunction against the Sawyer-Man Electric Company, restraining it from making any incandescent lamps in accordance with Edison's lamp patent No. 223,898.

The decision is as follows:

"United States court of appeals for second circuit—Edison Electric Light Co., Edison General Electric Company, appellees, *vs.* Sawyer-Man Electric Company, appellants.

"This is an appeal from the order of the circuit court granting an injunction, *pendente lite*, restraining the defendant from making, using, or vending the incandescent electric lamps of the patent granted to Thomas A. Edison, January 27, 1880, No. 223,898, of which the complainants are the owners. The order was granted *pro forma*, in the view that a final disposition of the questions involved might be promptly made by the decision of the court.

"The validity of the patent and the infringement of its second claim by such lamps as the defendant makes were adjudged by the circuit court for the Southern District of New York, July 14, 1891, in a decree at final hearing. That suit was brought against the United States Electric Lighting Company, and was defended by the Westinghouse Electric Company, a corporation which since October 10, 1888, has been the owner of the business carried on in the name of the present defendant. The business of the defendant consists exclusively in the manufacture of the infringing lamps. The decree of the circuit court adjudging the validity of the second claim of the patent, and its infringement by lamps such as are made by the defendant, was upon an appeal affirmed by this court, October 4, 1892. That decree among other things awarded the complainant a perpetual injunction. The present suit was brought subsequently.

"It is apparent that the order for the present injunction is in effect one to extend the terms of an injunction already granted in a suit, determined by the court of last resort between the same parties in their privies, so as to include a new infringement."

The decision then recites the various consolidations and absorptions of the interested companies, and continues as follows:

"Pending the suit against the United States Electric Light Company, the Westinghouse Company succeeded to the business of the United States Company, the Consolidated Company and the defendant; and since September, 1888, the defendant has been the manufacturer of lamps for the Westinghouse system. Each of the various companies engaged in the manufacture and sale of electric-lighting apparatus has, as a rule, manufactured all the different pieces of apparatus which are necessary for making up a complete "plant," the different parts being constructed with reference to use with each other, and not so as to be adapted to use in the systems of apparatus made by other manufacturers. For the purpose of public lighting from central stations, local companies, known as the illuminating companies, have been organized in various cities and towns, which have purchased plants from one or the other of the manufacturing companies, and the central stations of such illuminating companies have, as a rule, been equipped wholly with electrical apparatus made by some one manufacturing company. In many cities and towns there are competing illuminating companies using the systems of different manufacturers, some being equipped with the Edison system, some with the Westinghouse system, and some with the Thomson-Houston system.

"The United States Company has installed about 1,050 plants, with lamp capacity of about 350,000 lamps. About 300 of these plants were installed before the suit upon the patent was brought against it. The Consolidated Company also installed a large number of plants. After the Westinghouse Company succeeded to the business of the United States Company and the Consolidated Company, it also installed a large number of plants.

"It is said that the aggregate lamp capacity of the incandescent lighting lamps, installed with generating apparatus supplied by the Westinghouse Company, at the present time represents a capital of about $25,000,000 and a lamp capacity of over 1,300,000 lamps. The lamps themselves represent but a small part of the cost of the plant, the greater part being represented by the electric apparatus supplied by the Westinghouse Company and its predecessors, but the lamps are essential for the continued operation of the plants. Unless the lamps can be replaced as they are worn out and can be procured when needed, these plants will be crippled and the greater part of the investment in them will be lost. The central-station plants supply lights to consumers as gas companies supply gas; and if these operations should be stopped, great inconvenience to the public would ensue. The various companies give employment to a large number of men, who might be thrown out of employment if the lamps could not be obtained.

"In 1889, the Edison General Electric Company was organized for the purpose of combining the Edison Electric Light Company with various other incorporations engaged in the manufacture and sale of electric apparatus, the organization of the subordinate corporations being retained. Prior to April, 1892, the Thomson-Houston Company had acquired the stocks of various other companies engaged in the business of manufacturing and selling electrical apparatus, and these companies were carrying on the business in combination with the Thomson-Houston Company and under its control. In April, 1892, these two combinations, the Edison General Electric Company and the Thomson-Houston Electric Company, included substantially all the companies which had heretofore been competing in this kind of business, except the Westinghouse Company; and in that month the General Electric Company was organized for the purpose of combining these two combinations in one, which should include all the concerns in this country, excepting the Westinghouse Company, which formerly were competing in the business of making and selling electric-light and power apparatus; but separate organizations of the constituent companies were still retained.

"The defendants insist that the preliminary injunction should not have been granted because (1) owing to the laches of the owners of the patent in asserting their claims and forcing them, a large capital has been invested in the manufacture and sale, not only of the lamps, but also in electric-lighting apparatus, which will be greatly depreciated in value unless the lamps can be used with it, and that an injunction will cripple and perhaps ruin the local illuminating companies which have invested in the plants of the Westinghouse companies, if they are prevented from using the lamp of the patents and thereby subject to great inconvenience those whom these plants furnish with light, and displace a large number of persons who are employed in operating the plants; (2) because the complainants and the other corporations with whom the complainants are associated, the competitors of the Westinghouse Company in the business of making and supplying electric power and lighting, have entered into an unlawful combination to stifle competition in that

business, and an injunction will be used unconscionably to further the objects of the combination; and (3) because by reason of the affiliation of the Thomson-Houston Company with that combination, and the prior dealings of that company with the defendant, the Consolidated Company and the Westinghouse Company, an equitable estoppel has arisen by force of which the complainant, as parties of the combination, ought not to be permitted to have an injunction.

"The question whether there has been any laches in asserting the patent was considered by the circuit court of appeals upon the appeal from the decree of the circuit court, and that court declared that no case was shown to authorize the refusal of an injunction on any theory of laches or equitable estoppel by reason of undue delay in bringing suit or acquiescence in known infringement. If the owners of the patent proceeded with due diligence as respects the United States Lighting Company, no other infringers of the patent can be heard to complain with reason that suit was not brought against them upon the patent previous to the adjudication of its validity in the circuit court. It is a matter of notoriety that that litigation was a very expensive and arduous one; and its progress must have been familiar to all those who were extensively interested in having the patent defeated.

"As regards the present defendant, there are no new facts of importance bearing upon the question of laches to distinguish the case from that shown in the former suit. We see no reason for changing the opinion expressed by this court in the former case, and do not deem it necessary, because the same offence has again been urged upon substantially the same state of facts, to add anything to that opinion.

"Every one of the manufacturing corporations, the competitors of the Edison Companies, commenced their operations with a knowledge of the existence of the patent in suit. They were controlled by business men of intelligence and experience. Their promoters and managers may have believed, and probably did, that the patent could not be successfully maintained. But they entered upon the business with an understanding of its risks and of the consequences that would befall them as infringers if the patent should be sustained. None of them can now be justly heard to say that the injunction, which is essential, if not indispensable, to the protection of the owners of the patent and their licensees, ought not be granted because of the great pecuniary loss which may result. If, in consequence of being deprived of the use of the lamps, their investments in other electric apparatus will be greatly depreciated, they must take the consequences.

"The users who have supplied themselves with electric-lighting plants from the infringers which required for their operation lamps of the patent are, of course, infringers. But those who did so before the decision of the circuit court sustaining the patents, and at a time when judicial decisions in foreign countries interpreting the patent were in conflict, and who are now willing to accept their lamps from the complainants upon reasonable terms, have much stronger equities than the manufacturing infringers. These equities the court will not disregard; but what would be reasonable terms if an application were made to the court on behalf of these users is a question which can only be determined in each case upon its particular circumstances.

"As to those users, however, who have acquired these plants subsequent to the decision of the circuit court, if they are deprived of the use of the lamps, and, as a consequence, the value of their plants may be greatly impaired, they must accept the results as a consequence of their own imprudence.

"We are not disposed to investigate upon the present case the character of the combination which has been formed under the name of the General Electric Company. Whether that combination is intended to fetter competition, and is illegal as one in restraint of trade, is a question which we should not undertake to decide upon the evidence before us, and in a suit to which it is not a party. The present complainants are entitled by the patent laws to a monopoly for the term of the patent of the manufacture and sale of lamps made under it; the right of this monopoly is the very foundation of the patent system. They do not lose that right merely because they have joined in a combination with others holding other patents securing similar monopolies, which combination may, when judicially examined in the proper form, be held to be unlawful. We do not feel justified in assuming upon the facts before us in the present suit that the use which the complainants propose to make of the injunction, an injunction which seems necessary to secure their monopoly and make the patent fruitful, would be such as to promote any other monopoly. When it shall be made to appear that some one, to whom in fairness and good conscience these complainants should sell their lamps, has been arbitrarily refused them, save upon oppressive and unreasonable terms, it will be time to consider whether the complainants should be allowed to continue in possession of the injunction.

"The alleged estoppel seems to be far fetched and shadowy. The history which has been given shows that before the Sawyer-Man Company was organized litigation upon the patent ensued and upon the Sawyer-Man patents had commenced; that in 1887 the stock in the Sawyer-Man Company, owned by the Thomson-Houston Company, was sold to the Consolidated Company, a party to the suit, and that subsequently, in 1888, the Westinghouse Company, an actual party to the litigation, bought that portion of the stock from the Consolidated Company which had been owned by the Thomson-Houston company. The estoppel lacks the elements which ordinarily create an estoppel *in pais*, namely, an injury or a harm to one person, resulting from a reliance upon the acts, conduct or declaration of another, in which there was an element of bad faith or wilful neglect of duty. The history of the connection of the Thomson-Houston Company from 1886 to 1888 with the Consolidated Company and with the Sawyer-Man Company shows that all these companies knew of the existence of the litigations in which the life of the present patent and of the Sawyer-Man patents was at stake. There can be no charge of concealment or constructive fraud. When the sale and agreement of 1888 were made there was no implied obligation upon the Thomson-Houston Company to remain in alliance with the Westinghouse system. The contingency that it might enter upon the manufacture of the competing lamps was contemplated. Its union with the Edison interests has neither hastened nor facilitated the application for the present injunction. We perceive no adequate reason from the facts why the complainants should not obtain the ordinary results which attend a complainant's success in a suit in equity for the infringement of a patent.

"The injunction order appealed from should be modified so as to cover only lamps made in infringement of the second claim of the patent, the other claims not having been infringed according to the adjudication of the circuit court or of this court. It should also contain a provision reserving the right to the defendant to move hereafter for the vacation, suspension or modification of the injunction upon proof of specific instances of refusal upon the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case to the owners of electric-light plants which were installed before the rendition of the interlocutory decree of the circuit court sustaining the validity of the patent."

SPECIAL REPORTS.

The matter under this head is prepared for the special information of electrical supply dealers, and is entirely new.

POSSIBLE CONTRACTS.

Riverton, N. J.—The Cinnaminson Electric Company has been organized to supply electric lights for this place and Palmyra.

Brooklyn, N. Y.—A new factory will soon be in course of erection on Rockwell Place, by the Citizens' Illuminating Company.

Jamestown, N. Y.—There is a possibility of the Keystone Electric Company, of Erie, Pa., locating its plant in this place.

Lisbon Falls, Me.—The establishment of an electric-light plant in this place is advocated.

Haverhill, Mass.—The common council has voted for the establishment by the city of one or more plants for the manufacture or distribution of gas or electricity for furnishing light for municipal use, and for the use of such inhabitants as may desire and pay for same.

Rockville, Conn.—The city has appropriated $6,000 for electric lights for the coming year.

Newburyport, Mass.—The Newburyport Electric Light Company is considering the erection of a new plant.

Genesee, N. Y.—The board of aldermen will advertise for electric-light service, the contract to be for two years with privilege of five.

Ambler, Pa.—The Ambler Electric Light, Heat and Water Company has been incorporated with a capital of $15,000.

Wilmington, N. C.—Capt. J. H. Barnard has made application to submit a bid for lighting the city with electricity. If awarded the contract he will erect a plant.

Longview, Tex.—The Electric Light and Power Company will erect an electric plant.

Cayuga, Ind.—A stock company is being organized to establish an electric-light plant to furnish lights for this and neighboring towns.

Bridgeport, Conn.—A corporation is to be organized with a capital of $1,000,000 to generate electricity by water-power. It is proposed to build a dam across the Housatonic River between Oxford and Monroe or Newtown. R. S. Hinman, of Oxford, Conn., acting for the promoters, will apply for a charter.

Seattle, Wash.—The Northwest Fixture and Electric Company has been incorporated with a capital of $20,000. Incorporators: A. L. Kasson, James Campbell, E. G. Sanders, E. C. Kilbourne, James G. Hawkins, Charles Swanberg, John J. Dwyer, D. T. Denny, J. S. Brace, E. B. Burnell, A. J. Stretch.

Brownsville, Ore.—It is proposed to establish an electric-light plant in this place.

Marblehead, O.—Electric lights will be used to illuminate the streets of this town.

Bowling Green, Ky.—A new system of electric lights is wanted.

Raton, N. M.—Fred. Bruggeman purchased at public auction the property, rights, etc., of the Raton Electric Light Company. New machinery will be put in and every effort made to meet the requirements of the growing population.

Westport, Mo.—The city council is considering the question of securing a city electric-light plant.

Nevada, Mo.—The Nevada Light Company has been incorporated with a capital of $100,000 to furnish gas and electric lights. Incorporators: A. E. Stillwell, William S. Taylor, A. A. Mosher, Robert B. Cone, George L. Farrell, F. B. Wilcox, William L. Mott.

Nashville, Ill.—A stock company is being formed in this city for the purpose of establishing an electric-light plant.

Leipsic, O.—This city is advertising for sealed bids for lighting the streets with electricity.

Clyde, O.—The citizens are anxious to have an electric-light plant established.

Cleveland, O.—The question of the city building its own electric plant is being very fully considered.

Llano, Tex.—There is talk of introducing electric lights.

Philadelphia, Pa.—A new building is to be erected at the Reading terminal station, in which will be placed an electric-light plant. Alex. Martin & Son, of Conshohocken, have the contract for the erection of the building.

Pleasantville, N. J.—It is quite probable that an electric plant will be established in this borough.

Wallingford, Conn.—Application is to be made for a charter for an electric-light company which will establish a plant here.

New York, N. Y.—A new four-story brick and terra-cotta pavilion will be erected at Fifty-ninth street and Tenth avenue by the trustees of the Roosevelt Hospital. Lamb & Rich are the architects.

The Corn Exchange Bank will put up an eleven-story building at Beaver and William streets. R. H. Robertson is the architect.

Cleveland, O.—The W. D. Graves Electrical Manufacturing Company has been incorporated with a capital of $25,000 with privilege of increasing to $75,000.

Franklinville, N. Y.—The citizens of this village will vote on the question of adopting electric lights.

Holland, N. Y.—It is quite likely that this village will be lighted by electricity. The tannery people will install a plant, and efforts are to be made to induce them to furnish lights for the village.

Blossburg, Pa.—The erection and operation of an electric-light plant is being agitated.

Rockdale, Pa.—Efforts are being made by the residents of this place to induce the Media Electric Light Company to operate electric lights in the town.

Columbus, O.—It is quite likely that the city will erect its own electric-light plant.

Boyertown, Pa.—The Boyertown Light, Heat and Power Company has been incorporated with a capital of $10,000, for the purpose of furnishing Boyertown with electric lights.

Manville, R. I.—The Contrexville Manufacturing Company is going to put in a new electric-light plant to light part of its mill and dwelling houses.

Luling, Tex.—The prospects for the establishment of an electric-light plant are very bright.

Reading, Pa.—Philadelphia capitalists have secured an option on the Reading and Southwestern Electric Road for $230,000, and on the East Reading Electric Road for $250,000.

Sioux City, Ia.—It is reported that Senator J. D. Yeomans has secured an option of the Sioux City Street Railway, the Leeds Electric Railway and the Riverside line, and has gone east to try to secure the backing of eastern capitalists for the purpose of consolidating the various interests.

Birmingham, Conn.—The Birmingham and Ansonia Horse Railroad Company is going to extensively increase its system in Ansonia.

Marlboro, Mass.—The Marlboro Street Railway Company will extend its tracks.

Milwaukee, Wis.—The Milwaukee Street Railway Company has decided to build the Southside power-house itself.

Providence, R. I.—The Union Railroad Company is looking around for a site on which to erect a new power-house.

Worcester, Mass.—It is quite probable that the Worcester, Leicester and Spencer Street Railway Company will build an electric line to Webster.

Petersburg, Va.—The city is contemplating the erection of an electric-light plant, and desires to secure the service of an electrical engineer who is competent to prepare plans and specifications and details upon which it may solicit bids for the erection of such plant.

NEW ROADS.

Boston, Mass.—William B. Mack, of this city, on behalf of himself and others will petition the legislature for a charter of incorporation under the title of the Bay State Elevated Railway Company, for the purpose of constructing an elevated-railway system.

Brazil, Ind.—An electric street railway will be built to Harmony via Knightsville, Donaldsville and Morgan's Crossing by the Brazil Rapid Transit Electric Street Railway Company.

Chicago, Ill.—The Chicago General Street Railway Company has been organized for the purpose of securing an entrance for several of the new surface roads into the down-town business districts. To effect this the construction of an elevated terminal is talked of. Lyman M. Paine is an incorporator.

Cranston, R. I.—The Union Railway Company of Providence has applied for permission to operate cars by electricity in the town for twenty years.

Detroit, Mich.—Residents in the section northwest of the Grand Trunk and Lake Shore tracks and north of Michigan and south of Grand River avenue have petitioned the city council to advertise a franchise for the construction and operation of a street-car line for their benefit.

Fall River, Mass.—Milton Reed, Benjamin Cook and others have petitioned the legislature for a charter of incorporation for the purpose of building an electric line from this city to Taunton. Mr. Cook is engineering the scheme.

Keokuk, Ia.—A belt line will be built around and through the city by the Keokuk Railway and Improvement Company.

Lewiston, Me.—B. Peck says that he will invest $5,000 in an electric road between this city and Bath.

Marietta, Pa.—An electric railway will be built and operated between this town and Maytown by the Marietta and Maytown Electric Street Railway Company.

Norwalk, Conn.—The Norwalk Tramway Company will petition the general assembly for permission to operate an electric road through the towns of Norwalk, Darien, Stamford, New Canaan, Westport, the city of South Norwalk, the borough of Norwalk, the borough of Stamford and the borough of New Canaan.

Port Huron, Mich.—The construction and operation of an electric street-railway system is being contemplated by Messrs. E. J. Schoolcraft and Wm. L. Jenks, who have received a franchise for the purpose.

Saint Paul, Minn.—The city council has ordered the City Railway Company to build a cross-town electric line, the work to be done next summer and the line to be completed by fall.

Springfield, Mass.—An electric street railway between this place and Thompsonville is projected.

Waverly, N. Y.—Interstate Traction Company. Capital, $20,000. This is the company that will build the projected electric line to connect with a similar one in Pennsylvania.

Wooster, O.—Efforts are being made by eastern parties to secure permission to build and operate a street-railway system.

Worcester. Mass,—The Worcester Traction Company, which has acquired control of several street-railway systems, will expend between $300,000 and $400,000 in changing the lines into trolley roads, and other improvements.

EXTENSIONS.

Akron, O.—The Akron Street Railroad Company has had its charter amended so as to permit of enlarging its system.

Chicago, Ill.—The North Chicago Street Railroad Company has received permission to extend the West Harrison street line.

Lowell, Mass.—The Lowell, Lawrence and Haverhill Street Railway Company has applied for permission to extend its railway into North Andover and Bradford.

Northampton; Mass.—The Northampton Street Railway Company has applied for permission to extend its tracks to East Hampton and other places.

Rockland, Me.—The Rockland, Thomaston and Camden Electric Railroad Company has asked that it be allowed to extend its road up Myrtle street.

INCORPORATIONS.

Chicago, Ill.—Chicago General Street Railway Company. Capital, $3,000,000. Incorporators: Lyman M. Paine, H. L. Burnett, Charles L. Hull.

Columbia, S. C.—Florence Street and Suburban Railway Company.

Denver, Col.—Denver and Globeville Street Railway Company. Capital, $10,000. Incorporators: R. G. Head, J. H. Head, W. S. Renean.

Keokuk, Ia.—Keokuk Railway and Improvement Company. Capital, $1,000,000.

Marietta, Pa.—Marietta and Maytown Electric Street Railway Company. Capital, $24,000.

THREE GOOD BOOKS.

CENTRAL STATION MANAGEMENT AND FINANCE, by Horatio Foster. Price, $1.00.

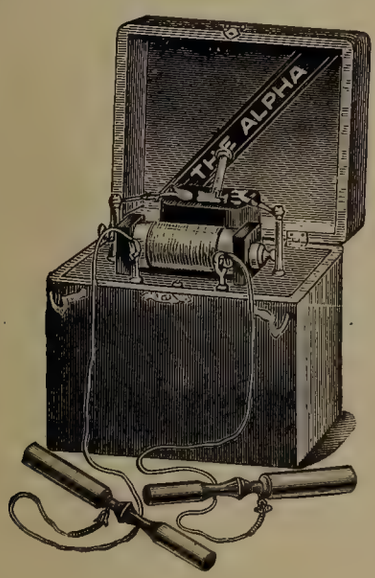
THE ELEMENTS OF DYNAMIC ELECTRICITY AND MAGNETISM, by Phillip Atkinson.

This work covers every apparatus that depends upon dynamic electricity and magnetism for its operation. The title of the book is a misleading one; the book is more practical than the title would indicate. It gives valuable information on most all classes of electrical instruments and machines. Price, $2.00.

DYNAMO CONSTRUCTION, by Urquhart. Price, $3.00.

THE ALPHA FARADIC BATTERY.

The large demand for a reliable faradic outfit at a low cost has led to the production of the apparatus herewith illustrated. It is intended particularly for family use and is so simply constructed that any member of a family can operate it properly. It is contained in an elegantly polished wooden box and all the metal-work is nickel-plated.



GARADIC BATTERY.

The battery is easily and cheaply charged, and when not in use the zinc is withdrawn from the liquid so as to prevent unnecessary waste. Three degrees and classes of current are generated, according to the nature of the case, and the ability of the person to stand the shock. These three currents range from the mild to very strong.

Full directions come with each outfit and it is a very easy matter to get it into operation.

Mr. Henry Schwindt, 610 Eighth avenue, New York city, is the manufacturer of this outfit.

PERSONAL.

Mr. Jared Crane, who was highly recommended by the General Electric Company, has been appointed superintendent of the St. Albans (Vt.) Electric Light and Power Company.

Superintendent William Tracy, of the Alton (Ill.) Gas and Electric Light Works, has resigned his position to accept a similar one at Leavenworth, Kan.

A NEW YORK Safety engine is to drive the electrical plant of the Harlem Wood and Lumber Co., 138th street, New York.

NOTES OF GENERAL INTEREST.

THE ROCKVILLE (CONN.) GAS COMPANY has made a number of extensive improvements to its plant. It hopes to have the incandescent plant in operation by January. The company will do everything possible to afford an excellent arc and incandescent service. The members of the company are interested in various electrical enterprises and provided with plenty of capital.

THE CORNWALL (N. Y.) ELECTRIC LIGHT AND POWER COMPANY has received the contract for lighting the New York, Ontario and Western Railroad Company's new coal docks with electric lights.

C. A. ELLIS, trustee of the Thousand Island Electric Light and Power Company, has issued a notice requesting all persons having claims against the company to present same to him before January 1, 1893.

PERRY (N. Y.) is in the enjoyment of a full and complete electric service.

THE POWER plant of the Jefferson (O.) Light and Power Company is nearly completed, and it is expected to have it ready for operation soon after January 1. The company is already booking contracts for lights.

JUDGE ALDEN, of the district court, Kansas City, Kan., has granted a temporary injunction restraining the mayor and council from entering into an agreement with the Fort Wayne Electric Company for the purchase of an electric-light plant.

THE New York Central and Hudson River Railroad Company is pushing the work of introducing the block-signal system on its road. It was expected that during the present week the entire Hudson River division to Albany would be completed and put into practical operation. Work will be continued west of Albany during the winter, and in the spring it is expected that the equipping of the entire line from New York to Buffalo and Niagara Falls will be completed.

THE electric-light plant at Wellesley, Mass., has been put into regular operation. About 400 25 c. p. lights are used, placed 125 feet apart in the village, and 250 in the outskirts.

WORK is being rapidly carried on with the construction of the electric-light line between Leesville and Moodus, Conn. The capacity of the dynamo which will be placed in the Connecticut Silk Company's mill at Leesville is 1,000 lights.

THE following gentlemen have been elected officers of the Bolton Carbon Manufacturing Company, of North Tonawanda, N. Y.: W. H. Bolton, of Buffalo, president; George P. Smith, treasurer; A. H. Hathaway, secretary.

THE Kingston (N. Y.) board of aldermen recently passed a resolution requesting the mayor to notify the electric-light company to either furnish better light or none at all.

THE Buffalo (N. Y.) board of public works has ordered that three new electric lights be placed at the corner of Main and Seneca streets.

NEARLY all of the poles for the electric light in Amityville, L. I., have been erected, and it will not be very long now before the lights are turned on.

IT is reported that the Rochester Gas and Electric Light Company is doing everything possible to frustrate the success of the new company. One of the provisions of the franchise given the Rochester Gas and Electric Light Company is that a new company shall enter into an agreement with the then existing companies to remove such poles as may be necessary so as to maintain one line of poles. The old company recently cut down a number of its poles so as to compel the new company to erect poles of its own.

THE Westinghouse Electric Light Company has nearly completed the wiring of the eastern section of York, Pa., and are working westward. The work will soon be finished throughout the entire city and the lights turned on.

A CONTRACT has been left for the installation of an electric-light plant in the opera house block, Denver, Col.

IN compliance with the order recently issued by Mayor Grant to cut down all electric-light wires left above ground in violation of the law, workmen commenced on the wires of the Mount Morris, Thomson-Houston, Brush and United States Electric Light companies. When informed of what was going on, the Thomson-Houston Company through its counsel, ex-Judge William H. Kelly and Supt. E. E. Dexter, called on the mayor and complained against the action. A consultation was held with expert S. S. Wheeler and Inspectors Burke and Brown. A rather lively time ensued, and after order had been secured the suggestion of the mayor that about a dozen of the Thomson-Houston wires be temporarily exempted from the order was agreed upon. Ex-Judge Kelly said that the Thomson-Houston Company was continually bothered by the inspectors, while the Western Union and Postal Telegraph companies were left undisturbed, and that he considered it blackmail. Subsequently Mr. Wheeler informed the mayor that the Thomson-Houston Company was the most flagrant violator of the board's rules, and had fewer miles of wires in the subways and more improper and dangerous wires overhead than any other company. He also said that Judge Kelly's statement as to having permission from the board of fire underwriters to string wires over roofs was positively untrue. The mayor then directed the company to remove the lamps in Twenty-fourth street and remedy the violations complained of. Meanwhile Commissioner Gilroy was directed not to proceed against the company while a remedy was being effected.

OBITUARY.

GEORGE H. MEEKER.

Mr. George H. Meeker, the well-known Western manager of the New York Insulated Wire Company, died at his home in Chicago on December 5. Mr. Meeker attended the funeral of his grandfather in Astoria, L. I., on November 26 last, and there contracted a cold which eventually resulted in his death. He was 28 years of age and leaves a widow. Mr. Meeker had a very large circle of friends in the electrical trade, all of whom will be pained to learn of his death.

M. M. M. SLATTERY.

Marmaduke Slattery, the inventor of the Slattery Induction System of electric lighting, died at Fort Wayne, Ind., on December 14. It is said that he received a royalty of $10,000 a year for the use of his system.

ANNIHILATION OF TIME.

The general public outside of the commercial world has but a very vague conception of the important functions performed by the transatlantic cables in bringing the various parts of the globe into close relationship. Distance is practically annihilated, and there is not to-day a place on the face of the civilized portion of the globe that is not within a few hours' communication of New York. A spirit of rivalry exists between the different cable companies in the matter of speedy transmission of messages, and a recent instance of the elimination of time through the agency of the Direct United States Cable Company reflects greatly to the credit of the enterprise of Mr. James Brown, the New York superintendent, who has brought the service of this company to a state of perfection.

On this occasion The United Press filed a message of inquiry with the New York office, at 40 Broadway, addressed to the Central News, London, and in exactly ten and one-half minutes afterwards the reply was handed General Manager Phillips. There have been times when quicker transmissions have been recorded, but that was when special arrangements have been made. It is a question, however, as to whether this achievement on the part of the Direct Cable Company has ever been equalled in the ordinary course of transmission.

MONTREAL'S ELECTRIC LIGHTS.

Mr. A. J. Corriveau, of Montreal, Can., in a recent interview concerning the proposition of the city council to renew the contract for the lighting of the streets with the Royal Electric Company without inviting tenders, said that he thought the council should go into the matter thoroughly. While the Royal Company had the advantage of having its plant already installed, yet notwithstanding there were other companies who would unquestionably be willing to enter into competition. In reply to a question as to the feasibility of utilizing the Lachine Rapids to develop power for the supply of light and power for use in the city, Mr. Corriveau said that it would be a grand scheme, but that he was sorry to say he believed it far distant. There were many difficulties in the way that would have to be overcome.

Mr. Corriveau does not believe in the city of Montreal owning its own electric plant. The experience of various cities in the United States, he said, had shown conclusively that they could be more economically carried on by private enterprise.

ELECTRICAL SOCIETIES.

BUFFALO ELECTRICAL SOCIETY.

At a meeting of the Buffalo Electrical Society, held December 5, Mr. P. K. Stern read an interesting paper on electric heaters. The attendance at this meeting shows that the society has opened the season with its old-time enthusiasm.

At the next meeting Mr. Frank Kitton will deliver a lecture on magnetism, and at a subsequent meeting A. C. Terry will lecture on the subject of electric motors, treating the subject in a popular and elementary way.

The society is considering the project of a series of lectures on electrical engineering, known as the University Extension Course. The members of the Buffalo Society of Natural Sciences are very much interested in this course of lectures, and the prospects are that the plan will be eminently successful. The lectures will be delivered by one of the best electrical engineers in the State.

The following officers have been elected for the year 1892–1893: President, Frank Kitton; vice-president, P. K. Stern; secretary, Astley C. Terry; treasurer, Samuel Stewart; librarian, John G. McNerny. Executive committee: Frank Kitton, A. C. Terry, F. P. Jones, John P. Chapin, P. K. Stern, Samuel Stewart, F. A. Hallock, Geo. A. Burnett.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The seventy-second meeting will be held at the headquarters of the Institute, 12 West Thirty-first street, Wednesday, December 21, at 8 P.M. The change from the usual meeting night of Tuesday has been made in order to permit suitable preparations.

The paper for the meeting is entitled: "Seven Years' Experience in Armature Insulation," by Mr. Edward P. Thompson, member, for Mr. Charles W. Jefferson.

There will be exhibits illustrating the steps in the manufacture of armatures and the results obtained. The author suggests the following topics for discussion in connection with the paper :

SUGGESTIVE TOPICS.

Armature.—Rigidity and its dependence upon insulating material employed. What has been learned by observation and special tests ?

Preservation of Insulation.—Is it better to try to remove the cause of heating, or to neutralize the heat ?

Burning Out Armatures.—What does insulation have to do with it, and what are the remedies ? Also, what are the causes ?

Durability of Insulation.—Differences in connection with armatures for inside use, such as installations, and outside, *i.e.*, railway, mining and elevator use. Effects of atmosphere, motion and rough treatment.

Financial.—Does the expense of insulation, if the best, have an appreciable effect upon the cost of construction, and, on the other hand, will it pay in the end to put in a cheaper material ?

Comparative Merits of Insulating Materials for Different Conditions.—Effects of high potential. Power to resist spark-puncturing. What have tests shown as to properties of materials to withstand "breakdowns" independently of high ohmic resistance ?

The discussion will be opened by Messrs. W. J. Hammer and Harold Binney.

Dr. J. B. Williams will also make comparative tests of different samples of insulating material considered suitable for this class of work, and manufacturers and dealers are invited to send specimens to the secretary, which should be about two inches square and one-sixteenth inch thick, or less.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, December 17, 1892.

MR. HERMANN AICH, 43 Murray street, carries a large stock of enamelled reflector shades and hoods for incandescent and arc lights. They are made of thin steel, enamelled in different colors and are extremely durable. Special sizes or shapes can be made after design. The enamel is easily kept bright and clean and never loses its color or brilliancy.

P. CLAUS & Co., 357 West 40th street, have just sold two of their bi-polar dynamos to go in a lumber yard in East Liverpool, Mich. Mr. Claus has just returned from the west. He recently sold a 200-light machine to Blodgett Bros., Boston, and while west he sold 3 bi-polar dynamos of an aggregate capacity of 900 lamps.

MR. WILLARD W. LOW, president of the Electric Appliance Co., 242 Madison street, Chicago, was in the city last week.

MR. ROBERT WATSON, manager of the New York office of the Elektron Manufacturing Company, 89 Liberty street, is meeting with unusual success in the sales of the popular dynamos and motors manufactured by his company. The demand for them is phenomenal, and he has all he can do to keep pace with the orders received. One of the Elektron dynamos has recently been installed by Mr. Rousseau, electrical engineer, of Mott Haven, in the residence of Mr. G. P. Morisini, the well-known banker, to run several hundred 16-c. p. lamps. The power will be furnished by one of the Priestman oil-engines made in Philadelphia, Pa. Mr. Rousseau first made an experiment with a similar plant in his factory in Mott Haven, and is said to be lighting it at a cost of one cent an hour for 7 lamps. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE.

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Dist. Tel., N. Y.	3,825,000	100 00	56 00
American Telegraph and Cable	14,000,000	100 00	85 00
American Visual Telegraph Co.	500,000	100 00	†75 00
Bell Telephone	17,000,000	100 00	209 50
Bell Telephone 7s	2,000,000		*113
Boston Electric Light Co	1,500,000	100 00	118 00
Brooklyn Edison Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light, 5s	500 000		*100
Brooklyn Citizens' Electric Light	500,000	100 00	140 00
Brooklyn Municipal Light	500,000	10 00	16 00
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Ill., N. Y.	1,000,000	100 00	30 00
Brush Elec. Ill., 6s, N. Y	300,000	100 00	*102
Brush Elec. Co., Parent		50 00	40 00
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Chattanooga Elec. Lt. Co., Tenn., 6s	200,000		*101
Chattanooga Elec. Lt. Co., Tenn.	100,000	100 00	92 75
Chicago Gas	25,000,000	100 00	99 50
Columbia Chronophone	500,000	25 00	35 00
Commercial Cable Co	7,716,000	100 00	175 00
Cons. Gas Co., N. Y.	35,430,000	100 00	123 00
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Detroit Elec. Lt. & P. Co	300,000	25 00	14 00
Detroit Elec. Lt. & P. Co. 6s	300,000		*101
Detroit Electrical Works	1,000,000	10 00	4 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
Edison Elec. Ill. 5s, N. Y.	3,050,000		*109
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Elec. Illuminating, N. Y.	6,500,000	100 00	111 00
Edison Electric Light Co., Phil	2,000,000	100 00	105 00
Electric Protection Co., N. Y.	100,000	100 00	75 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Electrical Forging Co	2,000,000	100 00	85 00
Elmira Municip. Imp. Co., 5s	1,800,000		par
Erie Telephone	4,800,000	100 00	49 50
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Franklin Electric Co. N. Y.	5,000,000	100 00	†83 00
Fremont E. L. & P. & Gas Co., O.	95,000	100 00	102 50
General Electric Co.	50,000,000	100 00	113 75
General Electric Co., 5s	4,000,000		*101
General Electric pref.	4,223,700	100 00	116 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guarantee Identification Co., N. Y.	50,000	50 00	40 00
Hickory Electric Co., N. C.	12,000	100 00	112 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Laclede Gas Co	7,500,000	100 00	24 50
Laclede Gas pref.	2,500,000	100 00	71 00
Laclede Gas 5s	10,000,000		*85
Law Telephone	400,000	100 00	96 00
Livingston E. Lt. Co., Mont., 6s	30,000		*92
Marshalltown Elec. Co. 6s, Iowa	65,000		*98
Marysville L. & W. Co. 6s, Ohio	60.000		*98
McLeod Railway Equip. Co	3,000,000	25 00	35 00
Metropolitan Elec. Signal Co., N. Y.	1,500,000	100 00	35 00
Metropolitan T. & T., 5s	2,000,000		*103
Metropolitan Traction			138 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	101 0
Nat'l Elec. Manuf. and Const. Co., N. Y.	50,000	100 00	101 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	59 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock	2,535.000	100 00	98 25
N. Y. Storage Battery	100,000	100 00	96 00
North American Railway Co	39,767,200	100 00	12 00
Postal Telegraph	10,000,000	100 00	81 00
Peninsular Elec. Lt. & P. Co., Va.	30,000	10 00	9 50
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Rockaway Elec. Light	50,000	100 00	40 00
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Suffolk Electric Co., Boston	300,000	10 00	10 50
Swan Incandescent	800,000	100 00	6 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	1,900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	115 00
The Ongley Electric Co., N. Y.	250,000	100 00	85 00
The Siemens & Halske Co., Ill.	500,000	100 00	par
The Washington Wat. Pow., Wash.	1,500,000	100 00	90
The Wells & French Co., Ill.	600,000	100 00	par
T.-H. Electric Co. 5s, N. Y.	500,000	30 00	*101
U. S. Rubber Co.	13,481,000	100,00	43 00
U. S. Rubber Co. pref. 8s	12,942,500	100,00	98 50
Western Union	100,000,000	100 00	94 75
Westinghouse Elec. & Manf. Co.	7,000,000	50 00	33 00
Westinghouse Elec. Co. pref. 7s	4,000,000	50 00	49 50
West Point W. Lt. & P. Co., Va.	25,000	100 00	101 00

*Per cent. †Registered stock.

A WELL LIGHTED ESTABLISHMENT.

What is said to be one of the finest illuminated stores in the city of New York is that of B. Altman & Co., 6th avenue, 18th and 19th streets. About a year ago the Clark Electric Company, of 192 Broadway, New York, placed in the above store, two arc lamps for the purpose of showing the Altman people what could be accomplished in the way of superior electric lighting. This firm had formerly been using incandescent lights, but so pleased were they with the success of the Clark lamp, after having given it an exhaustive test of six months duration in competition with lamps of other makes, that they gave the Clark Electric Company a contract to supply lamps for the entire building.

They have just completed the installation of the main floor consisting of 27 arc lamps of ornamental design giving an illumination of over 40,000 C. P., well distributed throughout the floor. Work on the remaining floors is being pushed with all possible speed. The current for the lamps is supplied from the Edison Electric Illuminating Company's subway on Sixth avenue. With the aid of these lights the various goods are shown off to the best advantage and can be inspected as well as by daylight. The cost between this style of illumination and that of gas or incandescent lights is said to be about as 15 to 1.

HARRISBURG IDE AND IDEAL ENGINES.

Messrs. W. R. Fleming & Co., whose offices are in the Mail and Express building, New York city, and who are contractors for steam-power plants for electric light and railway service, also representing the Harrisburg Foundry and Machine Works, Harrisburg, Pa., who build the celebrated "Ide" and "Ideal" engines and horizontal steel boilers and steam road-rollers, have contracted for over 2,500 H. P. of engines during the past 30 days, among which are the following plants :

A 1,000 H. P. plant for electric-railway service at New Britain, Conn., for which they are building two 500 H. P. tandem-compound special railway engines of the "Ideal" self-oiling type.

Two simple Ideal engines for electric-railway service for the Second avenue surface railroad in New York city. These engines are arranged for direct-connected multipolar dynamos, similar to the four-unit plant being installed in the new Mail and Express building, New York.

They are now getting ready for export two tandem-compound "Ideals," of 225 H. P. each, to be shipped to Porto Rico, West Indies.

The new Y. M. C. A. at Hartford, Conn., are putting in simple engines of the same type for use in lighting their building in connection with the apparatus of the Edison Company.

The Hotel Beresford is being equipped with the same engines, and one has just been shipped to Rochester for the Rochester Car Wheel Works.

Two standard "Ideal" engines, of 175 H. P. each, have just been ordered by the United States government for service in dredging work at Portland, Ore.

The above report shows a steady increase in the business of W. R. Fleming & Co., and speaks well for the future of this firm's trade, as well as positive merit of the Harrisburg Ide and Ideal engines.

QUEEN & CO.'S TESTING SETS.

Queen & Co., Philadelphia, are meeting with great success in exploiting their standard portable testing sets.

One purchaser says: "The portable testing set referred to has been in use constantly since we received it, and we find it to be first-class in every respect.

"Have used it on all kinds of work, for both high and low measurements, and think it is about as complete an instrument of the kind as I have ever used."

Another writes: "In answer to your inquiry under date of Nov. 21, would say that testing set No. T 305, marked 487, has given us most satisfactory results, and we feel thoroughly satisfied with it in detail.

"It has won our confidence to the extent that we accept it as a standard, not only as a portable instrument, but in a greater share of our laboratory work and electrical measurements.

"It is correct to within a small degree, easily manipulated, and results quickly obtainable; and can say that we do not know of one single point left to be desired in this instrument for an instrument of this nature."

These instruments are made in a strictly first-class manner, and are adapted for use under the most exacting conditions, such as in a man-hole or close to dynamo machinery.

They are fully described in circular No. 285, issued by the makers.

TRADE NOTES.

The Globe Electric Cordage Works, Philadelphia, Pa., has disposed of its plant, including machinery, materials, patent rights, etc., to Alfred F. Moore, Third and Race streets, Philadelphia.

Taylor, Goodhue & Ames, 827 Monadnock Block, Chicago, general selling agents for Burton electric car heaters, have issued a neat pamphlet describing the Burton heater and its application to the heating of electric cars, and also giving a long list of testimonials from users of the heaters.

P. Claus & Co., 357 West 40th street, New York city, have issued a neat catalogue describing the bi-polar dynamo that they make, and giving a great many testimonial letters regarding the excellent merits of the machine. From these it is evident that this dynamo is an excellent machine.

The Trenton Brewing Co. has installed an Edison plant with a New York Safety engine.

The New York Safety Steam Power Co. has just shipped a 50 H. P. high-speed engine to the Tojo Mining Co., Mazatlan, Mexico, for driving a dynamo for mine lighting.

The Electrical Age's Illustrated Record of Patents.

Issued December 13, 1892.

487,703. Electric Meter. Charles W. Ayton, New York, N. Y. Filed Dec. 5, 1891.

487,735. Conduit for Electric Railways. John W. Hayden, Fort Wayne, Ind. Filed Jan. 16, 1892.

487,752. Contact-Rail. Frank E. Kinsman, Plainfield, N. J. Filed Feb. 23, 1892.

487,755. Armature for Electro-Magnetic Machines. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Feb. 5, 1892.

487,795. Multiple-Switch board Signal. Giles Taintor Keene, N. H., assignor, by mesne assignments, to the

PATENTS—Continued.

Western Electric Company, of Illinois. Filed April 7, 1892.

487,796. System of Electrical Transmission of Power. Nikola Tesla, New York, N. Y., assignor to the Tesla Electric Company, same place. Filed May 15, 1888.

487,808. Trolley-Catcher. Joseph Werling and James F. Agnew, Minneapolis, Minn. Filed Feb. 25, 1892.

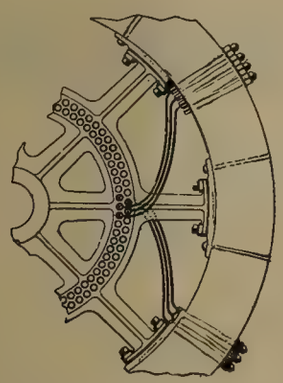
487,813. Electric-Railway Trolley. Adolf Wörner, Buda-Pesth, Austria-Hungary, assignor to Siemens & Halske, Berlin, Germany. Filed Feb. 3, 1892. Patented in France; in Germany and in England.

487,816. Automatic Safety Device for Dynamo-Electric Machines. Francis B. Badt, Chicago, Ill. Filed Feb. 19, 1892.

487,834. Manufacture of Secondary-Battery Electrodes. William W. Griscom, Haverford, Pa. Filed Sept. 30, 1892.

487,839. Galvanic Battery. Harry T. Johnson, New York, N. Y. Original application filed July 22, 1891. Divided and this application filed April 1, 1892.

487,846. Casing for Bases of Incandescent Lamps. George R. Lean, Boston, and Charles B. Burleigh,



487,755.—ARMATURE FOR ELECTRO-MAGNETIC MACHINES.

Chelsea, Mass., assignor to the Bernstein Electric Company, of Maine. Filed Nov. 27, 1891.

487,852. Multiple-Switchboard Circuit. Alfred H. McCulloch, Boston, Mass., assignor, by mesne assignments, to the Western Electric Company of Illinois. Filed March 9, 1892.

487,853. Multiple-Switchboard Busy-Test Circuit and Apparatus. James L. McQuarrie, Boston, Mass., assignor, by mesne assignments, to the Western Electric Company, of Illinois. Filed April 7, 1892.

487,854. Busy-Test Apparatus for Multiple Switchboards. James L. McQuarrie, Boston, Mass., assignor by mesne assignments, to the Western Electric Company, of Illinois. Filed April 7, 1892.

487,890. Manufacture of Incandescent Electric Lamps. Casimir Pauthonier, Boston, Mass., assignor to Adolph Ladenburg, New York, N. Y., and R. T. McDonald, Fort Wayne, Ind. Filed April 20, 1892.

487,915. Means for Bending Electrotype-Plates. Calvert B. Cottrell, Westerly, R. I. Filed Sept 22, 1892.

487,936. Automatic Keyboard-Operator. Henry S. Prentiss, Elizabeth, N. J. Filed June 19, 1891.

487,977. Lamp-Hanger. George Albee, Susquehanna, Pa. Filed Nov. 18, 1891.

487,981. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed Nov. 10, 1888.

487,982. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed April 24, 1890.

487,983. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed April 29, 1890.

487,984. Synchronous Multiple Telegraph. Charles L. Buckingham, New York, N. Y. Filed April 30, 1890.

487,985. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed Dec. 11, 1889. Renewed June 24, 1892.

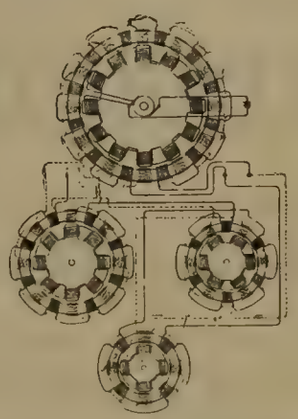
487,986. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed April 25, 1890. Renewed June 24, 1892.

487,996. Electrolytic Apparatus. Thomas Craney, Bay City, Mich. Filed Jan. 4, 1892.

488,002. Lightning Arrester. William R. Garton, Keokuk, Iowa. Filed July 11, 1892.

488,012. Electric Gas-Lighter. Lucien M. Kilburn, Council Bluffs, Iowa, and Scott Van Etten, Omaha, Neb. Filed March 21, 1892.

488,013. Electric Belt. Ole Kjorstad, Eau Claire, Wis. Filed May 11, 1892.



487,796.—SYSTEM OF ELECTRICAL TRANSMISSION OF POWER.

488,016. Armature for Electric Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 8, 1892.

488,022. Electric-Railway Trolley. David Mason, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Filed Nov. 11, 1889.

488,023. Electric-Railway Trolley. David Mason, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Filed March 3, 1890.

488,027. Electric Coupling. John J. Purcell, Washingington, D. C., assignor of one-half to William H. Allen, same place. Filed June 18, 1892.

488,033. Spring-Jack Switch. Charles E. Scribner and Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 3, 1888.

488,034. Means for preventing Induction in Cables of Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 5, 1892.

488,035. Multiple-Switchboard System for Telephone

PATENTS—Continued.

Exchanges. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 17, 1892.

488,036. Multiple-Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 16, 1892.

488,037. Telephone-Switchboard Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 16, 1892.

488,038. Multiple-Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 18, 1892.

488,041. Electric Motor. Imle E. Storey, Boulder, Col., assignor to the Storey Electric Drill and Power Company. Original application filed Feb. 4, 1892, Divided and this application filed June 9, 1892.

488,046. Insulator. Charles Wirt, Chicago, Ill. Filed Jan. 4, 1892.

488,053. Test-Circuit for Multiple Switchboards. Ora A. Bell, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed March 12, 1891.

488,064. Magnetic Separator. Harvey S. Chase, Boston, Mass., assignor, by mesne assignments, to the International Ore Separating Company, of New Jersey. Filed Jan. 29, 1892.

488,107. Time-Meter for Electric-Lighting Systems. Judson O. Ball, Mount Pleasant, Iowa. Filed Feb. 20, 1892.

488,121. Automatic Regulator. Edward J. Houghton and William White, London, England. Filed March 26, 1892.

488,123. Electrical Safety Cut-Out. Henry S. Keating, London, England. Filed Aug. 31, 1892. Patented in England.

488,138. Electric Signal-Circuit. John V. Young, Boston, Mass., assignor to the Union Switch and Signal Company, Swissdale, Pa. Filed June 29, 1892.

488,139. Incandescent Lamp. Eugene W. Applegate, Omaha, Neb., assignor to the Applegate Electric Light and Power Company, Chicago, Ill. Filed April 7, 1892.

488,141. Process of Insulating Electric Conductors. Charles Cuttriss, New York, N. Y., assignor to the Knudson-Cuttriss Wire Company, Limited, of New York. Filed Jan. 20, 1892.

VULCANIZED FIBRE COMPANY,

Established 1873.

Sole Manufacturers of HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

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ELECTRICAL AGE

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A HAPPY NEW YEAR.

The ELECTRICAL AGE wishes all of its friends a happy and prosperous new year. To those who do not feel over-sanguine as regards the outlook we wish to say that, if they are not already subscribers to the ELECTRICAL AGE, their lot will be greatly lightened and the future will look more cheerful if they will subscribe for the ELECTRICAL AGE and read it.

ELECTRIC MAIL SERVICE.

The post-office department has decided to make a practical test of a new method of mail transportation between the main post-offices in New York city and Brooklyn. It consists essentially of a tube in which a carrier is operated by electricity on the trolley system. The carrier will transport a mail pouch between the two offices at a speed on thirty or forty miles an hour in practice, and the switching and stopping will be done automatically. The tube, which will be sixteen inches square, will be suspended from the elevated railroad structure in Brooklyn and run across the bridge, thence to the New York office. The invention is of Mr. A. Bryson, of New York, and he sees no reason why it will not work. It is expected to have the system ready for test about April 1 next.

PHILADELPHIA.

If any one labors under the impression that electrical enterprise in Philadelphia is asleep he is greatly mistaken. In this issue we show up many of the electrical establishments of Philadelphia in their true colors, and the colors are true in more than one sense of the word. Philadelphians do not make much fuss in doing business, but somehow or another they keep to the front.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

We are informed by Secretary Porter, of the National Electric Light Association, that no exhibition will be held under the auspices of the association during the next annual convention, which will be held in St. Louis, February 28, March 1 and 2, 1893. There is no doubt, however, that many supply houses will make exhibits on their own account.

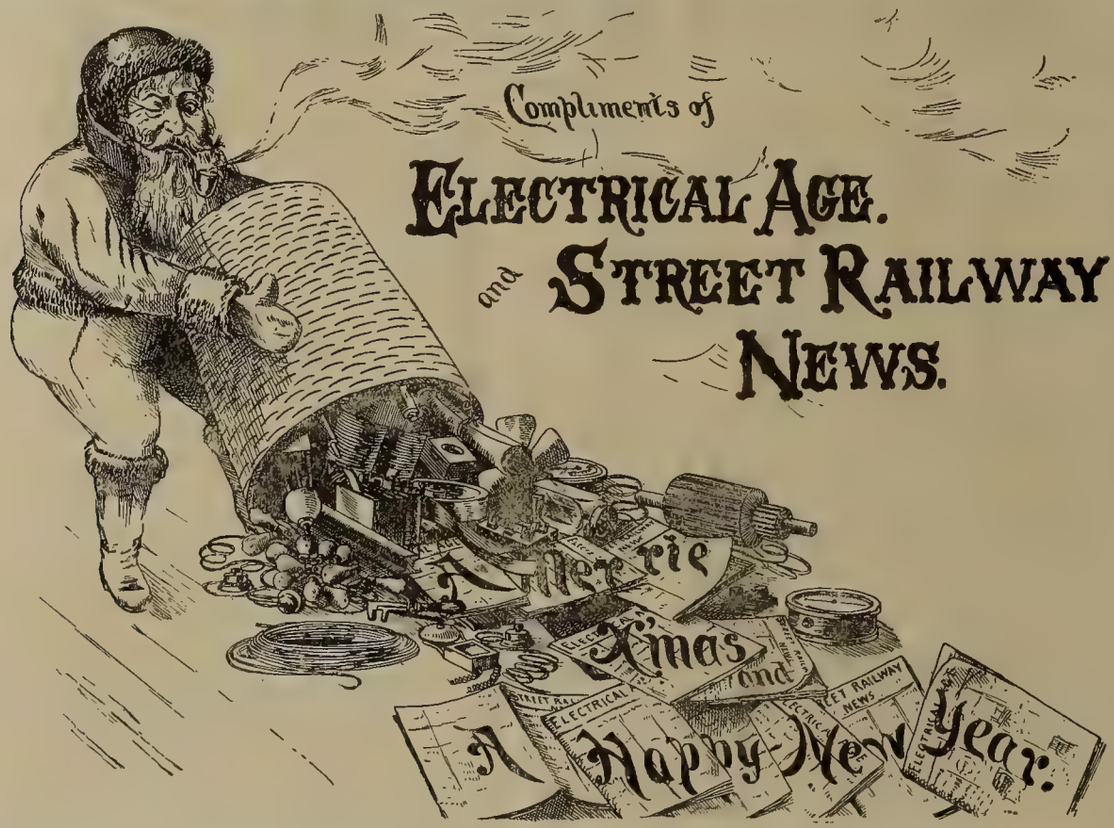
ELECTRICAL EXECUTION.

The 10th execution of the death penalty by electricity took place in Sing Sing prison on December 19, and, it is said, was the most successful of all. The victim was Frederick McGuire, who murdered Mrs. Amelia Gregory, at Middletown, N. Y., in October, 1891. The current with a pressure of 1,800 volts was turned on at 11:11 A.M. and continued for 8 seconds, then reduced to 150 volts. The object of reducing the intensity of the current gradually was to keep the muscles rigid and prevent a collapse of the body. The full current was afterwards applied for 8 seconds more, and McGuire was pronounced dead. There was no steaming or burning of flesh in this instance, and the physicians state that the man was rendered unconscious instantly and that he died in 12 seconds.

THE NOVELTY ELECTRIC COMPANY.

Few electrical concerns surpass in magnitude and reputation the Novelty Electric Company, of 54 North Fourth street, Philadelphia, manufacturer of dynamos, motors and electrical instruments and supplies of every description.

In the engine-room is one 50 H. P. Green-Corliss engine which supplies the power for manufacturing purposes as well as driving a Ball dynamo, with a capacity of 20 arc lights, and two of the Novelty Electric Company's incandescent dynamos. In addition to the latter two machines there is another incandescent dynamo in the factory, also used for lighting, making the total number of dynamos used for lighting purposes 3 incandescent and 1 arc.



OUR GREETINGS.

Fig. 1 gives a view of the engine-room, showing the Green-Corliss engine, and the Ball dynamo at the right.

The company uses 75 incandescent and 20 arc lamps in lighting its offices and factory. A view of the offices and ware-rooms is given in Fig. 2, from which a good idea of the extent of the company's establishment may

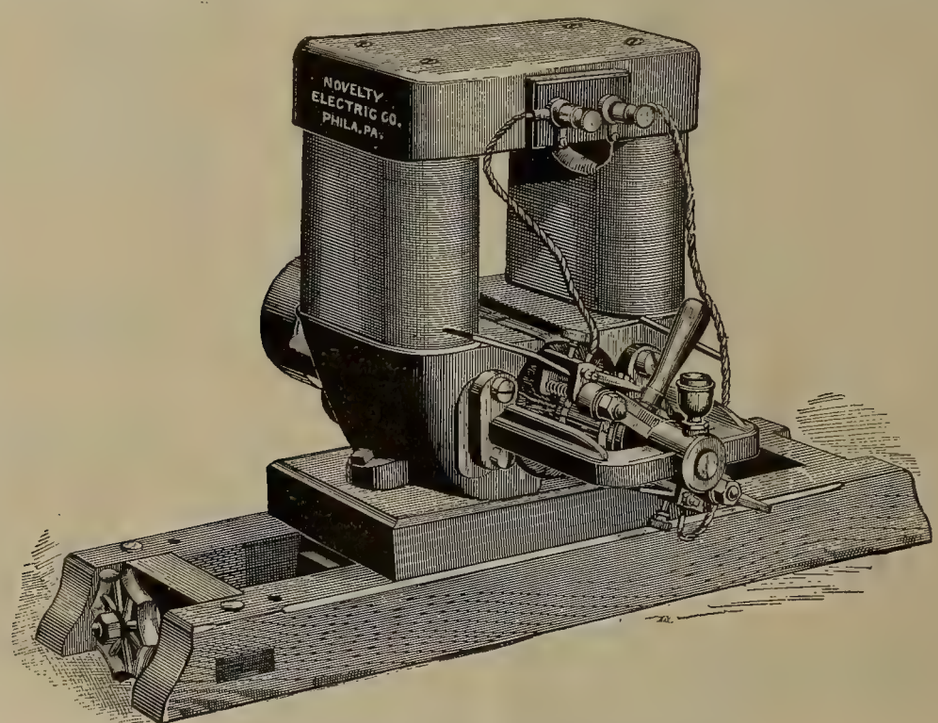


FIG. 3.—NOVELTY ELECTRIC CO.'S DYNAMO.

be had; Fig. 3 is an illustration of the company's dynamo, and Fig. 4 gives a view of a part of the factory.

The Novelty Electric Company was established in 1883, and it may be truly said that it has made for itself a reputation that few concerns of similar character enjoy.

The reason for its prosperity is not far to seek when the character of its head men is known. These gentlemen have a reputation which they take pride in maintaining, and it is this that is winning for the company the standing that it enjoys.

The officials are C. E. Trump, president and general



FIG. 1.—ENGINE-ROOM.



FIG. 2.—OFFICE AND SALES-ROOMS.

manager ; Frank J. Firth, treasurer ; C. J. Miller, electrician and superintendent of the factory. Mr. W. H. Beatty is travelling salesman, whose face is a familiar and welcome one in the trade.

The company employs about 60 persons and its scope of work is as wide as the electrical science itself, since it manufactures all kinds and classes of electrical instruments ; and the company carries on electrical construction work as well. Some idea of the success of the concern may be gained from the fact, so we are informed, that its business has trebled itself during the present year.

THE LA ROCHE ELECTRIC WORKS.

THE La Roche Electric Works, of 116 and 118 North Sixth street, Philadelphia, claim to be the oldest manufacturers of electric-light dynamos, the entire mechanical and electrical construction of the apparatus being original with Mr. F. A. La Roche, E.E. The company's apparatus, it is said, is used in some of the best-known laboratories in the world, and it claims the further distinction of being one of the largest manufacturers of electrical apparatus in the United States. It employs only the best of mechanics and materials, consequently the work it turns out is of the highest class.

Fig. 1, gives a view of the La Roche alternating-current dynamo for long-distance lighting. This class of machine is made in seven different sizes, ranging in capacity from 40 to 2,600 16 C. P. lamps. This type of machine is so constructed that in case of necessity the armature can be removed with great facility, by taking off the top half of the field, which can be easily accomplished by one man. The iron used for the field is made expressly for this purpose, and the field-coils are locked in place by a new style of bolt. The coils can be removed and replaced without any adjustment whatever. The armature is of new and original design, and has no iron support; while the brushes and brush-holders are automatic and self-adjusting. Mica is used throughout as the insulating material. These machines are automatic in their regulation and run smoothly under any condition of load, and are giving satisfaction wherever they go.

Fig. 2, is an illustration of the company's arc-light dynamo, which is claimed to be the best in efficiency and the most economical as regards power. The regulation of the machine is said to be unequalled and very efficient, and no outside mechanism is used. These machines are constructed with the utmost care, nothing but the best of material being used. They are made in 12 sizes, ranging in capacity from 1 light to 60, and in horse-power from 1 to 50.

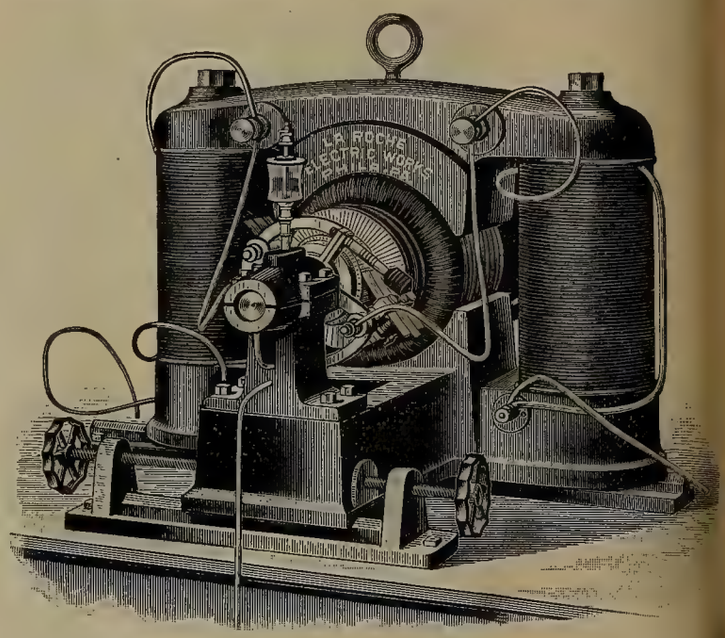


FIG. 2.—ARC-LIGHT DYNAMO

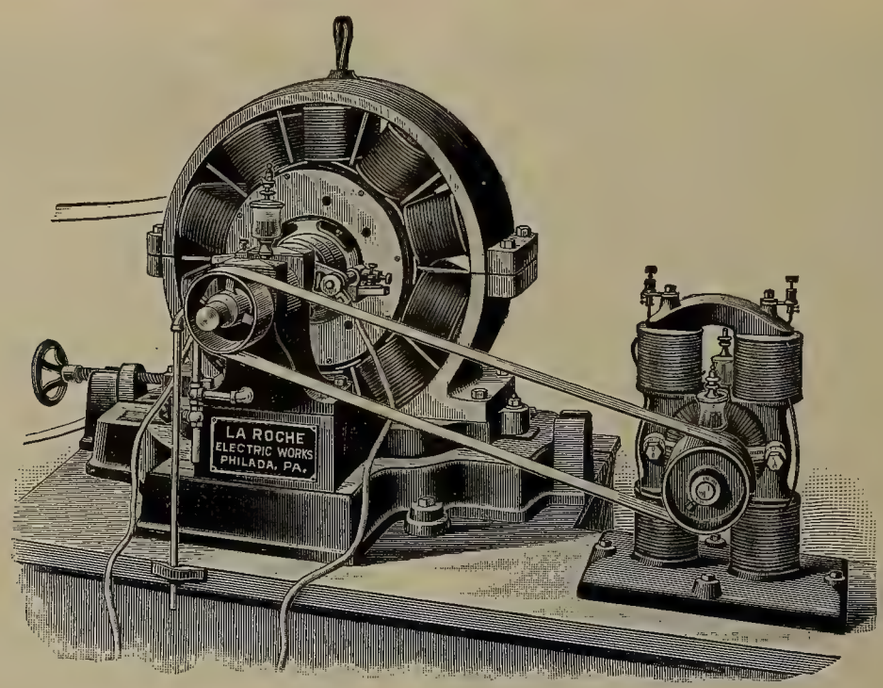


FIG. 1.—ALTERNATING-CURRENT DYNAMO.

Fig. 3, shows a view of the direct-current incandescent dynamo made by the company, of which there are 4 types manufactured, comprising 20 different sizes, ranging from 5 lights capacity to 1,000 lights. These dynamos are all made self-regulating, and show no sparking at the brushes under sudden and varying conditions of load.

An important feature of this class of machine is its low speed, which reduces the wear and tear to a minimum and increases the life. The machine is set on an insulated sliding base, so that the belt can be loosened or tightened at will without the necessity of stopping the machine, and it is fitted with the company's automatic

brush-holder, which permits of lateral adjustment, thereby prolonging the life of the brushes and connections.

Besides the apparatus above described the company also manufactures all of the accessory parts of each of these systems of electric lighting; also motors of sizes ranging from $\frac{1}{8}$ to 50 H. P., fan-motors of $\frac{1}{8}$ and $\frac{1}{4}$ H. P., etc., etc.

The La Roche Company has a special department in its works for the manufacture of special apparatus for laboratories and colleges, and it makes any kind of electrical machinery from specifications. Its manufacturing

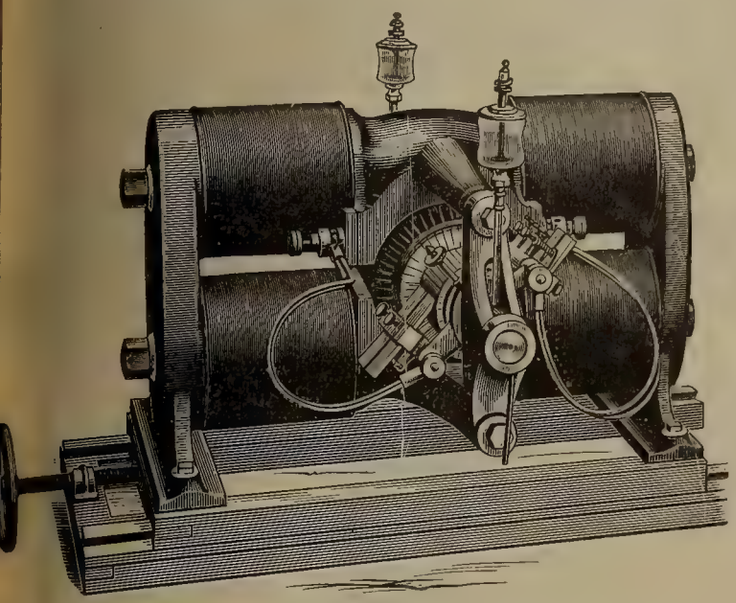


FIG. 3.—DIRECT-CURRENT DYNAMO.

plant is a complete one, and it is able to give prompt attention to all orders and contracts.

Isolated and central-station plants on the La Roche system are giving the best of satisfaction, and the same is said of the many motor plants which the company has installed.

RAIL-JOINTS.

The question of good rail-joints is one that has annoyed many a street-railway manager, and to-day he is practically as much in the dark as when he first began his investigations. Inventions of rail-joints may be likened to the growth of mushrooms, so numerous are the patents which are being constantly taken out. But

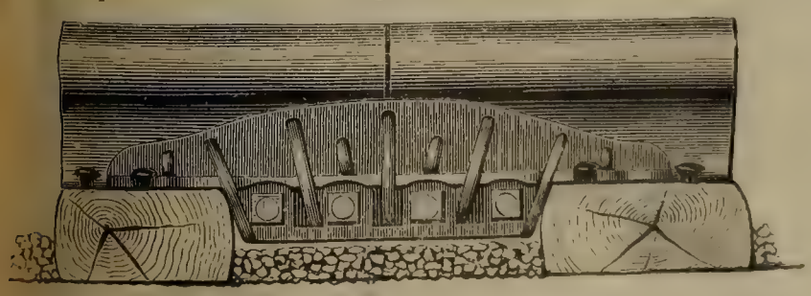


FIG. 4.

when the joint is put to a practical test it frequently proves to be no improvement on existing ones or, worse still, utterly worthless.

Three different styles of rail-joints have been offered for the consideration of street-railway officials by the Price Railway Appliance Company, of 125 South Fifth street, Philadelphia. While these joints differ in detail of construction, it is claimed that each produces the same effect as regards an absolute grasp of the flange without tendency to slide and in avoiding the leverage of the splice-bar system of joints. They are adapted to any T rail or ordinary girder rail. It is believed that the principle applied in the construction of these joints is such that a more satisfactory provision has been secured against pounding than has heretofore been produced. Our illustrations show some of the various sections of



FIG. 2.

joints. Fig. 1, shows the Double Girder Joint; Fig. 2, an interior, and Fig. 3, a top view of the same. Fig. 4, is an illustration of the Spoke Joint, and Fig. 5, of the Ribbed Truss Joint, to which a thin cap is attached at the upper edge of the arch reaching to and under the head of the rail.

PERSONAL.

Mr. D. W. Davis, formerly salesman and superintendent for the Buckeye Engine Company, has taken charge, as manager, of the Western branch office of the Phœnix Iron Works Company, of Meadville, Pa., manufacturers of automatic, simple, compound and triple-expansion engines, also boilers, heaters, etc. Mr. Davis is located at 418 Chamber of Commerce Building, Chicago, Ill.

STURGES SLEET WHEEL.

A device has been invented by Superintendent Sturges, of the Belt Line Railroad, Utica, N. Y., known as the "Sturges Sleet Wheel." The object of this wheel is



FIG. 3.

to remove ice from trolley wires during the winter season. A common practice is to keep the trolley wire greased, and while this method produces good results, still it is not absolutely reliable. Mr. Sturges' wheel removes ice after it has been formed, and this has been



FIG. 1.

demonstrated by actual tests on the Belt Line Railroad. The sleet wheel is about the size of the trolley wheel, and can be adjusted in a minute and a half. It is made of bronze and divided in the centre of the groove into two parts. The parts are not solid, but are divided in sections like the old-fashioned horse-car wheels. On each of these sections is a shoulder which comes into direct contact with the trolley wire, and when the wheel revolves the shoulders scrape the ice from the wires as neatly as a knife.

MORRIS, TASKER & CO.'S POLES.

The rapidly growing use of poles for electrical purposes and the evident disposition on the part of the public to object to the use of unsightly affairs in the

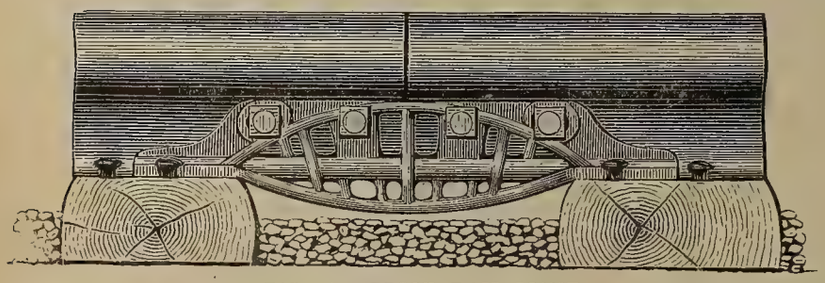


FIG. 5.—PRICE RAIL-JOINT.

streets, has led engineers to devise poles that would be free from the objections urged, and in this way keep in harmonious relations with the will of the people.

Morris, Tasker & Co., Incorporated, 222 and 224 South Third street, Philadelphia, have succeeded in meeting the æsthetic demands of the people and producing a class of poles that possess the merit of beauty as well as practical utility.

These poles are made of wrought-iron pipe, and are in every way calculated to meet every requirement and condition imposed in the particular service for which they are designed. They are made in sectional lengths

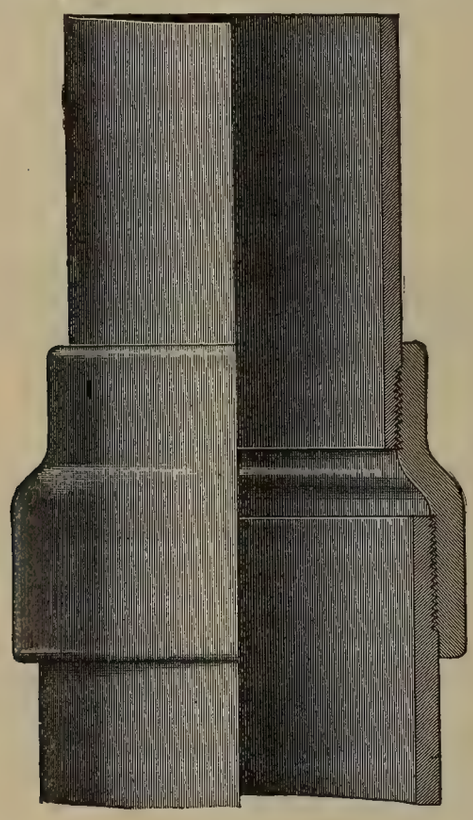


FIG. 1.

of pipe, some sections being joined in the manner shown in Fig. 1. This figure shows the plain joint. The company also forms the connection between the lengths by an upset or double joint, which adds materially to the stability of the joint and pole.

In Fig. 2, we have a combined electric-light and a double-trolley centre-pole, built up in three lengths of pipe, and ornamented at the cross-arms, which ornamentation imparts to the pole a handsome appearance. These poles are made with top extensions which support electric arc lamps for street illumination, and they are also provided with projecting spurs for the purpose of facilitating the climbing of the pole by the lamp-trimmer.

Poles are also made with cross-arms, but without the lamp, in several lengths, for carrying feeder wires for electric-railway and lighting purposes.

Figs. 3 and 4, show the method of insulating the cap of side poles for electric railways, Fig. 3, giving a sectional view of the pole and cap, and Fig. 4, the top of the pole complete.

On some of the poles the joints are made by the shrinking process, the end of one of the lengths of pipe being heated to red heat while the end of the other length is fitted into it while it is hot. On cooling, a very strong and durable joint is the result. This class of joint is illustrated in Fig. 5.

Besides the manufacture of poles, Morris, Tasker & Co. manufacture boiler-tubes, wrought iron pipe and fittings, etc. In the electrical line they



FIG. 2.

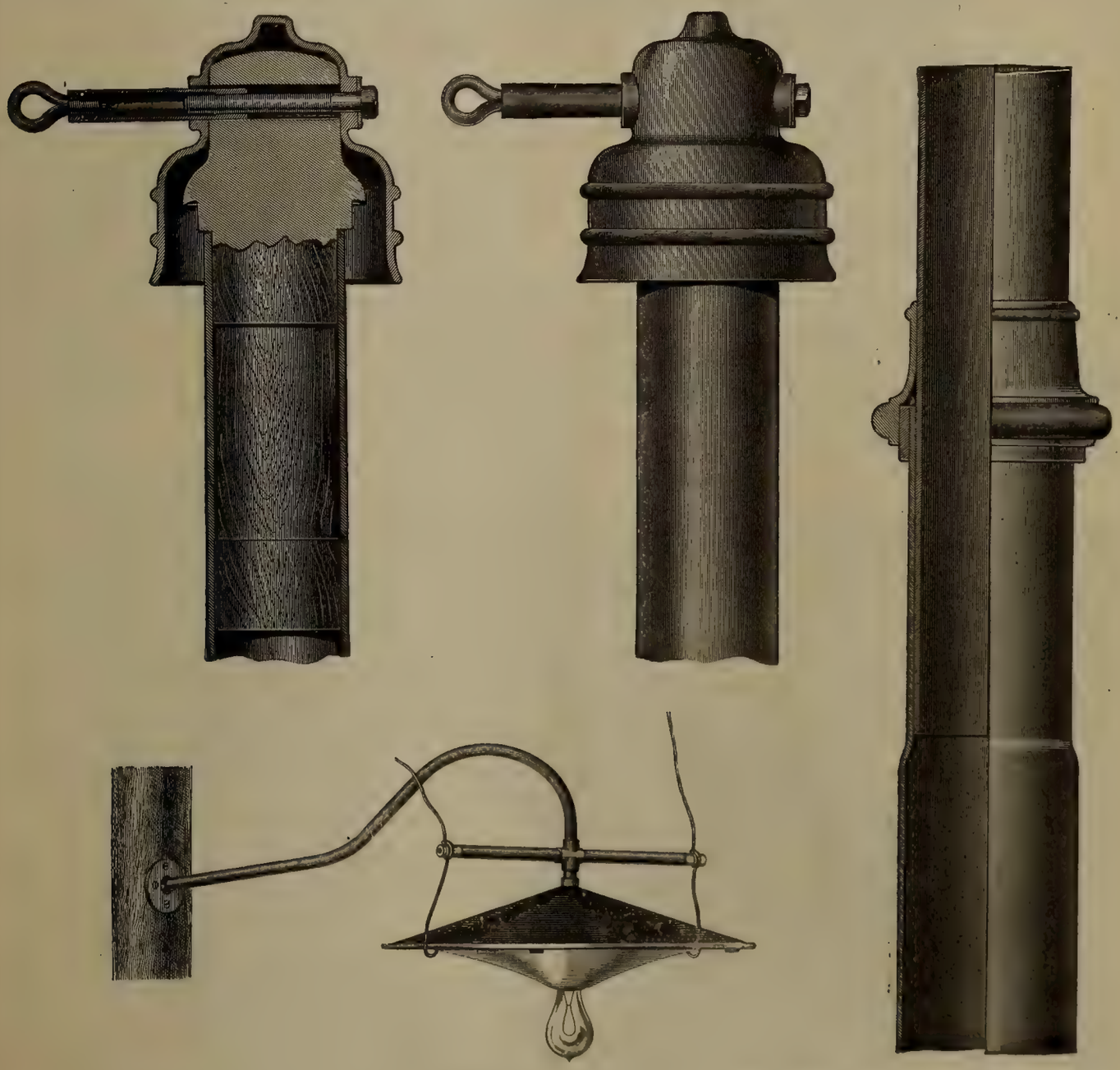
make incandescent lamp-brackets of three designs for outdoor use, one style of which is illustrated in Fig. 6. These brackets are made for attaching to wooden poles, and are well constructed. They are provided with hoods and reflectors and are very serviceable.

THE "STANDARD" AUTOMATIC TIME CUT-OUT.

Where the electric light is employed for the display of goods in large dry-goods houses, etc., after the close of business or used for advertising purposes the services of an attendant are required to extinguish the lights at a specified time. It was for the purpose of dispensing with the necessity of an attendant and at the same time permit the burning of lights as long as desired and then extinguish them automatically that the apparatus illustrated and described herewith was invented.

This device is known as the "Standard" Automatic Time Cut-Out, and is said to be absolutely reliable in its action and at the same time the only thing of its character upon the market that is worked automatically, purely mechanically and without the aid of electro-magnetic switches. In operation the clock movement is wound up and the cut-out hand set at the time desired to have the lights extinguished, and, as the manufacturers express it, the machine "does the rest."

A very important feature in connection with this apparatus, and one that should strongly appeal to the senses of all electric-light users, is the fact that it completely cuts out the main circuit, at the same time automatically cutting out the meter from the house service. The value of this service cannot be overestimated, bearing in mind that it is generally conceded that electric meters are not thoroughly accurate in their record, the use of current being registered to a very appreciable extent whether the lights are on or not. Another prominent feature is that when the service line is opened by this device lightning during a storm is arrested, and danger by fire through faulty connections averted. The device is also made to take the place of electric meters, where supply stations desire to control the number of hours of service to consumers.

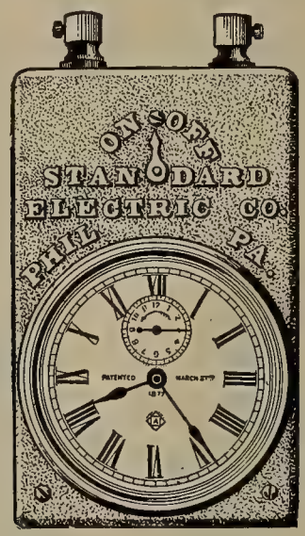


FIGS. 3, 4, 5 AND 6.—MORRIS, TASKER & CO.'S POLES AND REFLECTOR.

The time for cutting lights *on* and *off* can be regulated to the fraction of an hour, which gives the exact number of hours consumed, thus avoiding complications. The device is securely locked, giving freedom to the consumer only to wind the movement.

Mr. William McDevitt, chief inspector for the Philadelphia board of fire underwriters, has made a very careful examination of the "Standard" Automatic Time

Cut-Out, and has expressed himself as being highly pleased with its successful operation as a safety device, and will recommend it to the board as an excellent safety appliance for use on both arc and incandescent circuits. If approved the board will recommend its universal use in the city of Philadelphia. The cut-out is made to ex-



STANDARD AUTOMATIC TIME CUT-OUT.

tinguish from 1 to 150 lamps on incandescent, or 1 to 30 lamps on arc circuits. Preparations are now being made to manufacture the cut-outs with double-pole switches, which will permit the cutting out of as many lamps as may be desired.

The "Standard" Automatic Time Cut-Out is manufactured by the Standard Electric Company, of 2246–2248 N. Ninth street, Philadelphia. The members of this company are Mr. James F. McLaughlin and Mr. W. W. Kerr, the well-known attorney in the celebrated Star Route cases. Mr. McLaughlin is the electrical engineer of the company and inventor of the various appliances dealt in by it. Mr. Difenderfer is general manager and takes care of the company's interests.

The company is now bringing out a new fan-motor of very handsome design. The armature runs on *lignum vitæ* bearings and is regulated for three speeds. The rheostat is at the bottom of the motor. The motor rests on four feet having rubber cushions, making it perfectly noiseless. The armature is Siemens wound, there being two field-magnets, one on each side. The frame, with supports for the bearings and field-coils, is of cast iron, in one piece.

The company also claims to have the most positive and quick-acting hand-switch ever introduced on the market, and to this end has expended a considerable amount of money for power presses and dies. The switches will be ready for the market on the 1st of February next, and it is said will revolutionize the hand-switch market in price, positive action and durability.

WESTON & CO.'S SWITCHES, ETC.

Messrs. Wm. H. Weston & Co., 830 Filbert street, Philadelphia, consulting and manufacturing electricians, make a specialty of switches, switchboards, stage and field regulators and all kinds of special apparatus. Great care is taken to have each article carefully constructed on the best known modern principles and the workmanship and material of the finest quality throughout. The firm has won for themselves an excellent reputation, which they jealously guard. Those who deal with them can always be assured of every article they purchase being exactly what it is represented to be.

In the accompanying illustration Fig. 1 shows one of the double-throw switches and Fig. 2 an iron resistance-box. Weston & Co. invite inspection of their goods and

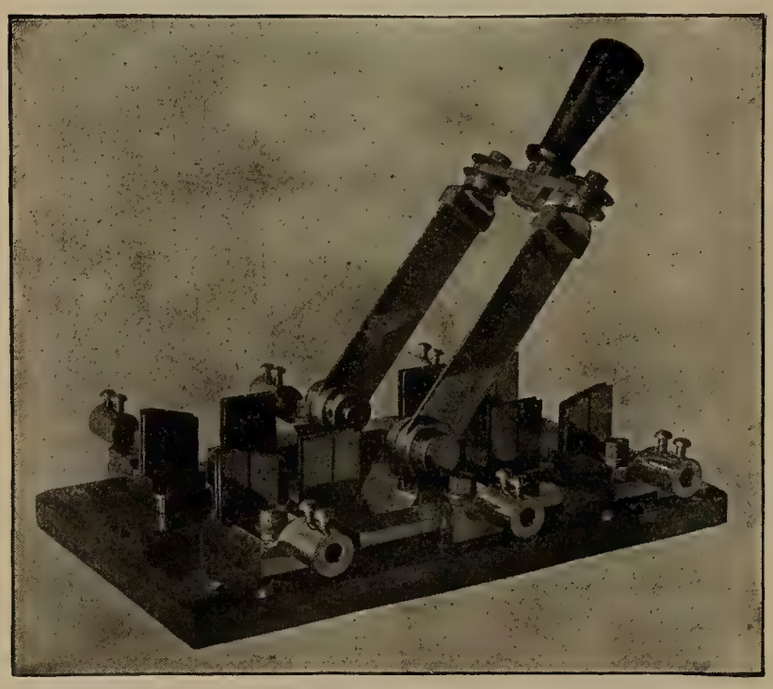


FIG. 1.—WESTON DOUBLE-THROW SWITCH.

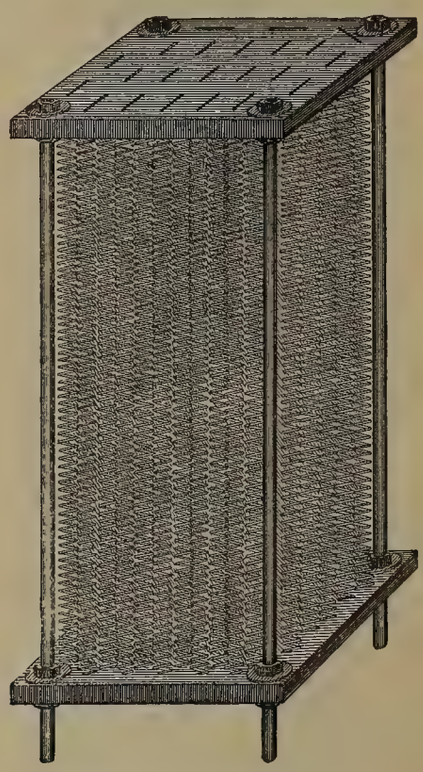


FIG. 2.—RESISTANCE-BOX.

are always prepared to furnish estimates at reasonable prices.

During the present year their business has increased to such an extent that they will soon be compelled to look up more commodious quarters. Their works are run by a 3 H. P. Barriett motor, of which they speak in the highest terms.

THE HELIOS ALTERNATING ARC LAMP.

If arc lights can be produced on incandescent circuits, why can they not be likewise produced on alternating-current circuits? is a very natural and logical question to ask. The alternating-current circuit would seem to be the one on which arc lights should find their most economical use, but not until lately has the problem been solved. Many attempts have been made to produce a successful alternating-current arc lamp, but for one reason or another nothing of a tangible character has resulted. Recently, however, a lamp of this character was put upon the market which seems to meet every requirement in an alternating-current arc lamp.

The Helios Electric Company, of 1310 Filbert street, Philadelphia, is the concern that is entitled to the credit



FIG. 1.

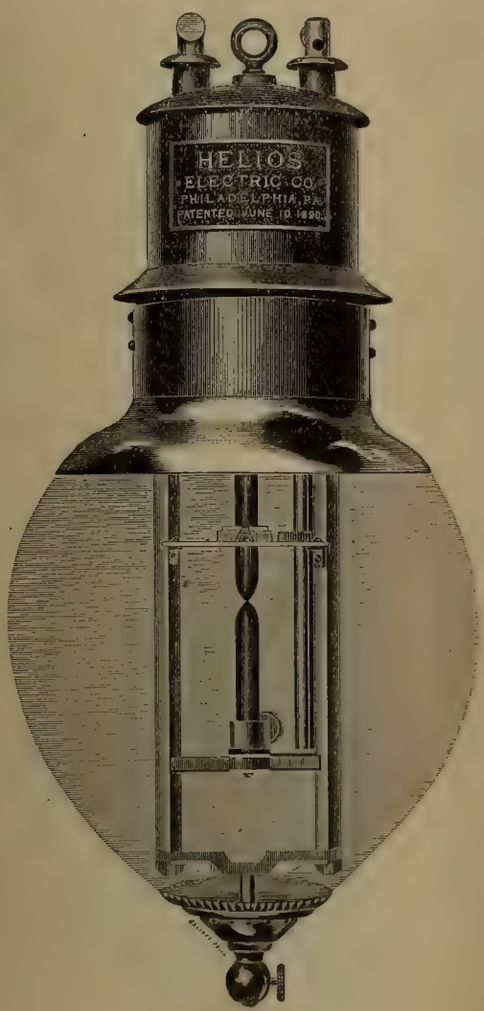


FIG. 2.

for this successful result. The lamp which it makes was invented by a German named Coerper, of Cologne, and from all reports it is meeting with great success.

One of the disadvantages of former arc lamps for alternating-current circuits was the loud humming noise produced, but in the Helios lamp this has been reduced to such an extent that it gives out no more noise than does an ordinary direct-current lamp.

In order to avoid the waste of light, which was another disadvantage of earlier experimental lamps, and which was caused by the formation of a crater upon the lower as well as the upper carbon, a white enamelled reflector is placed about 1½ inches above the arc. This throws down all of the light emitted from the crater of the lower carbon and, it is said, increases the useful illuminating power of the lamp 40 per cent.

Fig. 1, shows the internal mechanism of the Helios lamp, and Fig. 2, is an illustration of the lamp complete, as it appears when in actual use.

The mechanism of the lamp is of the simplest character and provides for the movement of the upper and lower carbons in the same ratio, the lower ascending and the upper descending. This results in the maintenance of the arc at a given point along the line of the carbons, from the beginning until the carbons are entirely consumed.

A single solenoid coil controls the regulation, the feed of the carbons being controlled by a lever which presses against the periphery of a friction wheel included in the releasing train. It is said that so fine a feed as that of $\frac{1}{1000}$ of an inch is possible by this arrangement. A dash-pot is provided to steady the movement of the regulating mechanism.

Much care has been given to the artistic qualities of the lamp as well as to its practical features, and in Fig. 2, we see that it has a pleasing appearance. Its extreme length is about 25½ inches.

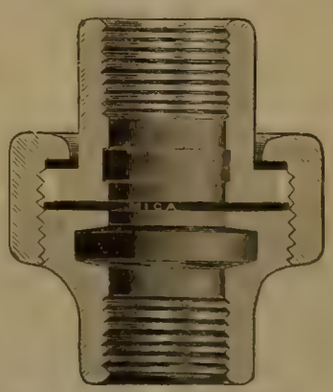
The Helios lamp is made in two sizes, viz.: 300 watts and 425, the former to produce a light of 1,500 C. P. and the latter of 2,000 C. P. The lamps are connected in multiple arc and require a pressure of 28 volts.

The company will shortly produce a connector designed to deliver 30 volts directly to the lamps.

At the present time 13 Helios lamps are being used to aid in the work of rebuilding the *Public Ledger* building, which was recently damaged by fire, and two are doing excellent service in the jewelry store of A. R. Justice, on Chestnut street. We are informed that there is a healthy and growing demand for these lamps among the proprietors of large stores in Philadelphia.

VALLEE BROS. & CO.

The reputation of the firm of Vallee Bros. & Co., 17 North Sixth street, Philadelphia, dealers in electrical supplies, is far from being confined within the precincts of that city. They are known all over the country as a concern handling a line of goods the superior quality of which can always be absolutely relied upon. The members of the firm are very proud of this reputation and are unceasing in their efforts to maintain it. The business was started eight years ago by Messrs. Geo. W. and



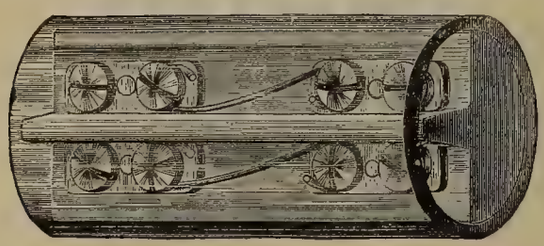
MICA INSULATING JOINT.

Garrett A. Vallee, natives of Philadelphia, and some few years later Mr. H. C. Roberts, of Connecticut, was taken into partnership. Each of these gentlemen is a thorough and expert electrician and well versed in the details of construction work. This branch of the business, however, is not carried on at the present time, the firm being well content to devote their entire time to the disposal of their various specialties, for which there is an enormous and constantly growing demand. The store and basement occupied by the firm is 25 x 80 feet and completely

stocked. Want of space prevents us from enumerating the various lines of goods handled by Vallee Bros. & Co., but among them are the specialties of the Bryant Electric Company, of Bridgeport, Conn.; those of John R. Fletcher, etc., etc. A new insulating joint handled by the firm is known as "The Roberts," and has been approved by the Philadelphia board of fire underwriters. It is entirely insulated with mica, is fire-proof, acid-proof and water-proof. This joint is shown in the accompanying illustration. Messrs. Vallee Bros. & Co. conduct both a wholesale and retail trade, and are always glad to furnish estimates for goods to be shipped to any part of the country.

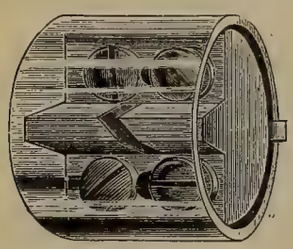
FUSE-BLOCKS AND INSULATING JOINT.

The "Warrell" double and single pole fuse-blocks and the "Warrell" insulated joint, manufactured by the National Electric Company, of 1231 Filbert street,

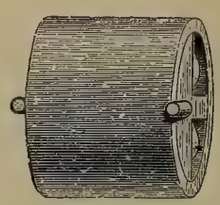


DOUBLE FUSE-BLOCK WITH GLASS SHELL.—FULL SIZE.

Philadelphia, are said to be perfectly adapted to the purposes for which they are intended. The company is confident that they are the best on the market. Prominent characteristics of the fuse-blocks are that they are of the smallest size compatible with efficiency; the shells



SINGLE FUSE-BLOCK.



SINGLE FUSE-BLOCK.

are of glass, affording a full view of the interior and dispensing with the necessity of removal for examination, and they can be easily removed in case repair should be necessary. The single-pole block, being less than one inch in length, is very desirable for side brackets where small canopies are used. The blocks are made of vitrified



DOUBLE FUSE-BLOCK.

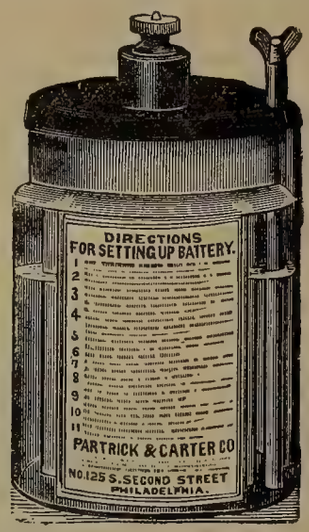
porcelain, and are therefore not affected by dampness. That they have been approved of by the board of fire underwriters is a sufficient proof of their excellence.

The "Warrell" insulated joint has been designed to replace the old and unsightly joints that have heretofore been in use. They are very small, neat, safe, and being the same size as the gas-pipe, are not noticeable and do not require any canopy to cover them, thereby effecting a saving in this respect.

The company will move to 1223 and 1225 Filbert street, on January 1, 1893.

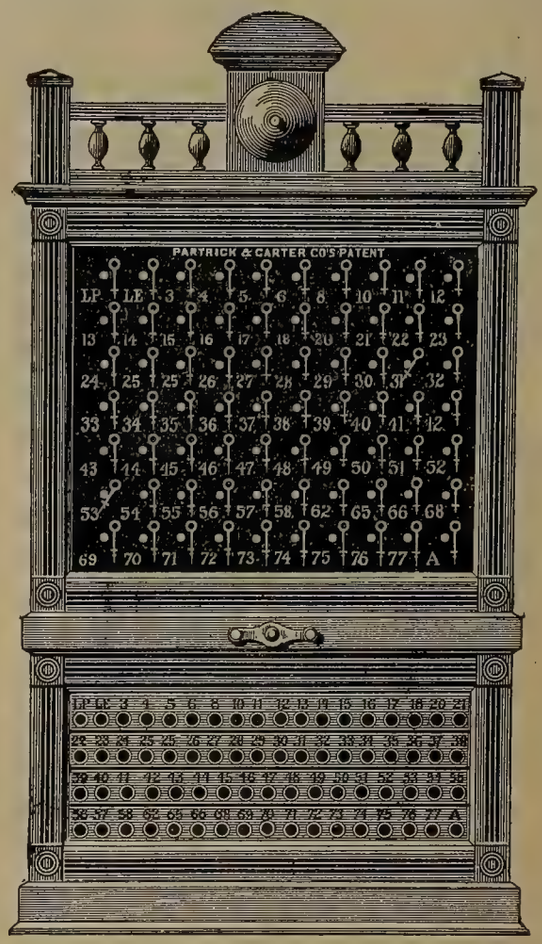
THE PARTRICK & CARTER CO.

Every one in the electrical business has heard of Partrick & Carter, of Philadelphia, the old telegraph-supply house. It is one of the oldest institutions of its kind in this country, having been established in 1867, when the



DISQUE LECLANCHE BATTERY.

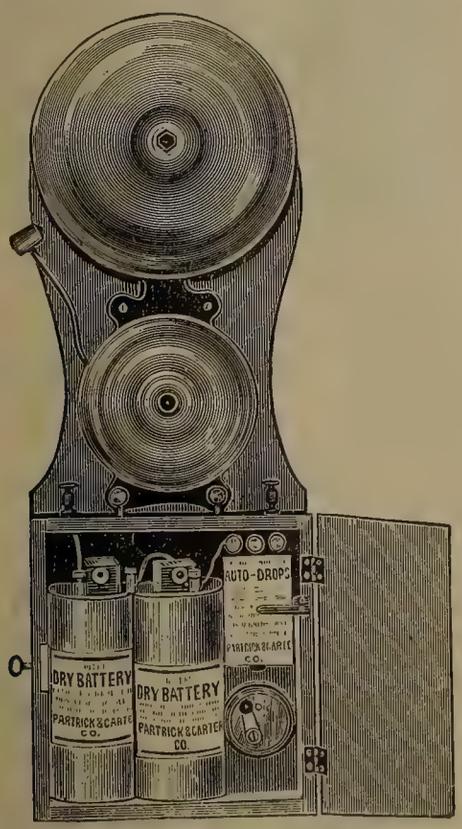
telegraph was the only electrical industry. The house is now known as The Partrick & Carter Co., and its headquarters are at 125 South Second street. The members of the company are Franklin S. Carter, Charles M. Wilkins and E. Ward Wilkins, and these gentlemen



ANNUNCIATOR WITH RETURN CALL.

continue to maintain the long-established reputation of the house and win the respect of every one by honest and fair trading. "Treat a man squarely and he'll look you up again," seems to have been the cardinal principle

with this house, and one which has added greatly to its prosperity. The Partrick & Carter Co. manufactures for the trade solely, and does no construction work whatever. Chief among its various manufactures is the patent needle annunciator, of which it is the sole proprietor, and claims that it is without a rival as to simplicity, quickness of action and all qualities that constitute a first-class annunciator. These annunciators are in use in every State in the Union and Canada, and nothing further need be added by us in recognition of their superior quality. Then comes the room-bell and push used in connection with the annunciator, followed by the patent indicating box-bell burglar alarms, electric bells, electro-mechanical gongs, buzzers, push-buttons and door-pulls, door and window springs, batteries, electric gas-lighting apparatus, and a host of other things. The greatest care and best material are used in the con-



FIRE-ALARM GONG FOR HALLS.

struction of each article, and after it has left the factory may be considered as being as near perfect as it is possible to make it.

REFLECTOR SHADES.

A few of the many various styles of reflector shades for incandescent lights manufactured by the American Reflector Company, of 132 North Fifth street, Philadelphia, are shown in the accompanying illustrations. Only the best of material and workmanship are employed in the construction of these goods, and they are sold at a very reasonable figure. They are made in every conceivable shape to suit all purposes, and special designs can be made to order.

The "Klemm" Electric Desk Shade is shown in Fig. 1. It is claimed to be one of the best shades made for office use. It throws a mellow, pleasant light where it is wanted and entirely shields the eyes from the glare. It has a ground-glass door on the bottom, which is easily opened. This shade is made to fit any holder. Fig. 2, shows a deflector street hood for incandescent street lighting. The socket is thoroughly protected and the reflector is white enamel.

Fig. 3, is a view of a patent Opal Flat-Cone Reflector used for lighting churches, halls, theatres, stores, etc. This style is also made in corrugated silvered glass.

Fig. 4, shows a corrugated silvered glass flat reflector,

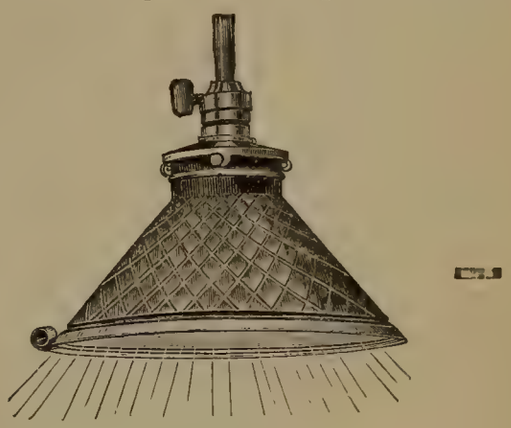


FIG. 1.

for clusters, and is adapted for lighting show-windows, stores, offices, etc.

The American Reflector Company has been established since 1855, and from its continuous success it is very evident that its goods give every satisfaction. The manager, Mr. Fred'k Klemm, is always glad to welcome



FIG. 2.

visitors and explain the various degrees of merit of the different styles of shades, and will cheerfully furnish estimates. The company does not confine itself to the



FIG. 4.

manufacture of shades for incandescent lamps only, but handles patent reflecting gas and lamp shades, double-cone chandelier reflectors and lanterns. A specialty is made of patent daylight reflectors.

THE HENRION DYNAMO.

The accompanying illustration shows a purely French dynamo designed and built by a Frenchman in France, M. Fabius Henrion, of Nancy. The armature is of the disc type, and the three pairs of parallel circuits are coupled together so that only two pairs of brushes are required; yet, if desired, four or six may be used. The machine is so constructed that the armature is readily and easily accessible, the top part of the frame being removable for the purpose. The method of lubrication of the bearings of this machine are unique. The ring system is employed, the rings, however, being made with numerous perforations, the object of which being to pick up more oil and apply it to the bearings than can be done by the usual smooth form of ring. Strainers form a part of the bearings, and they are so arranged that the oil is self-strained as well as self-applied.

These machines, says *Industries*, from which our facts and illustration are obtained, are wound for any desired output, and are frequently compounded to allow for the loss in the leads.

C. S. SOLOMON & CO.

C. S. Solomon & Co., engineers, 1015 Sansom street, Philadelphia, are agents for the Mather Electric Company, and contract and furnish estimates for complete central-station and isolated plants; they also install motors of any horse-power for power purposes. The members of the firm are all well-known electrical engineers,

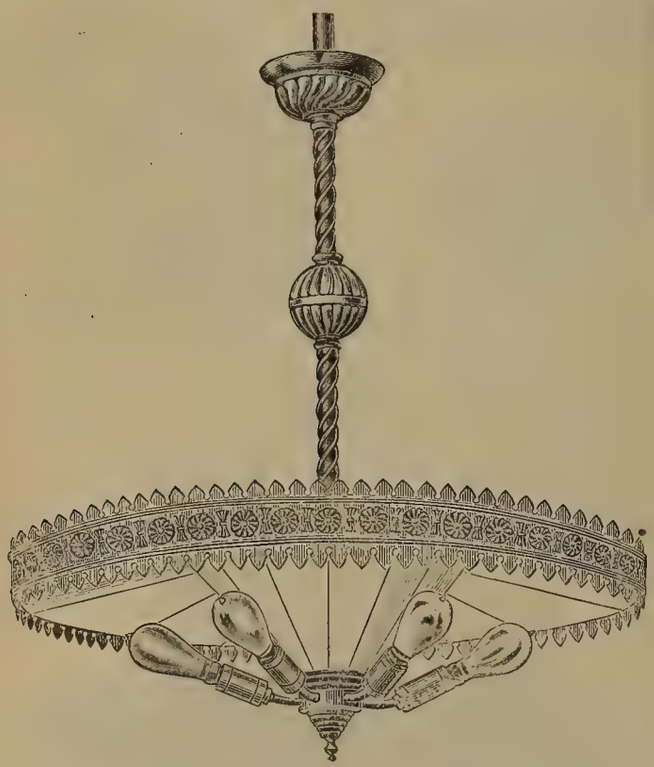
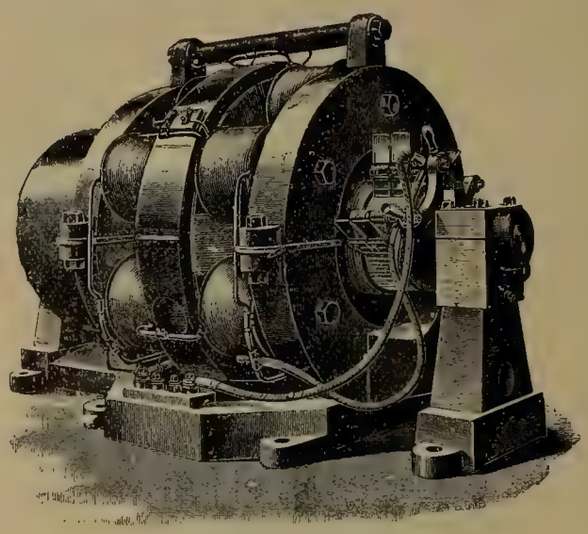


FIG. 3.—REFLECTOR SHADE.

and they have every facility for undertaking contracts of any extent. They also do general machine work. The firm has been very successful with the installation of the Mather dynamos, for which there is always a popular demand. These machines give every satisfaction and are thoroughly reliable. They have been illustrated and described so often as to need no further recommendation from us.

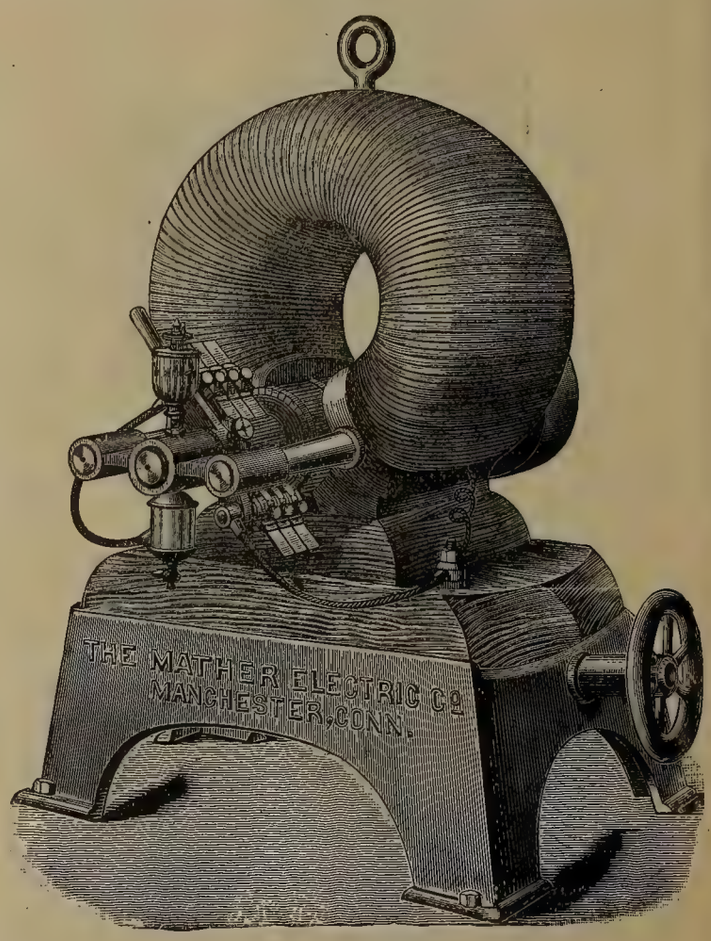
OBITUARY.

Mr. John T. Knight, a leading and influential citizen of Easton, Pa., and president of the Edison Illuminating Co., of Easton, died in that place on December 15. He was seventy years of age.



HENRION DYNAMO.

THE Philadelphia and Reading Railroad Company has ordered from the Westinghouse Switch Company, of Pittsburg, a switch system for its new terminal in Phila-

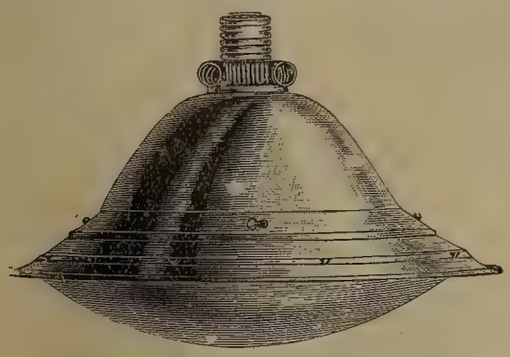


MATHER DYNAMO.

delphia, which will probably be the most complete in the country. There will be sixty-eight switches and seventy signals, the switches to be operated with compressed air and electricity from a tower.

"C. S." SPECIALTIES.

The "C. S." specialties manufactured by the Cutter Electrical and Manufacturing Company, 27 South Eleventh street, Philadelphia, are in common use throughout the length and breadth of the land. We illustrate herewith a few of them, and beyond a brief reference no ex-

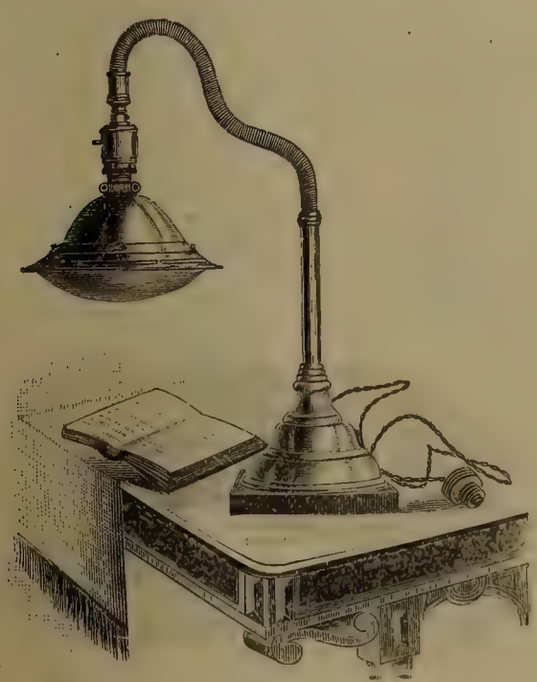


"C. S." REFLECTOR AND SHADE.

tended description is necessary. The "C. S." reflector and lamp-shade will ever be popular, owing to its many points of merit. It is made of aluminum and glass, and weighs but five ounces. The only breakable part is the glass diffusion plate which, if accidentally broken, can be easily replaced at a small cost. This shade diffuses a gentle light throughout the room, there being no marked boundary to the zone of illumination.

The "C. S." portable lamp-stand speaks for itself. It consists of one of the reflector lamp-shades attached to the stand with a flexible arm that can be adjusted to any position; a feature that cannot fail to be appreciated, enabling as it does the light to be thrown in any direction.

The "C. S." incandescent switch, illustrations of which are shown "closed" and "open," has been upon the mar-



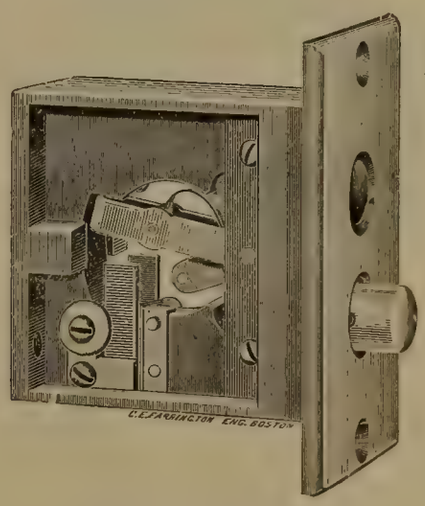
"C. S." PORTABLE LAMP-STAND.

ket for a long time and is as firmly established as the "Rock of Gibraltar." They are very durable, highly efficient and made of the best material. Two push-buttons are used, the white one closing and the black one opening the circuit. Owing to the peculiar construction of the switch an exceedingly convenient method is afforded of placing a number of switches in "gangs" on the same face-plate, in a manner similar to that adopted in electric gas-lighting.

The Cutter Electrical and Manufacturing Company is continually bringing out new specialties, all of which are valuable for their specific purposes and sold at extemely moderate figures.

NOTES OF GENERAL INTEREST.

THE city of Philadelphia has awarded the contract for lighting the greater part of the city for 1893, to the Brush Electric Light Company.



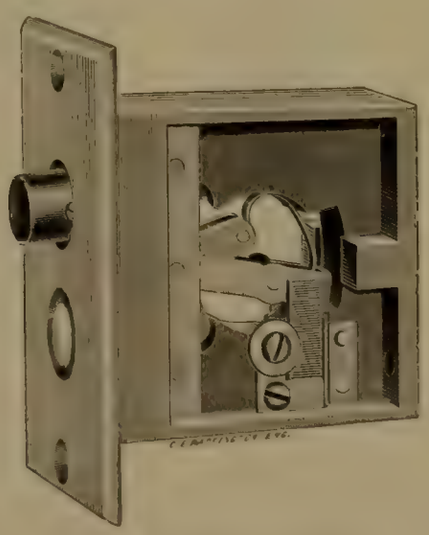
"C. S." SWITCH, OPEN.

THE Elkton (Md.) Electric Light and Power Company will increase its capital stock.

THE Citizens' Electric Light Company, of Braddock, Pa., will light Rankin borough with 20 arc lights at a cost of $75 each.

ROWING-SHELLS OF ALUMINUM.

The manufacture of rowing-shells of aluminum is an infant industry. It is reported that the Cornell crew is having an eight-oared aluminum boat built in Philadel-



"C. S." SWITCH, CLOSED.

phia, and it has given a great impetus to the new industry. Other college crews are having metal boats built, and much is expected of these shells.

ARC-LIGHT CUT-OUT.

A new arc-light cut-out which possesses many meritorious features is that recently put upon the market by the E. G. Bernard Co., of Troy, N. Y. In the earlier instruments wooden insulation was used, but this has been substituted by porcelain, which is now used exclusively.

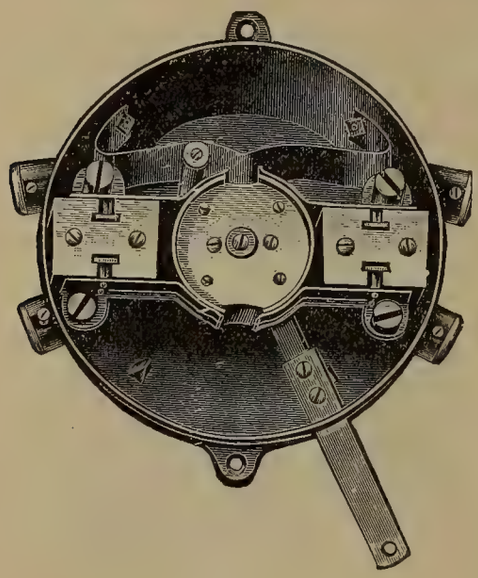


FIG. 1.

An ingenious arrangement of springs effects quick action in operation, the speed of the throw not being dependent upon the quickness of the motion of the hand.

We give two illustrations of this cut-out, Fig. 1 showing the interior construction and Fig. 2 the instrument complete. These cut-outs are supplied with glass or metal fronts as desired, and by a novel clamp attachment on the binding-posts the wires are held in position very firmly and it is impossible for them to work loose. The wires are led into the cut-out through porcelain and the case is perfectly weatherproof. The make and break is accomplished by positive action, and the device taken altogether is very simple in construction and effective in action.

The E. S. Greeley & Co., 5 and 7 Dey street, New York, are the New York agents for these cut-outs, many of which are now in use in several of the largest stations throughout the country, with most satisfactory results.

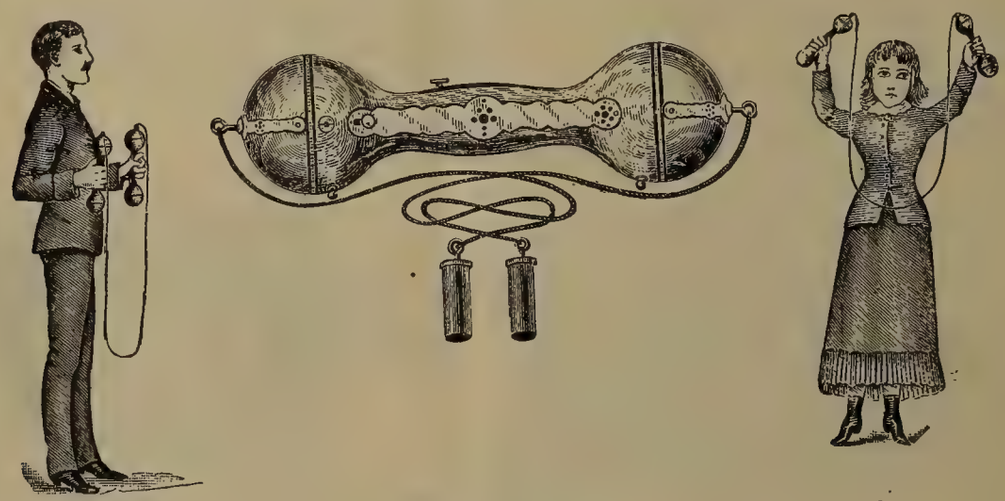
ELECTRIC DUMB-BELL.

The accompanying illustration shows how the healthy exercise of dumb-bell practice can be made still more so through the agency of the electrical current. The electric current,as is well known, has a very stimulating effect on the nerves, and this in combination with the effects of the exercise on the muscles cannot help but be beneficial to the entire system. There is nothing bogus about the



FIG. 2.

electric dumb-bell; an electrical current is actually delivered. Mr. Henry Schwindt, 610 Eighth avenue, New York, manufactures the electric dumb-bell which was awarded a first-class medal at the American Institute Fair, 1883. Since that period many improvements have been incorporated, and to-day the electric dumb-bell is as near perfection as is possible to make it. The price is reasonable and there is no reason why it should not find its way into every household.



ELECTRIC DUMB-BELL.

Modesto, Cal.—The Modesto Electric Light Company has been incorporated with a capital of $50,000. Incorporators: F. W. Eaton, George E. Whitaker, Max Caspari, H. C. Wyman and R. Lloyd Easton, of San Francisco.

Baltimore, Md.—Messrs. M. A. De Lew, H. W. Bailey and others are considering the advisability of constructing an extensive electric-power plant.

MICANITE, AND ITS APPLICATION TO ARMATURE INSULATION.*

BY EDWARD P. THOMPSON, M.E., FOR CHARLES W. JEFFERSON AND ARTHUR H. S. DYER.



N armature and its commutator consist of the combination of two elements; namely, electric and magnetic conductors and insulators. In the earlier days of armatures, the electrical and mechanical dimensions and proportions of the conductors were considered of prime importance. The first armatures were small and the electromotive force low, and consequently little attention, comparatively, was given to the element insulation. Lately, simply paper, cloth, convolutions of ligatures, or these materials impregnated with shellac or similar insulating varnish or paint, were employed for the purpose of preventing leakage or short-circuit. To remove the solvent of the shellac, the armatures were baked for twenty-four hours. Judging from the variety of materials used at present, and the changes from one material to another, it would seem that the insulators are now receiving their share of consideration, while the core, wires, commutator-sections and other conducting portions are secondary details. Why so much difficulty with armature insulators and so little with other insulators, such as line insulators? Because in the former not only must the material be of extremely high resistance but also unaltered under the effects of heat, and must be crowded into very small quarters. Space must be economized. If the electric current or heat alone were present and if space were not so much limited the problem would be easily solved. It yet remains to be proved that any known substance is absolutely a non-conductor—nor is the resistance of a given conductor constant. Unfortunately for the armature constructor, the worse the conductor the less the resistance with increase of temperature. An extra current is produced in metals upon variations of current. A diminishing of current occurs when first entering a substance of high resistance. Finally and gradually the current becomes constant. This action for convenience is often called polarization. As this property is noticeable only in long lengths of the insulating material, it has little bearing upon any of the armature elements other than in connection with the covering of the wires. The substance possessing the property of polarization in a marked degree is gutta-percha.

Paper or fabrics by themselves should never be used as an insulator, because when moist they conduct a current so well that they may properly be termed semi-conductors. A coating of shellac or oil upon almost any substance enormously increases its resistance, and protects porous and deliquescent substances from water. Paper thus covered serves, with machines of low electromotive force, the purpose of preventing leakage, but by no means perfectly in practice with large machines. Its advantages are more in the nature of convenience and cheapness than of efficiency.

Paper which has been thoroughly dried is of very much higher resistance—so high that it falls under the head of non-conductors, and therefore the shellacs should not be applied until after the paper has been subjected to a thorough drying process.

It is a peculiar property that a given substance in a compact condition is of very marked higher resistance than when powdered or comminuted; for example, pulverized glass is a semi-conductor, while sheet glass is as high in resistance as silk. This property has been noticeable in armature practice. If the insulating material is cracked here and there it is unfit for armature use. The cracks are in the nature of interstices between the particles of a powder, and at the cracks the material is in part ground. The explanation may lie in the distinction that the pulverized material has more surface, or that damp air exists in the spaces between the particles, or that a spark can traverse a gas better than a solid, or that each particle becomes coated with a film of moisture. The last seems the most probable, because the best surface concentrators of water usually exhibit the property most strongly.

The locations of insulation in an armature are between the armature discs to prevent eddy and Foucault currents; between the core and the windings to prevent the current from short-circuiting the coils through the core and burning out the armature; between the commutator-sections to prevent leakage from one coil to another; over projections or in grooves in the core; and around the wire to guide the current in convolutions. All these parts, even in the best made armatures, become more or less abnormally hot. Means have been planned and sometimes put into practice for cooling the parts, and thereby saving the insulation. One method consists in constructing the armature after the style of a fan or with large radiating surface; another, in equipping a device to blow out the sparks at the commutator, and again, in using cooling insulating liquids. With whatever precautionary means the machine is equipped, the parts, either accidentally or through inefficiency of means, will become abnormally hot. The machine will be injured if combustible materials form the bulk of the insulator. The materials of an ideal armature consist of copper, iron, and a heat-proof and water-proof non-conductor. If the material is combustible, or altered in its chemical nature by heat, its resistance is changed and generally lowered. Manufacturers of incandescent lamp filaments know that complete carbonization cannot take place except at a very high temperature, like 3,000 degrees Fahrenheit. An armature may rise to 500 degrees. At this temperature, easily carbonizable materials, such as linen, cotton and other forms of cellulose are weakened, blackened and the resistance reduced. Shellac, although blackened at this temperature, is converted into those compounds whose resistance is not lowered. Shellac forms an exception, therefore, in being charred by such a temperature without reduction of resistance.

There is a greater detriment than chemical change by heat. The material cracks, becomes somewhat comminuted, and the resistances, both mechanical and electrical, are therefore greatly reduced. If paper or cloth or even shellac is depended upon as the insulating material rather than as the binding material, it is not electric proof; because principally it becomes, when charred, fractured at numerous points, if not completely pulverized. As to why shellac is not appreciably lowered in resistance by partial carbonization may be because it is an animal substance.

One of the most important attributes of an armature should be its rigidity. It should be like a rock in this particular. If the insulation should consist of a soluble material, for example, and the same dissolved out after the completion of the armature, or of some material that would be reduced in size by heat, then the wire and bolts would soon become loose from the rapid rotation and vibration, and finally the armature would be useless. Change in volume of the insulators has caused nine-tenths of the armature break-downs.

(*To be continued.*)

* Abstract of a paper read at the seventy-second meeting of the American Institute of Electrical Engineers, New York, December 21, 1892.

SPECIAL REPORTS.

The matter under this head is prepared for the special information of manufacturers of electrical apparatus, engineers, contractors, supply dealers, etc., and is entirely new.

POSSIBLE CONTRACTS.

Niles, Mich.—This city and Buchanan are considering the feasibility of damming the St. Joseph river near the latter city for the purpose of securing the necessary water-power for the generating of electricity for light and power purposes.

Kokomo, Ind.—The Citizens' Light and Power Company has the plans completed for its new generating station and will build it at once.

Riverside, Cal.—The construction of a mammoth electric-light plant in the Santa Ana cañon about 9 miles from San Bernardino is projected. The idea is to furnish electric-power for San Bernardino, Riverside, Redlands, Colton and other neighboring places. W. H. Goucher, of Los Angeles, has charge of the preliminary work.

Meriden, Conn.—The lamp committee ask for an appropriation of $21,000 for lighting purposes for the ensuing year. Electric and naphtha lights are used.

Niles, O.—Messrs. Wilson Bros., who control the Niles Electric Light and Power Company, are contemplating plans for the organization of a stock company, in which case the capacity of the plant will be doubled.

Elwood City, Pa.—The Elwood Electric Light Company, of Elwood City, Lawrence county, has been incorporated with a capital of $1,000.

Dravosburg, Pa.—The Dravosburg Light, Heat and Power Company has been chartered with a capital of $20,000.

Renovo, Pa.—The Renovo Electric Light Company will increase its equipment by putting in position a 100 H. P. engine, two more dynamos and a 120 H. P. boiler.

Philadelphia, Pa.—The Pennsylvania Railroad Company is considering a plan for the lighting of its tracks between this city and New York with electric lights.

Columbus, O.—Representative McCoy will introduce in the coming legislature a bill providing for an appropriation to establish electric-light plants in the deaf and dumb and the blind, the insane and idiotic asylums, the state house and the university.

INCORPORATIONS.

Altoona, Pa.—Juniata Valley Electric Railway Company. Capital, $100,000.

Chicago, Ill.—South Side Urban Rapid Transit Company. Capital, $5,000,000. Incorporators: George H. Smith, J. Meredith Davies, Lafayette Kirkpatrick.

The Chicago and Suburban Transit Company. Capital, $1,000,000. Incorporators: Andrew Shulson, Christ. Thorbjornson and William W. Riley.

Rochester, N. Y.—Rochester, Windsor Beach and Irondequoit Bay Electric Railway Company. Capital, $1,000,000. Directors: Stephen Remington, A. J. Johnson, George Weldon, George W. Archer, Joseph W. Palmer, Charles Goetzmann, John Fahy, John Van Voorhis, William Moran, Frank J. Hone, Henry Gallagher, Max Brichner, Joseph C. Tone.

West Haven, Conn.—The West Haven Electric Power Company has been incorporated with a capital of $50,000. William H. Brown, Harris G. Eames and F. B. Furnald are the incorporators.

Kittery, Me.—The Electric Brake Company has been organized with a capital of $500,000 for the purpose of manufacturing and dealing in electric apparatus of every description. The officials are Henry B. Walensby, of Lynn, Mass., president; Frederick S. Alley, of Lynn, Mass., treasurer.

EXTENSIONS.

Brooklyn, N. Y.—The Brooklyn City Railroad Company will probably extend its system by some sixty miles of road.

Montville, Conn.—The Montville Horse Railroad Company will ask for permission to extend its tracks along the Norwich and New London turnpikes in the towns of Montville and Waterford.

Saint Louis, Mo.—The East Saint Louis lines owned by Mr. John Scullin are to be extended to all parts of the city.

CHANGE OF POWER.

Middletown, Conn.—It is said that Boston capitalists have acquired a controlling interest in the Middletown street-railway system with the proviso that permission be asked to change to electric-power.

Newark, N. J.—The authorities have passed the ordinance permitting the street-car companies to operate their lines by electricity.

NEW ROADS.

Altoona, Pa.—The Juniata Valley Electric Railway Company has been organized for the purpose of operating an electric line from Altoona to Bellwood and Tyrone, and return.

Atlanta, Ga.—The Henry C. Davis Company, of New York, will build the East Lake railway at a cost of $200,000 and operate it by electric-power; the company to furnish the capital for a donation of land and other considerations.

Belfast, Me.—It is understood that the projected electric railroad between Belfast and Northport will be built next season.

Bellows Falls, Vt.—An electric road to run from this place to Saxton's River village is talked of.

Greenville, N. J.—There is talk of building an elevated railroad through the county from the Kill Von Kull, at Bergen Point, to the North river. Mr. S. L. Harvey, president of the Greenville Citizens' Improvement Association, is taking an active interest in the movement.

Minneapolis, Minn.—It is reported that Henry Villard is engineering a scheme to have the Northern Pacific road operate an electric line between this city and St. Paul.

New Haven, Conn.—Henry Sutton, Charles K. Bush and others have published a notice of their intention to apply for permission to build a street railway, to be operated by horse, cable or electric power, between this city and the town of Derby

New York, N. Y.—The New York and Brooklyn Railroad Company has petitioned the board of aldermen for permission to build a tunnel under the East river from Park row and Spruce street to Myrtle avenue and Fulton street, Brooklyn.

NEW BOOKS.

ELECTRICITY AND MAGNETISM: Being a Series of Advanced Primers. By Edwin J. Houston, A.M. New York: The W. J. Johnston Co., Ltd. Cloth, 306 pages, 116 illustrations. Price, $1.00.

During the Philadelphia Electrical Exhibition of 1884, Prof. Houston issued a set of electrical primers for the benefit of the visitors to the exhibition, and the great popularity and wide general sale they attained showed that the public appreciated the attempt to furnish them a literature they could easily read and understand. As these primers have been out of print for some time, the author has prepared a new series but on somewhat different lines.

During the last eight years the advances in the applications of electricity have been so great and so widespread that the public would be no longer satisfied with instruction in regard to only the most obvious and simple points, and accordingly the new primers are of a more advanced character as regards matter and extent; the treatment, however, remains such that they can be easily uuderstood by any one without a previous knowledge of electricity. This volume contains eighteen primers in all, the last one being a review or "primer of primers," which sums up the salient features of the different topics treated. The subjects of the different primers relate to the various sources and phenomena of static and current electricity and of magnetism, with practical deductions and applications. Atmospheric electricity and the phenomena of the earth's magnetism receive a particularly interesting treatment, and the primers on the electromagnet, electro receptive devices and frictional and influence machines are very practical in their scope.

A feature of the work is the abstracts from standard electrical authors at the end of each primer, which generally have reference, and furnish an extension to some important point in the primer, and at the same time give the reader an introduction to electrical literature.

While the work is primarily intended for popular reading, the care of statement and logical development of principles make it a valuable work for electricians who wish to gain a knowledge of, or to review, the principles upon which the science is based.

MAGNETISM AND ELECTRICITY, by Arthur William Poyser, M.A. 376 pages and 317 illustrations. Longmans, Green & Co., London and New York. Price, $1.50.

There are books without number on the subject of magnetism and electricity, and to make a new work a success it must have features that all its predecessors do not possess; in other words it must be a departure from all other works of the kind. The author of this book has succeeded in following out a plan of his own and has produced a work that is at once interesting and very instructive, although the subject is an old one.

The book is gotten up in experimental form, so that as the student progresses he, by making the experiments described, trains the mind in the observation of facts that could not be apprehended by simple reading and study. There are 193 experiments outlined, and at the end of each chapter there are exercises covering the range of the chapter preceding them.

This work will no doubt be found of great value to students in electricity from the fact that it gives plain directions as to how to prove the facts stated in the text. It is well gotten up and the type is clear and easily read —in short it is a practical work, and one a copy of which every practising electrician and student should have.

THE Lakeside, Minn., common council has reconsidered its action giving the Lakeside Light and Water Company authority to put in electric lights at Lakeside.

FIRE.

Fire damaged the electric-light station of the General Electric Company, Buffalo, a few days ago, to the extent of $50,000. It is stated that the fire started at the switchboard.

A NON-MAGNETIC WATCH.

A non-magnetic watch means a good deal to one whose business requires him to be in the immediate vicinity of dynamos or other electrical apparatus where large currents are used. In fact such a watch is an absolute necessity where accurate time is desired, for the reason that we are constantly surrounded by electric currents from electric wires or on electric cars, etc.



NON-MAGNETIC WATCH MOVEMENT.

The Paillard non-magnetic watch, made by the Non-Magnetic Watch Co., 177 Broadway, New York, is absolutely non-magnetic, while it possesses all the merits of other makes. These watches are accurate time-keepers and are endorsed by leading electricians, horologists and scientists of the world.

The movements of these watches are not an experiment; sixteen years of constant use have proved them to be equal to those of any other of the best watches made.

PHILADELPHIA NOTES.

T. J. COPE, 8 North Sixth street, is the manufacturer of the ever popular Cope Automatic "Come Along," or wire puller. This device has no superiors, and is sold at a very reasonable figure.

THE CHARLES SCOTT SPRING COMPANY, 1028–1038 New Market street, manufactures a fine grade of springs for electric, horse or cable cars. They are made of crucible steel and every one guaranteed.

MESSRS. C. H. & H. STANTON, dealers in electrical supplies, have opened a fine store at 132–134 South Third street, well stocked with their various specialties, including incandescent lamp candelabra, glass shades, Edison lamps, etc. Their stock is well worth inspecting, and reasonable prices is the prevailing rule.

J. G. HIGH AND HARRY G. MILLER are associated together in business at 123 North Third street. They are general electrical contractors, and make a specialty of concealed work, arc and incandescent wiring, and also handle among other things knife-switches and trolley hangers. Give them a call, as they do first-class work at moderate prices.

THE PARAMORE ELECTRIC COMPANY, 123–125 Swanwick street, will soon move to Chicago. The company is experimenting with the "Paramore" storage battery, and interesting developments may be looked for. The officers of this company are: A. H. Gillingham, president; S. P. Hutchinson, secretary; John P. Logan, treasurer; E. C. Paramore, electrician; R. Fitch Rankin, general manager.

The Bennett Manufacturing Co., Limited, 1510 Chestnut street, is the place to go to for a choice selection of engineer's, architect's and draughtsmen's instruments made of aluminum or German silver. Only instruments of the highest grade are handled in this establishment. A specialty is made of fine repairing work, which is promptly attended to. Mr. G. Bourberger is manager of the company's affairs.

The National Typewriter Company, 715–719 Arch street, issues an illustrated and descriptive catalogue of the well-known "National" typewriter manufactured by it. A noticeable feature of the catalogue is contained in the last pages on which will be found a "Columbian Calendar," giving complete dates from 1753 to 2002. This calendar will be found exceedingly useful, and by mentioning the Electrical Age the company will send a copy.

Wright & Starr, electrical engineers, 501 Girard Building, are agents for the Waddell-Entz Electric Company, their district comprising Pennsylvania, Delaware, Maryland, District of Columbia, Virginia and West Virginia. These gentlemen do a general electrical business, and among some of their specialties are new-type, direct-driven dynamos, slow-speed stationary and railway motors, insulated wire, flexible cord, electric traction equipments, etc., etc.

The Heisler Electric Co., manufacturing and constructing electrical engineers, Drexel Building, is meeting with great success in the installation of its improved long-distance series system of which it makes a specialty. The company has already installed a large number of plants on this system, and is continually closing contracts for others, a pretty good proof of its satisfactory service. The company also handles direct and alternating current constant-potential incandescent apparatus with regulating or ordinary sockets for isolated plants, transformer apparatus, series lamps for use on arc circuits, D. C. fan-motors, $\frac{1}{8}$ and $\frac{1}{12}$ H. P. for any voltage, etc., etc. The company invites the closest inspection of its various apparatus, and will be pleased to submit estimates.

On and after January 1 next the Associated Press will cease to exist as a distinct organization, and the business will thereafter be conducted by The United Press, into whose hands it has passed. The business will be carried on at the offices of the Associated Press, 10th and Chestnut streets, where there is more accomodation than at the quarters at present occupied by The United Press, at 7th and Chestnut streets. Under the new régime the personnel of the office will be as follows: W. C. Pearse, manager; W. A. Connor, day editor; H. A. Wells, night editor. Reporters: C. H. Campbell, F. Eppelsheimer, J. P. Hyatt. Operators: E. C. Boileau, W. N. Gove, C. McCullough, I. D. Maize, W. H. Conn, E. D. Gillispie, J. W. Stanley, C. L. Laverty, Robt. Laverty, T. J. Clinger.

The Pennsylvania General Electric Company, 509 Arch street, carries a complete line of apparatus for the installation of general station-lighting plants, arc and incandescent, on the Edison and Thomson-Houston systems; equipments for electric-railway systems, both station and line; electric-mining plants, locomotives, etc., and electrical supplies of every description. The Pennsylvania Company has a contract for installing an electric-light plant in the terminal station of the Reading R. R., to consist of 10 arc dynamos, 30 lamps each, Western Electric Company's system; 5 Westinghouse compound engines, 60 H. P. each, triple-plated O. K. wire placed in a conduit is used. The company controls the output of an incandescent-lamp factory, and represents the following companies: National Electric Manufacturing Company, of Eau Claire, Wis., and Weston Electric Company. A specialty is made of selling Hart & Hegeman switches, and at present the company is having a great run on Waterhouse incandescent arc lamps. Silas W. Pettit is president; Frank A. Rhue, secretary; E. D. Mullen, treasurer and general manager.

H. M. Sciple & Co., Third and Arch streets, have all they can do to supply the demand for the well-known Weston engines, built by the Weston Engine Company, of Painted Post, N. Y. These engines have been found to be highly efficient for electric-light plants, and are constructed on principles that will favorably compare with any other make of engine. The Weston engines are automatic in action and built in different styles, each one of which may be accepted as being representative of a superior grade of machinery. The following are some of the engines recently installed by H. M. Sciple & Co.: Electric-light plant, Coatesville, Pa., 100 H. P. Weston automatic engine; electric-light and power plant at Washington, D. C., 400 H. P. Clark compound engine; electric-light and power plant at Shenandoah, duplicate order; electric-light plant at Belchers, Eighth and Filbert streets, Philadelphia, 100 H. P. Weston automatic engine; electric-light and power plant at Huntington, W. Va., 575 H. P. Corliss engine.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, December 24, 1892.

The subway commissioners have ordered that subways be built through Front and Whitehall streets to accommodate telegraph and telephone wires.

The wires of the Thomson-Houston Electric Light Company, which were ordered by the mayor to be removed, will go into subsidiary subways which the company is now building.

It is reported that the Second avenue surface road will try storage-battery cars on its line in January. The cars will run between 70th and 127th streets as long as necessary to demonstrate the success or failure of the battery to be used.

In the first act of "The Professor's Love-Story," as produced by E. S. Willard at the Star Theatre, I noticed a Crocker-Wheeler rheostat and a number of pretty good-sized motors whose make I could not very readily distinguish. Somebody is evidently getting a good advertisement out of this without knowing it.

Edward E. Gold, president of the Gold Car Heating Company, Frankfort and Cliff streets, feels mighty proud nowadays, and justly so, since this company was given the highest award (a silver medal) at the American Institute Fair. This concern is the inventor and manufacturer of car-heating apparatus, compound coils and other steam-heating appliances.

Mr. J. W. Mackay, president of the Commercial Cable Co., has again sent over the Commercial cables his Christmas and New Year's greetings to the staff of the line, accompanied by a Christmas box in the shape of an order for the payment of an extra half month's salary. Mr. Mackay in his message complimented the men on their work during the year just closing, and felt sure of the continuance of their co-operation in maintaining the leading position of the Commercial Cable Company. The Commercial Cable Company is the only one of the many similar concerns that remembers its employés so handsomely at this time, which is probably the reason it gives the public such excellent cable service.

ELECTRICAL SOCIETIES.

FRANKLIN ELECTRICAL SOCIETY.

The Franklin Electrical Society of Rochester, N. Y., held an informal reception on Christmas Eve, December 24, which was well attended and a merry time was enjoyed.

CATALOGUE.

The Shultz Belting Company, of St. Louis, Mo., has issued a very handsome illustrated and descriptive pamphlet containing information that will be found very interesting and useful by engineers and all users of belts. The pamphlet also gives a complete description of the various styles of belt manufactured by this well-known concern and the prices of same. The company is getting up a calendar for 1893, and both it and the pamphlet may be had for the asking by engineers and belting consumers. Mr. A. B. Laurence, 225 Pearl street, New York, is the manager of the company.

CHRISTMAS NOVELTIES.

The other day while at Bridgeport, Conn., I noticed a large crowd had gathered before a show-window; on looking in I saw an immense shoe 4½ feet long and 3 feet high, out of which occasionally popped an old woman. It was built to represent the old woman that lived in the shoe. Every now and then little dolls' heads would pop out of some part of the shoe, presenting a very pretty sight. The whole mechanism is done by a series of cams on wheels, operated by a 6 H. P. Crocker-Wheeler motor. In order to work the thing properly the motor had to be geared down from 1,600 revolutions to 3 revolutions a minute.

Having seen this I was asked to kindly step next door and if I did not mind crawling through a 15-inch hole I could see a very pretty sight. I was not disappointed on reaching the right place; and I believe what I saw to be the most artistic mechanically dressed window I had ever seen. The scene represented Christmas Eve on the Brooklyn bridge, and showed Jersey City and Governor's Island in the distance. The bridge is 24 feet long, and across the same are strung 24 three candle-power lamps; and a mechanical arrangement showing cable cars, wagons and people crossing continuously. Underneath could be seen ferry-boats crossing the river and overhead a beautiful moonlight effect. Santa Claus, driving his reindeers, the whole being suspended by an invisible wire, was seen passing the moon, with very pretty effect. On the river could also be seen all sorts of ships, including representations of the American navy, gun-boats, etc., the Yale and Harvard crews rowing, ocean steamers, etc., etc.

The above appears in the windows of W. B. Hall & Co., dry-goods merchants. Messrs. Schweiger & Warren, of Bridgeport, are the originators and builders of these very pretty advertising schemes. A. E. K.

The Electrical Age's Illustrated Record of Patents.

Issued December 20, 1892.

488,179. Trolley-Stand for Electric Cars. Edward M. Bentley, Boston, Mass. Filed July 20, 1892.

488,198. Electrical Distribution-Box. William H. Hart, Brooklyn, N. Y. Filed March 22, 1890.

488,205. Lamp-Socket and Terminal Therefor. Joseph Hutchinson, New York, N. Y. Filed Feb. 8, 1892.

488,222. Incandescent Electric-Lamp Base. Frederick C. Rockwell, Hartford, Conn. Filed Dec. 26, 1891.

488,225. Railway Signal. Edmund Schaefer, Lynchburg, Va. Filed Aug. 26, 1891.

488,233. Storage Battery. George A. Washburn, Cleveland, Ohio, assignor, by mesne assignments, to the Ford-Washburn Storelectro Company, same place. Filed Dec. 10, 1889.

488,256. Process of Uniting Broken Pieces of Arc-Light Carbons. Nathan P. Stevens, Concord, N. H. Filed July 1, 1892.

488,261. Dynamo-Regulator. Charles J. Bogue, New York, N. Y. Filed Feb. 18, 1892.

488,285. Signal-Repeater. Thomas H. Patenall, Rahway, N. J. Filed Jan. 2, 1892.

488,298. Device for Raising or Lowering Suspended Electric Lights. Franklin P. Welsh, Omaha, Neb. Filed June 14, 1892.

THE "CLARK" WIRE.



Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

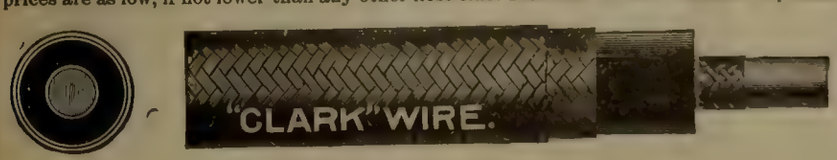
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says:

"A thoroughly reliable and desirable Wire in every respect."

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weather-proof protection, and also preventing chafing and abrasion, which is water, acid, and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish Single Wires of all guages and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



EASTERN ELECTRIC CABLE CO.,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, Treasurer and General Manager.
HERBERT H. EUSTIS, President and Electrician.

PATENTS—Continued.

488,299. Induction Apparatus. Charles Willms, Baltimore, Md. Filed May 7, 1892.

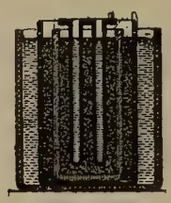
488,305. Electric Motor. Charles S. Bradley, Yonkers, N. Y. Filed June 23, 1890.

488,306. Alternating-Current Motor. Charles S. Bradley, Avon, N. Y. Filed March 15, 1892.

488,307. System of Distribution for Polyphase Alternating Currents. Charles S. Bradley, Avon, N. Y. Filed July 29, 1892.

488,329. Electric Arc-Lamp. Albert D. Puydt, Liege, Belgium. Filed Feb. 17, 1892. Patented in Belgium and in England.

488,351. Closed Conduit for Electric Railways. Léon O. Dion, Natick, Mass. Filed Nov. 9, 1891.



488,233.—STORAGE-BATTERY.

488,367. Telephone. Parnell Rabbidge, Sydney, New South Wales. Filed March 3, 1892.

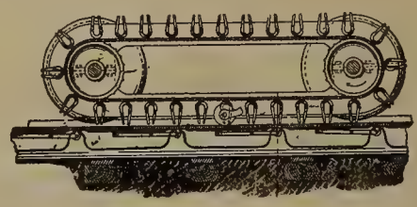
488,385. Guard for Telephones. Edward B. Chase, Philadelphia, Pa. Filed July 30, 1892.

488,388. Fire-Alarm Apparatus. Augustus G. Davis, Baltimore, Md. Filed May 27, 1892.

488,415. Means for Operating Station-Indicators. Ruben B. Ayres, New York, N. Y. Filed Sept. 1, 1892.

488,466. Electric Forge. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Oct. 6, 1891.

488,467. Electric Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 8, 1892.



488,351.—CLOSED CONDUIT FOR ELECTRIC RAILWAYS.

488,468. Electric Metal-Working Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Aug. 31, 1892.

488,469. Electric Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Company, of Maine. Filed Sept. 22, 1892.

488,482. Musical Instrument. Robert W. Pain, New York, N. Y. Filed Dec. 4, 1890.

488,502. Telephone System. Charles C. Jennings, Chicago, Ill., assignor to Charles H. Thompson and George A. Sheley, Detroit, Mich. Filed Oct. 23, 1888.

488,520. Electrically Operated Stringed Musical Instrument. Willard H. Gilman, Boston, Mass. Filed March 9, 1892.

488,532. Electrical Switchboard. James W. Lyon, Brooklyn, N. Y. Filed June 11, 1889. Renewed Feb. 7, 1891. Again renewed June 6, 1892.

VULCANIZED FIBRE COMPANY,

Established 1873.

Sole Manufacturers of HARD VULCANIZED FIBRE,

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Grey. Send for Catalogue and Prices.

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(ELECTRIC BRAND)

For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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Over 99 Per Cent. Pure

SAL-AMMONIAC.

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FOR ALL PURPOSES.

Scrap and Native Platinum Purchased.

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RODS AND PLATES FOR BATTERIES.

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THE GOODRICH HARD RUBBER CO. AKRON, O.

HARD RUBBER GOODS

BUSHINGS TUBES WINDOW SHEET BATTERY CELLS KEY KNOBS LAMP SWITCH HANDLES ETC.

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FLEXIBLE HARD RUBBER TUBING.

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Sockets, Bushings, Tubing, Friction-Tape.

Soft Rubber Goods for Electrical Purposes.

SPECIALTIES TO ORDER.

THE B. F. GOODRICH CO.,

Akron Rubber Works, Akron, Ohio.

THE COLUMBIA RUBBER WORKS CO.,

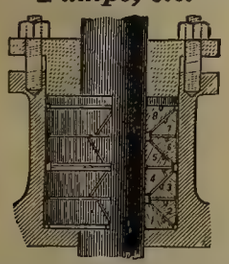
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NEW YORK: 65 Reade Street. | CHICAGO: 159 Lake Street.

KATZENSTEIN'S

Self-Acting Metal Packing

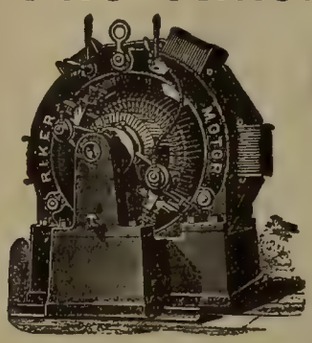
For Piston Rods, Valve Stems, etc., of Steam-Engines, Pumps, etc.



Adopted and in use by leading Engine Builders, Mills, Iron Works and Steamships, Electric Light and Power Plants since the last 10 years. Also, FLEXIBLE TUBULAR METAL PACKING for Slip Joints on Steam Pipes and for Hydraulic Pressure. For further particulars and prices send for circular.

L. KATZENSTEIN & CO., 357 West St., NEW YORK.

The Riker Electric Motor Co.,



MANUFACTURERS OF

DYNAMOS, MOTORS,

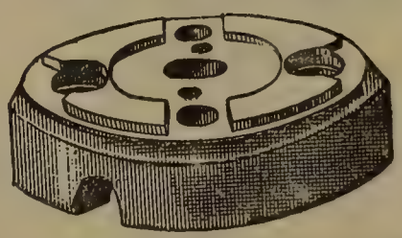
And Specialties in Motors

FOR CAR PROPULSION, MINING APPARATUS, TURN TABLES, TRAVELING CRANES, PUMPING OUTFITS, VENTILATING FANS, ETC., ETC.

Designers and Makers of Special Electric Machinery,

45 & 47 YORK STREET,

ANDREW L. RIKER, Electrician. BROOKLYN, N. Y.



EMPIRE CHINA WORKS,

144-156 GREEN ST.,

Near Manhattan Ave., Greenpoint, Brooklyn, N. Y.

OUR PRODUCTION IS THE

Genuine Hard Porcelain

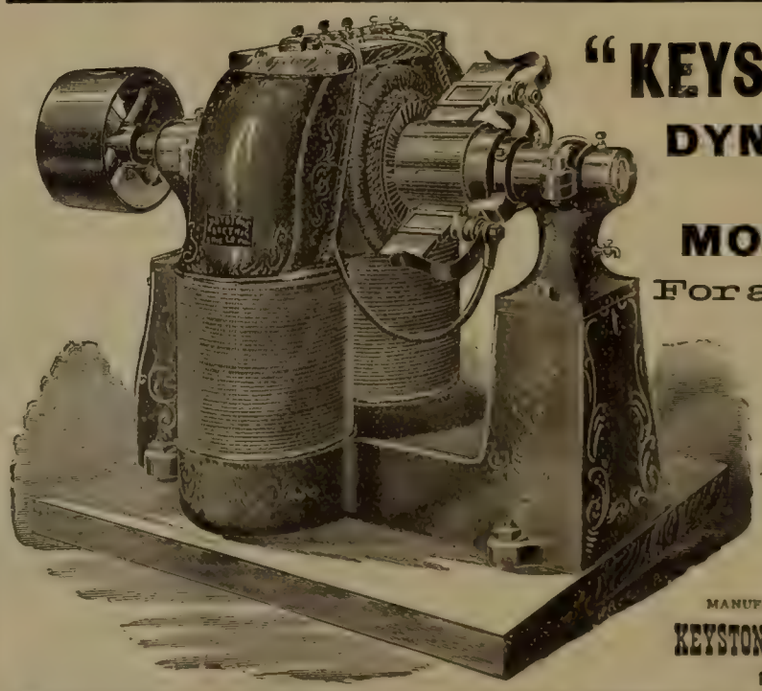
and includes Cut-Outs, Switch Bases, Insulators, all sizes.

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For all Uses.

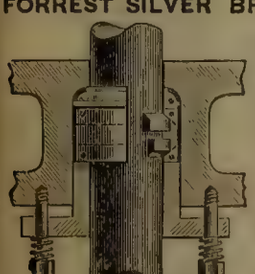
Special Reversible Motor for Running Elevators.

MANUFACTURED BY THE

KEYSTONE ELECTRIC CO.

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FORREST SILVER BRONZE PACKING.



Applied to any stuffing-box without disconnecting. Steam, air and water tight without the aid of soft packing under the highest steam pressure and piston velocity. Automatic, admits of excessive vibration, lashing and crowding of rod, does not bind, economical, guaranteed to outlast all other packing. Used by the largest Iron Works, Steamships and Electric Light Companies for years all over the world. Address

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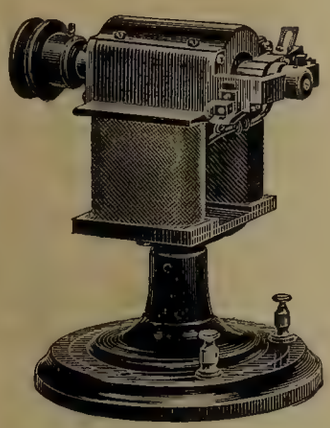
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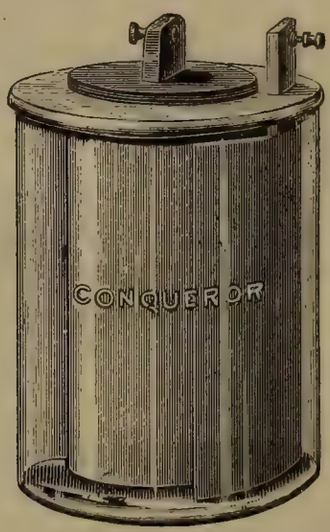
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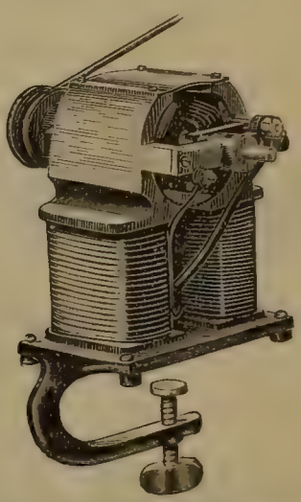
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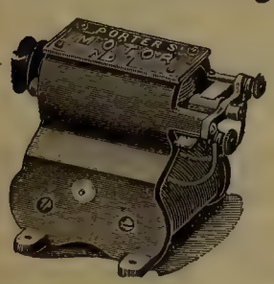
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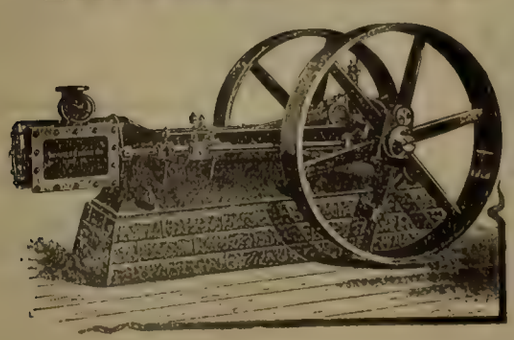
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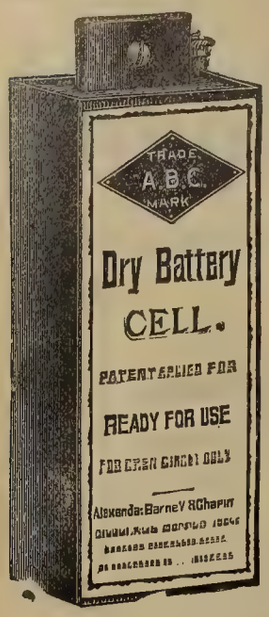
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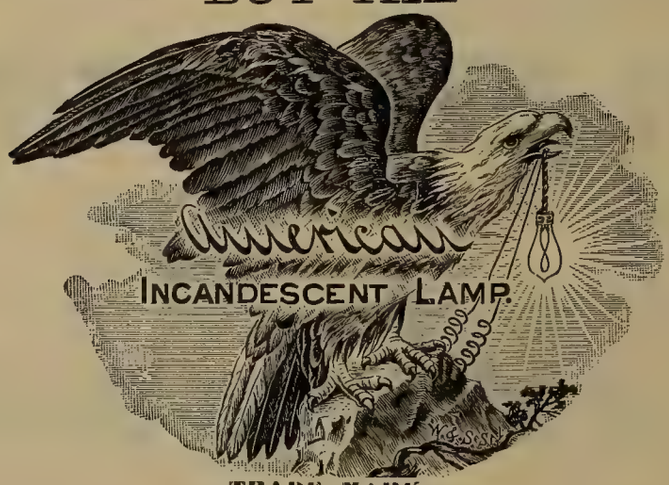
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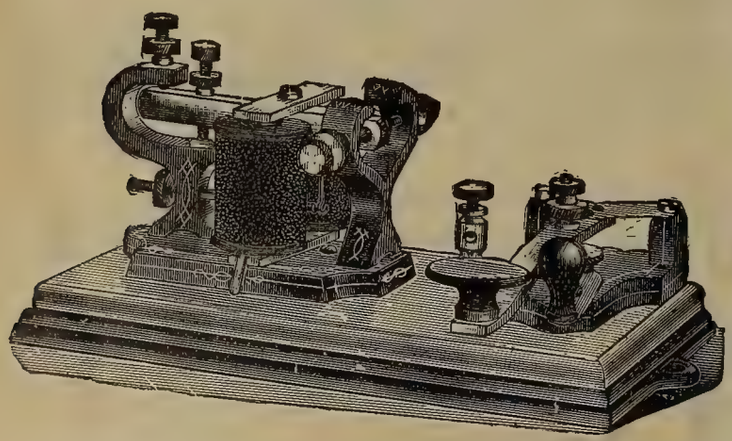
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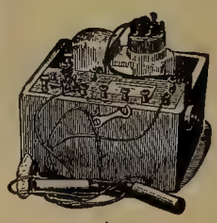
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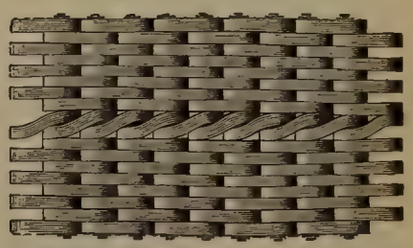
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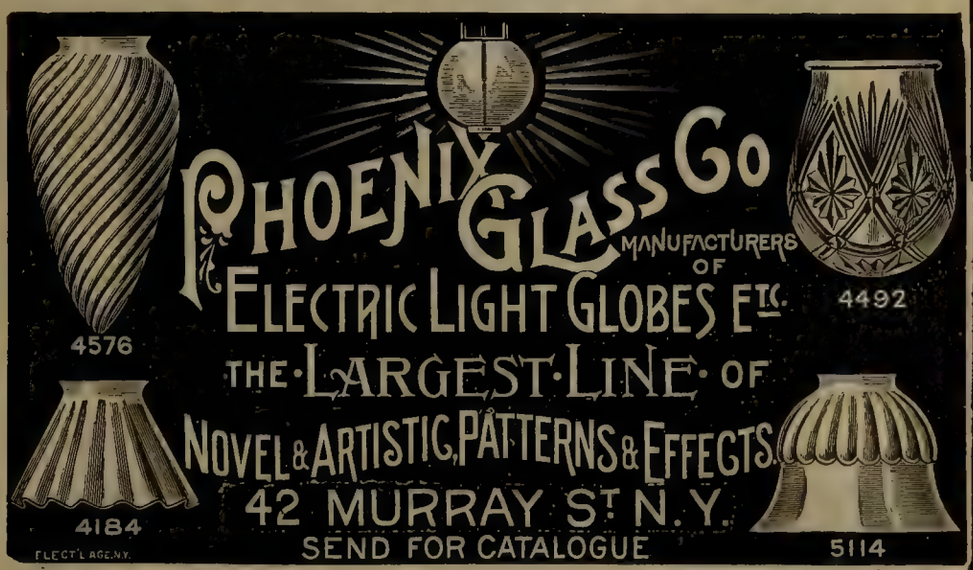
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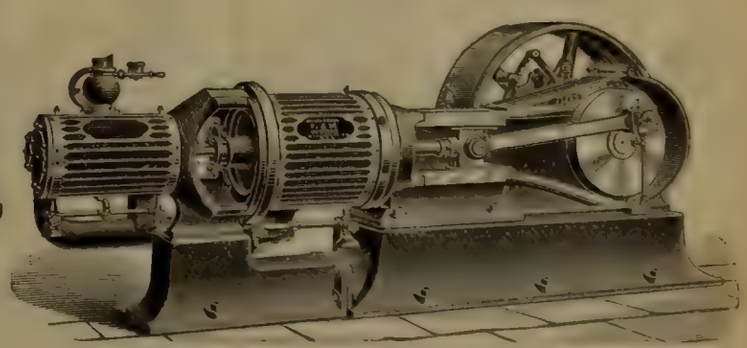
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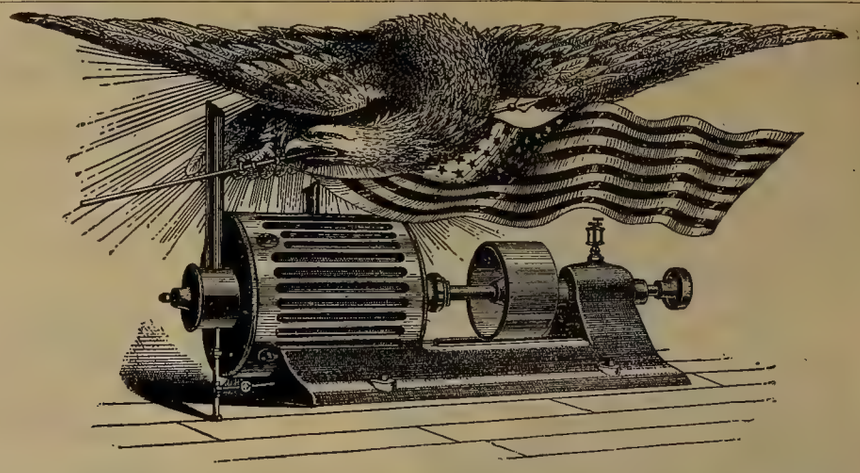
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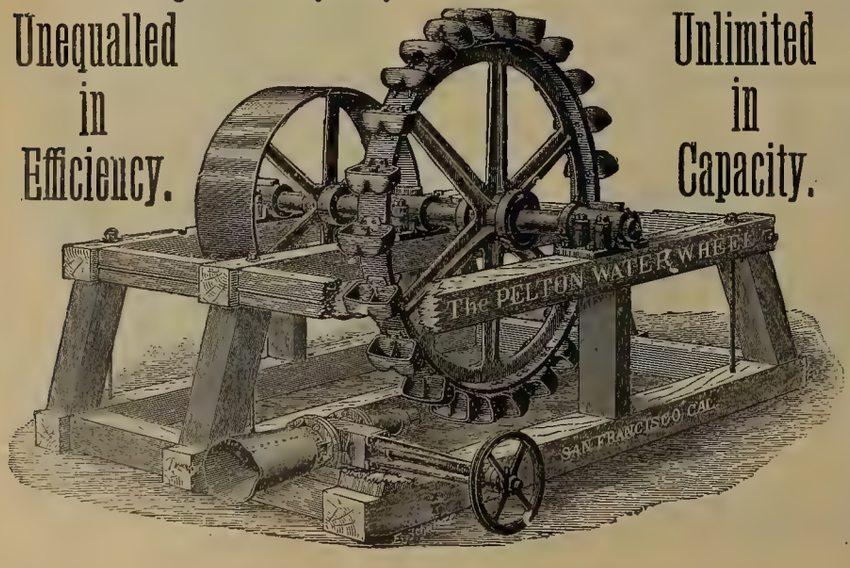
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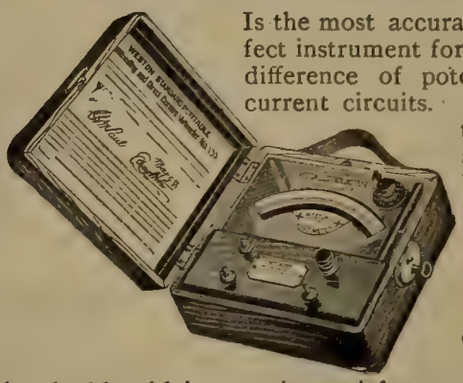
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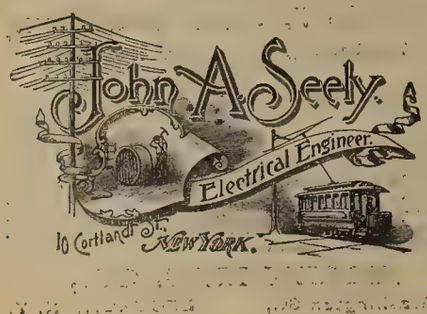
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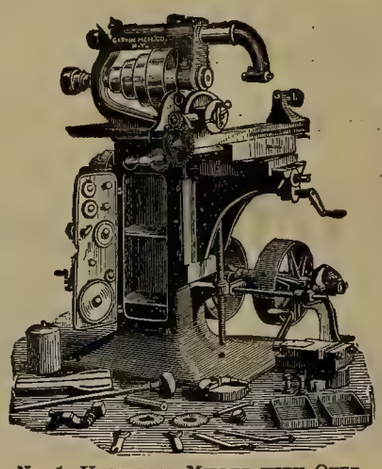
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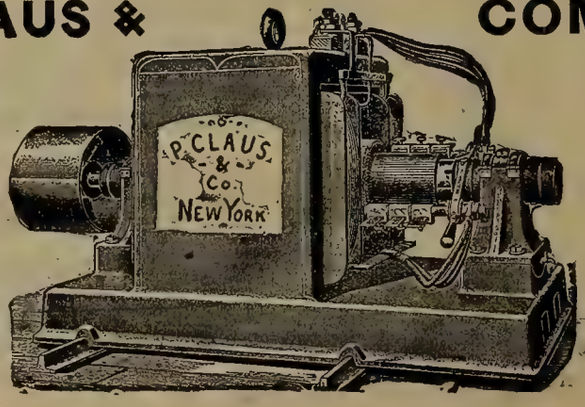
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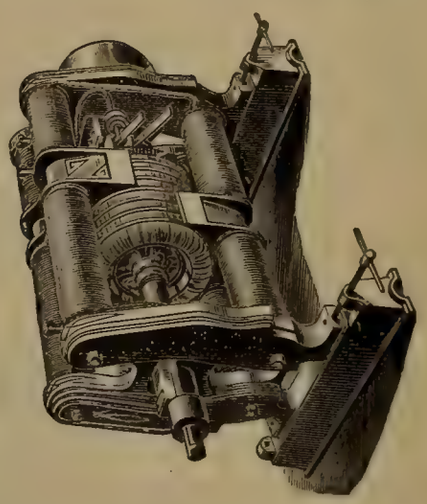
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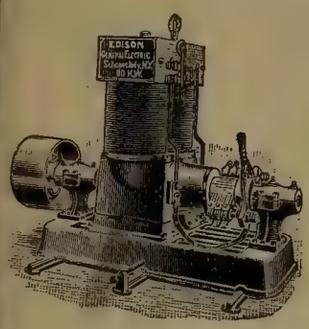
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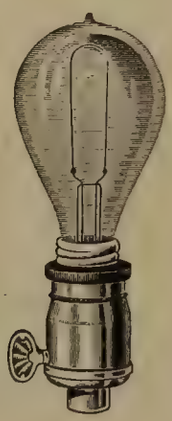


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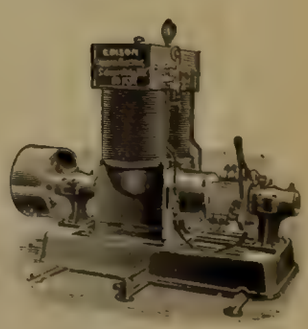
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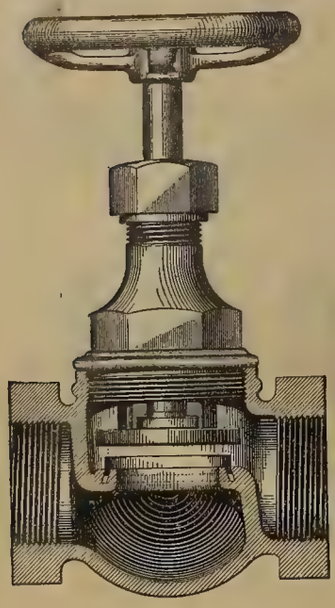
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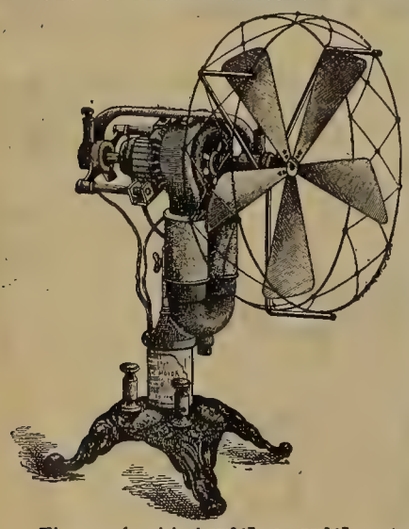
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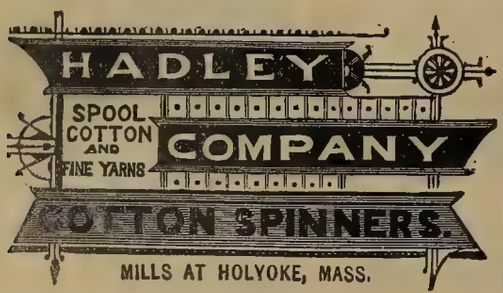
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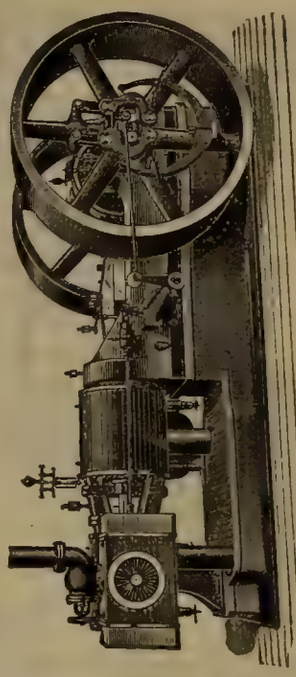
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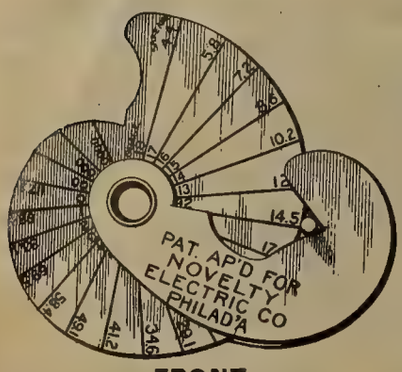
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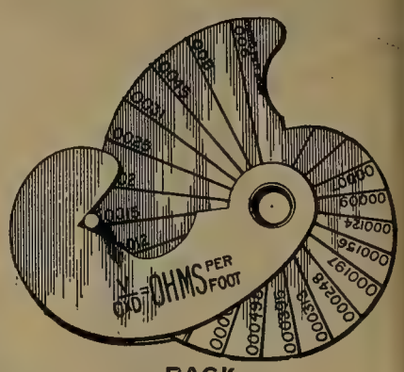
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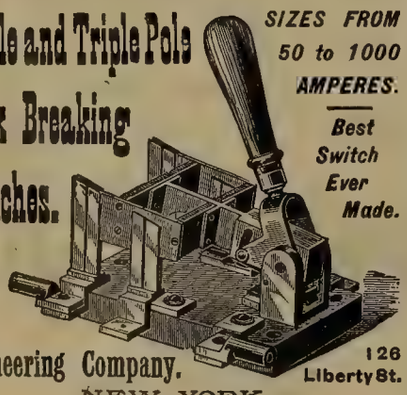
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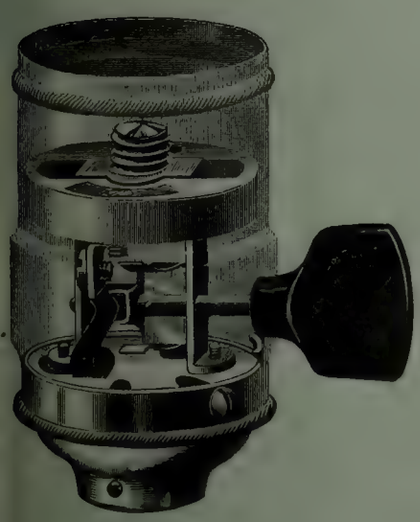
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